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Received 19 January 2013
Revised 4 June 2013
Accepted 1 July 2013
Published Online First
19 November 2013

Physical activity is medicine for older adults

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ABSTRACT

There is evidence from high quality studies to strongly support the positive association between increased levels of physical activity, exercise participation and improved health in older adults. Worldwide, around 3.2 million deaths per year are being attributed to inactivity. In industrialised countries where people are living longer lives, the levels of chronic health conditions are increasing and the levels of physical activity are declining. Key factors in improving health are exercising at a moderate-to-vigorous level for at least 5 days per week and including both aerobic and strengthening exercises. Few older adults achieve the level of physical activity or exercise that accompanies health improvements. A challenge for health professionals is to increase physical activity and exercise participation in older adults. Some success in this has been reported when physicians have given specific, detailed and localised information to their patients, but more high quality research is needed to continue to address this issue of non-participation in physical activity and exercise of a high enough level to ensure health benefits.

INTRODUCTION

It is very clear that physical inactivity is a major contributor to mortality. The WHO reported that around 3.2 million deaths each year are attributable to physical inactivity.¹ Governments around the world are recognising the importance and the large impact of physical inactivity on health and health-related expenditure. This has led to the production of global and national guidelines for physical activity.^{2–5} Many non-communicable chronic health conditions prevalent in both developed and developing countries are associated with physical inactivity.^{6–8} With increasing age, there is an increased risk of developing non-communicable chronic health conditions.⁹ In a recently published review, Blair *et al* emphasised the direct link between physical inactivity, low cardiovascular fitness and the presence of chronic health conditions.⁶

Five leading risk factors for death are high blood pressure, smoking, high blood glucose, physical inactivity and obesity.¹⁰ A glance at these risk factors reveals that high blood pressure and glucose levels as well as obesity are connected with physical inactivity.⁶ Alongside the increasing incidence of these risk factors with ageing, there is a decline in many physiological systems; a loss of muscle mass, a decline in balance ability, a reduction in muscle strength and endurance¹¹ and a decline in cognitive performance,¹² all of which impact on functional independence. Paterson *et al*⁸ suggested that increasing physical activity levels is the most important intervention to improve health in populations. For older adults, extending life is an important factor, but the maintenance of functional

independence is also of high importance, both to maintain quality of life and to manage health resources.¹³

In the literature, the term ‘exercise’ is frequently used to distinguish structured programmes from incidental day-to-day physical activity, such as housework.¹⁴ Whether physical activity is defined as incidental or as exercise is of less importance than the amount, the frequency and the intensity of the activity. In this review, physical activity refers to any activity that has an energy cost, such as housework, shopping, gardening and structured exercise programmes (such as Tai Chi or aquarobics). The objectives of the review are to (a) present clear guidance around the amount, type and frequency of physical activity for achieving health gain in older adults (>65 years of age), (b) discuss the measurement of physical activity, (c) present the evidence for health benefit of increased physical activity for older adults and (d) discuss the extent to which older adults achieve the suggested physical activity guidelines with suggestions on how to improve uptake and maintenance of high levels of physical activity.

RECOMMENDED LEVELS OF PHYSICAL ACTIVITY FOR OLDER ADULTS

The WHO guidelines ‘Global Recommendations on Physical Activity for Health’, included recommendations for physical activity in older adults.¹⁰ A position stand published by the American College of Sports Medicine (ACSM) has similar recommendations.⁷ The recommendations from the WHO publication are summarised in box 1. A key message is that at least 150 min per week of moderate intensity physical activity is required for health benefit in older adults.

**MEASUREMENT OF PHYSICAL ACTIVITY
Metabolic equivalent**

When accessing the research-based literature on physical activity and exercise, it is important to understand how physical activity levels and intensity are measured. One frequently used method of calculating intensity of physical activity or exercise is the metabolic equivalent (MET) value, which is an indicator of energy expenditure. One MET is roughly equivalent to the energy expended during quiet sitting. Physical activities have been categorised to produce a compendium of MET values,¹⁵ for example, bicycling at a leisurely pace of 5.5 mph has a MET value of 3.5 and washing dishes has a MET value of 1.8. The contents of the compendium can be accessed freely at <https://sites.google.com/site/compendiumofphysicalactivities/>. See table 1 for a selection of common daily activities and their corresponding MET values for adults.



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To cite: Taylor D. *Postgrad Med J* 2014;**90**:26–32.

Box 1 A summary of the WHO recommendations for exercise for people aged 65 years and older

1. At least 150 min of moderate-intensity aerobic activity, or at least 75 min of vigorous-intensity aerobic activity, or an equivalent combination.
2. Aerobic activity should be performed in bouts of at least 10 min duration.
3. For additional health benefits, undertake up to 300 min of moderate-intensity or 150 min of vigorous-intensity aerobic activity, or an equivalent combination.
4. People with poor mobility should do balance exercise to prevent falls on 3 or more days.
5. Muscle-strengthening activities should be done on two or more days.
6. If older adults are unable to do the recommended amounts of physical activity due to health conditions, they should be as physically active as they are able.

Modified from WHO's publication Global Recommendations on Physical Activity for Health¹⁰

Physical activity that is below 3.5 METS (light activities) or a total amount of activity that is below around 4200 kJ/week (equivalent to more than 3 h of brisk walking per week) is unlikely to produce health-related changes in adults. However, in older adults who have mobility limitations, the metabolic cost of activities that involve walking are higher than the average adult¹⁶ and should be considered when advising people with mobility limitation about physical activity levels. For people without a mobility limitation, time spent in sedentary activities (such as watching TV) and light activities (including light housework) does not reach activity levels high enough to improve health outcomes.³

Perceived rate of exertion

In most publically available guidelines, the MET unit is replaced by a more readily understandable metric. In the guidelines

Table 1 Examples of activities at a MET level of 3.5 and above

Setting	Activity	MET
Gardening	Clearing light brush, thinning garden, moderate effort	3.5
	Digging, thinning garden, composting, light-to-moderate effort	3.5
	Gardening, using containers, older adults >60 years	2.3
	Mowing lawn (not ride on mower)	5.0
Home activities	General kitchen activity (cooking, washing dishes, cleaning up), moderate effort	3.3
	Vacuuming, moderate effort	3.3
	Scrubbing floors, on hands and knees, scrubbing bathroom, bathtub, moderate effort	3.5
	Sweeping garage, pavement or outside of house	4.0
Locomotor activities	Making bed, changing linen	3.3
	Stair climbing, slow pace	4.0
	Walking, 2.5 mph, level, firm surface	3.0
	Walking, 3.5 mph, level, brisk, firm surface, walking for exercise	4.3
	Walking, household	2.0
	Loading/unloading a car, implied walking	3.5

Adapted from the Compendium of Physical Activities.¹⁵
MET, metabolic equivalent.

published by the ACSM, a simple scale of intensity based on a self-perceived rate of exertion is used. It is scaled from 0–10 with 5–6 being moderate-intensity exercise and 7–8 being vigorous-intensity exercise.⁷ The ACSM guidelines clarify physical activity intensity by describing sitting as 0 and the greatest effort possible is 10, with moderate-intensity activity being 5 or 6 and producing noticeable increases in breathing and heart rates, and vigorous-intensity activity (7–8) producing large changes in breathing and heart rates.³

Pedometers and accelerometers

Pedometers and accelerometers have gained considerable popularity as reliable methods of objectively measuring physical activity.¹⁷ Pedometers are low-cost mechanical counters that determine the number of steps a person takes throughout the day by detecting vertical motion during walking. Accelerometers measure accelerations in one or more planes of motion and can give an indication of the frequency, intensity and duration of different types of movement. Pedometers, in particular, are cheap, easily accessible and unobtrusive, allowing data to be collected during normal daily activities. In older adults, data collected from 2–3 days is considered a reliable indicator of usual daily physical activity.^{17 18} There is no complete agreement on how many steps a day are optimal. As a useful guide, an older adult achieving 10 000 or more daily steps is categorised as highly active, over 5000 but less than 10 000 as moderately active, and 5000 steps or below as inactive.^{19 20} Accelerometers can provide a profile of activity throughout the day, determining time of the day with higher activity or lower activity, duration of inactivity and duration of intensity of activity. Current research is exploring the pattern of activity over the day in relation to health.¹⁹

DIFFERENT TYPES OF PHYSICAL ACTIVITY AND EXERCISE Strength and aerobic fitness

There is strong evidence for the effectiveness of aerobic exercises and muscle-strengthening exercises, with the result that details are clear around the type and intensity of these forms of exercise. Aerobic exercise is defined as any type of activity that uses large muscle groups and can be maintained over a period of time including activities such as brisk walking, swimming or dancing.⁷ Guidelines state that aerobic exercise should be at a moderate level, in which the individual notices increases in heart rate and breathing rate.^{3 5} Resistance-based strengthening requires muscles to work against a load, which may be an external load or bodyweight that is progressively increased over the time of the programme.²¹ Most of the trials of progressive resisted strength training in older adults have high-intensity strength training protocols,²² most frequently involving 8–12 repetitions of the exercise to the point of muscle fatigue. These programmes usually involve the support of exercise professionals and are usually based in gymnasiums, as specialist equipment is often used.

Balance exercises

The evidence around balance exercises is not as strong as that around strength and aerobic exercises, and therefore, the recommendations are not as clear. In a systematic review of falls prevention interventions, it was apparent that the important components for falls prevention effects are exercises that challenge balance and exercises that strengthen lower limb musculature.²³ For community-dwelling older adults, participation in physical activities, such as Tai Chi or individually tailored home exercise programmes, can reduce falls in those at risk of

falling.^{24–26} What is unclear is whether any particular form of falls prevention intervention is better than others.²⁵ There is good evidence that at least some falls prevention programmes reduce falls in community-dwelling older adults but it is unknown whether these programmes raise participants' physical activity levels adequately to improve health by affecting cardiovascular fitness and strength. In-depth discussion of balance exercises and falls prevention is beyond the scope of this paper. See Sherrington *et al*²³ and Gillespie *et al*²⁴ for excellent reviews in this area.

Incidental physical activity

Incidental physical activity is that which occurs throughout the course of the day during activities of daily living. It is generally of low intensity but often contains some sporadic bouts of moderate intensity activity.²⁷ In a younger cohort (35–65 years old), achieving a moderate intensity of incidental physical activity for 20–30 min per day was positively associated with measures of cardiovascular fitness.²⁸ However, contrary findings in a similar cohort (35–69 years) indicated that incidental physical activity was unlikely to have significant health benefits.²⁹ At present, there is little research of this nature in older adults.

THE EVIDENCE FOR IMPROVED HEALTH OUTCOMES WITH INCREASED PHYSICAL ACTIVITY

The good news is that increasing physical activity levels can have a positive effect on both mortality and functional independence in older adults.

Mortality

There are many studies that show a reduced all-cause mortality and reduced risk of developing conditions such as cardiovascular disease and type 2 diabetes in people, including older adults, who exercise regularly at a moderate level.^{30–33} Epidemiological studies show a strong inverse relationship between physical activity, health and all-cause mortality.^{8, 34} In a large prospective cohort study of older American women, higher levels of physical activity were associated with around 40–50% lower all-cause, cardiovascular disease and cancer mortality rates compared with women with lower activity levels.³⁴

There is a strong association between objectively measured cardiovascular fitness and mortality, but not between self-reported measures of physical activity and mortality.³⁵ This may indicate that in addition to emphasising the need for physical activity, it may be important to encourage the use of objective measures of cardiovascular fitness, or objective measures of physical activity, such as pedometers.

Functional independence

Both muscle strength and aerobic fitness have been strongly linked to functional independence.^{36, 37} In older adults without disabilities, improvements in muscle strength and aerobic fitness resulted in improved functional independence.^{22, 38} Findings from a systematic review indicated that when older adults participated in exercise of sufficient intensity and frequency, the reduction in risk of functional limitation and disability was in the range of 30–50%.³⁸

Aerobic training alone or aerobic training combined with resistance training have been shown to result in improved physical function in older adults without disabilities. In some groups of people with chronic health conditions there are indications of positive effects of increased physical activity and exercise. A review by Vincent *et al* concluded that for obese older adults, participation in a programme of exercise that included aerobic

and resistance exercises combined with dietary restriction did lead to improvements in functional mobility.³⁹ However, in other groups of people, for example, older adults with disabilities from stroke, the translation of improvements in aerobic fitness and muscle strength into functional independence is unclear.⁴⁰

OLDER ADULTS ACHIEVING THE RECOMMENDED LEVELS OF PHYSICAL ACTIVITY

Many people fall short of achieving the recommended levels of physical activity and exercise. More than 60% of American adults over the age of 50 years failed to achieve the recommended activity levels.³ In England, 20% of men and 17% of women aged between 65 and 74 years achieved the recommended activity levels of 5 or more days of moderate-to-vigorous activity. From the age of 75 years onwards, 9% of men and 6% of women met the recommended guidelines.⁴ Very few older adults are currently meeting the recommended levels of physical activity and exercise.

There are a large number of barriers to exercise participation identified. Interestingly, O'Neill and Reid reported that 87% of their older adult participants described at least one barrier to participation in exercise.⁴¹ The most common reasons given by older adults for not participating in physical activity was ill-health, pain and injury.^{42, 43} One limitation of the research in physical activity and health is that many of the studies have used self-report measures of physical activity. There is some indication that self-report measures do not reliably reflect cardiovascular fitness^{35, 44} and may not predict health outcomes as clearly as objectively measured cardiovascular fitness.

The physical environment in which people live has been shown to influence physical activities, at least for children and younger adults.^{45, 46} Access to parks and other recreational facilities, safe footpaths and areas relatively free from crime have been identified as important factors.⁴² An evaluation of free public transport for older adults in the UK revealed that those with free passes not only travelled more often but they were also more likely to walk further than those who did not receive free passes,⁴⁷ although it is unknown as to whether sufficient walking was achieved for health benefit. There are promising indicators but it is not yet clear if the environment changes and transport policy changes will sufficiently influence physical activity in older adults.⁴⁸

WHO SHOULD EXERCISE?

Health-related beneficial effects are observed in older people with no apparent health condition and in those with common non-communicable chronic health conditions such as hypertension, type 2 diabetes, cardiovascular disease and some cancers.^{6, 49–51} In a sample of older adults with a mean age of 78 years, those who exercised more than 2 h per week had reduced mortality compared with less active individuals, even after adjusting the analysis for comorbidities and physical and cognitive impairment.⁵² It is clear that these groups of older adults should be encouraged to exercise at levels that meet most of the WHO guidelines.

Less is known about frail older adults and those with disabilities. In America, around 38% of people over the age of 65 have a disability, and this figure rises with increasing age to around 74% for people over the age of 80 years.⁵³ Yet the recommendations for physical activity and exercise for health benefit are limited for older adults with disabilities. A recent meta-analysis showed that increased physical activity not only delays the onset of functional limitation but it also slows down

the progression of functional decline in older adults with and without disabilities.⁵⁴

These groups of the population have an increased challenge to regularly exercise at a level to promote improved health outcomes. Recent reviews and meta-analyses^{54–56} concluded that exercise had a small-to-moderate positive effect on mobility and physical functioning in frail and mobility-limited older adults, with higher intensity exercise being more effective than low intensity on the outcome of physical function. Although no clear guidance could be drawn from the meta-analysis about the best type of exercise,^{56–58} there was an indication that strength training interventions were important for functional improvement.⁵⁷ The evidence for aerobic or strength training programmes leading to a reduction in mortality after a stroke is unclear.⁴⁰ What is still unclear is the type of exercise and clarification about the intensity of exercise needed to maintain or improve functional levels in adults with disabilities and frail older adults.

CAN WE INCREASE EXERCISE PARTICIPATION?

The importance of the physician

Older adults, particularly those with chronic health conditions, have relatively high rates of attendance at physician's offices; this puts the family physician in a strong position to give exercise-related advice. Older adults who received physical activity advice from their physician performed more moderate-to-vigorous intensity activity than those who did not receive advice.^{59–60} However, there is evidence to suggest that general practitioners (GPs) do not discuss physical activity with all relevant patients.^{60–62} In an American study of older adults, about 95% of participants had visited their GP in the last year, yet only about 62% reported receiving advice about physical activity.⁶¹

There is some criticism of the advice given by healthcare providers regarding increasing physical activity levels; one important criticism was that general advice is given with no specifics on how the older adult should go about increasing their activity levels or what they should specifically do.⁴² Interestingly, in a study in which older adults were given specific advice about the type and frequency of exercise by the GP, with follow-up by exercise professionals, the proportion of intervention group participants achieving adequate levels of exercise increased from 0.14 to 0.31. Perhaps of more interest was the significantly lower rate of hospitalisation in the year following the intervention in the experimental group compared with the controls.⁵⁹ Giving specific physical activity advice, a plan of action and some form of follow-up are important factors in facilitating the uptake and maintenance of exercise programmes in older adults; this has been demonstrated in physical activity programmes and in falls prevention programmes.^{26 63 64}

Behaviour change

Self-efficacy, a person's belief in their ability to successfully perform a specific behaviour,⁶⁵ is a concept that has been linked to exercise behaviour in older adults. Self-efficacy may be particularly important in the initial adoption of exercise programmes.⁴² There are an increasing number of behavioural approaches to maintaining participation in exercise and ongoing physical activity, yet to date there is no strong evidence supporting their use. A review considering adults with no identified cardiovascular disease risk factors concluded that the evidence supporting behavioural interventions is weak and should not be generally adopted without further supporting evidence.⁶⁶

Recent research has considered the use of financial incentives to improve adherence to health-related behaviours in an attempt to impact health outcomes.⁶⁷ Finkelstein et al offered monetary

rewards to older adults if they achieved certain levels of aerobic activity on an unsupervised and unstructured walking programme. The group that received financial incentives had significantly higher walking activity levels than their non-financially rewarded counterparts. Time spent walking at a level that would impact on aerobic fitness was 79% greater in those receiving the incentive. Those in the financial incentive group also walked more frequently and for longer durations. Around 7% of the control group in this study achieved activity levels that met public health recommendations, while 38% of the financial incentive group met the recommended physical activity levels. While the research in this area is new with many questions remaining unanswered as yet, further research may help to clarify the role of incentives in promoting physical activity and exercise participation.

COGNITIVE BENEFITS OF PHYSICAL ACTIVITY

In addition to positive physical effects of increasing physical activity there is a growing body of evidence indicating cognitive benefits. A Cochrane systematic review of the effect of aerobic exercise on cognition in people over the age of 55 years showed a positive effect, improving auditory attention and cognitive processing speed.⁶⁸ Research findings about the association of exercise with cognitive impairment are suggestive of benefit, but not unequivocal. Paterson *et al's*³⁸ review of the effects of exercise on cognition concluded that although the data look promising, information about the specific dose and type of exercise is as yet unknown and further research needs to be undertaken. There are some promising indications that moderate level exercise reduces the risk of developing cognitive impairment in older adults,^{69 70} and that for people with mild cognitive deficits, there may be a protective effect of exercise.⁷⁰

So, for many older adults, the benefits of exercise are substantial and are likely to improve health-related outcomes. One of the challenges for healthcare practitioners today is to help people to attain and maintain levels of physical activity that will be beneficial.

SUMMARY

With the average population age increasing in industrialised countries, there is an increase in the proportion of older adults, many of whom are at risk for developing non-communicable chronic health conditions. Older adults are generally less physically active than younger adults. In the presence of strong evidence linking physical inactivity to chronic health conditions and increased physical activity to lower mortality and morbidity in older adults, it is imperative to develop a strong commitment to improving physical activity levels in older adults. Governments around the world have begun to produce national guidelines for physical activity and health for older adults. The main challenge is to find effective ways to support older adults to increase their physical activity and then to develop habitual physical activity behaviours. Individual health practitioners have an important role in discussing and making recommendations around physical activity. GPs should have sufficient understanding of physical activity prescription to make recommendations to patients about type, amount, intensity and frequency of physical activity for health gain. Inclusion of physiotherapists or exercise professionals for exercise prescription may prove to be a valuable addition to the General Practice team. The health problems relating to physical inactivity are unlikely to be completely solved by individual health practitioners, and significant steps by governments and policy makers have to be taken to create environments that encourage participation in lifelong physical activity.

Main messages

- ▶ Low levels of physical activity are associated with an increased risk of mortality in people over the age of 65 years.
- ▶ Low levels of physical activity are associated with an increased risk of developing chronic health conditions in people over the age of 65 years.
- ▶ International recommendations for physical activity and exercise in older adults consistently recommend moderate level aerobic exercise for 30 min per day for 5 days of the week, combined with 2 days of strength training.
- ▶ There is some support for improvements in health for people with cognitive deficits who regularly achieve moderate levels of exercise.
- ▶ There is some support for improvements in health for frail older people who regularly achieve moderate levels of exercise.
- ▶ There is limited and conflicting evidence about the association of physical activity with mortality in people with stroke.
- ▶ Physicians have a key role in encouraging people to take up exercise at levels that will promote health and longevity.
- ▶ Physician-delivered physical activity recommendations are more effective when they provide specific recommendations and information about locally available exercise options.
- ▶ There is promising preliminary research looking at behavioural approaches to encouraging the uptake and maintenance of exercise participation.

RESOURCES FOR FURTHER INFORMATION ON PHYSICAL ACTIVITY IN OLDER ADULTS

<http://www.exercisemedicine.org> this website provides further background information on the value of exercises and has freely available resources physicians can use in their practice.

<http://www.acsm.org> this is the website of the ACSM and provides access to multiple resources on physical activity.

<http://www.cdc.gov/physicalactivity/growingstronger/index.html> the Centers for Disease Control and Prevention provide an exercise programme online for patients to access. It contains information for patients about why to exercise and how to exercise, giving specific examples of muscle strengthening exercises.

Current research questions

- ▶ What are the most effective methods to increase and then maintain physical activity and exercise participation in older adults?
- ▶ What is the most effective approach to improving the health of older adults with mobility limitations?
- ▶ How can societies prevent the decline in physical activity that occurs through middle and into older age and thus reduce the future health burden?

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Self assessment questions

1. Undertaking 30 min more of light activity, such as light gardening or housework will result in significant health benefit in sedentary older adults. (True or False)
2. Increasing cardiovascular fitness appears to be a key factor in improving health and reducing the risk of developing non-communicable chronic health conditions. (True or False)
3. Statistics from the UK indicate that around 6% of women over the age of 75 years achieve recommended levels of exercise to meet national guidelines on physical activity. (True or False)
4. Sedentary older adults who do not have any risk factors for non-communicable chronic diseases do not need to increase their physical activity levels. (True or False)
5. Patients who receive local information about specific types of exercise and physical activities from their doctor are more likely to adhere to the advice than those who receive general advice to increase their activity levels. (True or False)

Competing interests None.

Provenance and peer review Commissioned; externally peer reviewed.

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Answers

1. **False**—Evidence strongly suggests that the intensity of exercise has to be at least at a moderate level for around a total of 30 min per day. The person should notice slightly altered breathing, still able to hold a conversation, but panting slightly.
2. **True**—There is a strong relationship between high levels of cardiovascular fitness and good health. Any activity or exercise that improves cardiovascular fitness may be beneficial. Older adults can improve their health by improving cardiovascular fitness; this imparts benefit even if starting from a low level of cardiovascular fitness.
3. **True**—The challenge to health professionals is to find ways of motivating older adults to take up more physical activity and to maintain it over their lifetime.
4. **False**—There is strong evidence indicating that older adults who are apparently healthy should engage in recommended levels of physical activity with positive benefits on mortality and morbidity.
5. **True**—Evidence from a number of trials indicates that people who receive specific advice about exercise and/or increasing physical activity from their GP are more likely to increase their physical activity in comparison to those who receive either general physical activity advice, or no physical activity advice.