



More physical activity and less sedentary behaviour

Advice for CVD prevention

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Physical activity remains an important but undervalued strategy for the prevention of cardiovascular disease, and evidence is accumulating for sedentary behaviour ('too much sitting') as a new risk factor. For GPs, asking patients about both their physical activity and prolonged sitting time is a key first step. Promotion of regular physical activity in primary care has been shown to result in significant short to medium term increases in physical activity among individuals and is important brief advice to provide to everyone who accesses clinical care.

Key points

- **Physical inactivity remains a major cardiovascular risk factor.**
- **Providing advice to promote and increase physical activity is an ongoing challenge in clinical practice.**
- **Prolonged sitting is a new risk factor associated with cardiometabolic risk.**
- **Prolonged sitting may be associated with increased incidence of cardiovascular disease and mortality. However, people who are regularly physically active in their nonsitting time may offset these effects.**

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Cardiovascular disease (CVD) causes 18% of the total burden of disease (morbidity and mortality) in Australia,¹ and regular physical activity is an important measure for its prevention. However, 57% of adults do not meet the minimal level of physical activity recommended for health, which is 150 minutes/week of moderate-intensity physical activity (equivalent to around half an hour per day), and most adults report between 35 and 45 hours/week of sedentary behaviour (around 6 hours/day).² This article reviews the evidence on physical activity and CVD as well as the evidence for sedentary behaviour (prolonged sitting) as a potential CVD risk factor, and how these relate to the recently revised Australian guidelines.³ The implications of a new consideration of physical activity and sedentary time for clinical practice are also discussed.

The new guidelines

Australia's Physical Activity and Sedentary Behaviour Guidelines for adults (18-64 years), which were published in 2014, are derived from a review of epidemiological and clinical evidence and reflect consensus decisions about the amount of activity required for health.³ There are several differences between these new guidelines and the existing physical activity guidelines, which were published in 1999. These differences include a new guideline for 'any activity' above zero being beneficial, a new upper level for moderate activity of 300 minutes/week and a new strength training guideline (especially relevant for older adults). In addition, there is a new guideline for general sedentary behaviour (sitting time). For children, the guidelines suggest more physical activity – around 60 minutes/day – for optimal health. The new guidelines are discussed in the Box, along with a summary of the changes that have been made.⁴

Physical activity and CVD prevention: evidence update

A clear inverse relationship between physical activity and CVD risk has been recognised for over 25 years.⁵ Physical inactivity contributes as much to global mortality as does tobacco smoking, and it contributes to more deaths and morbidity than obesity.⁶ A plethora of recent summary analyses, including systematic reviews and meta-analyses, have confirmed that physical activity lowers the risk of angina or infarction or of dying from cardiac disease; studies typically show a



reduction in risk of approximately 25 to 30% in individuals who meet the minimal physical activity recommendations (150 minutes/week of moderate-intensity exercise) compared with those who remain inactive.⁷⁻¹⁰ The preventive association shows a dose–response relationship, with those at the higher end of the recommended amount (300 minutes/week) showing around 5% lower risk than those at the lower end (150 minutes/week).¹¹ The benefits seem to be marginally stronger for women than men.¹¹ All studies show a cardioprotective benefit of leisure time physical activities (including regular walking), most show a similar benefit from moderate-intensity activity at work,¹⁰ and some show associations with regular active transport. However, there are inconsistent associations for CVD protection with domestic physical activities.¹²

Many effects of being active are directly protective; thus, they are independent of other behavioural risk factors and biomarkers.¹³ Other cardioprotective benefits may be moderated by activity. For example, physical activity has a clear effect on lowering blood pressure (5 to 10 mmHg systolic, 1 to 6 mmHg diastolic),¹⁴ as well as favourably influencing lipid profiles, reducing C-reactive protein and other inflammatory markers, reducing central adiposity and, at high volumes of activity, increasing total energy expenditure to influence weight. Physical activity also benefits patients with cardiac failure,¹⁵ and it reduces the incidence of ischaemic stroke.¹⁶ Among people with metabolic syndrome or type 2 diabetes, physical activity has been shown to lower the incidence of CVD by around 35%.¹⁷

In addition, there is now established evidence collected over three decades for tertiary prevention benefits – namely, exercise training as part of cardiac rehabilitation programs in those with existing heart disease. Physical activity in cardiac patients improves quality of life, reduces re-infarction rates and probably prolongs survival slightly.¹⁸ Unfortunately, less than one-third of stable cardiac patients who are eligible for rehabilitation actually access such programs, which creates a need for effective low-contact community-based programs that emphasise moderate-intensity activity for people with cardiac disease.^{19,20}

Sedentary behaviour and CVD

What is sedentary behaviour?

Sedentary behaviour, or ‘too much sitting’, refers to activities involving sitting or lying down that do not increase energy expenditure substantially above the resting metabolic rate.²¹ This includes activities (at home or at work) such as performing desk work, watching TV,



driving a car and playing computer games. Sedentary behaviour is distinct from a lack of moderate-to-vigorous physical activity; it refers to prolonged periods of sitting, as opposed to failure to meet recommended physical activity levels.

Biological effects of sedentary behaviour on health

The associations of sedentary behaviour with cardiometabolic health are still being identified through studies in ‘inactivity physiology’.²² During prolonged sitting, the large postural muscles in the legs, back and trunk are inactive (very low detectable muscle activity), which results in decreased muscle uptake of circulating blood sugar and lipids. Inactive muscles influence lipoprotein lipase activity and glucose transporter 4 (Glut4) activity at the cellular level, which leads to hyperglycaemia, hyperlipidaemia and hyperinsulinaemia, and increased cardiometabolic risk.²³

Findings from cross-sectional and experimental studies support this association between prolonged sitting and cardiometabolic risk. For example, in a US study researchers examined the effects of one day of sitting in 14 young, healthy, fit non-obese adults and observed a 31% reduction in insulin sensitivity.²⁴ However, the impaired insulin sensitivity was mitigated when the sitting time was reduced from 17 hours/day to 6 hours/day and replaced with standing or light walking. An Australian study randomised 19 middle-aged adults to three groups: continuous sitting, sitting, with interruptions of light-intensity walking (3.2 km/hour) every 20 minutes, and sitting with interruptions of moderate-intensity walking (5.8 to 6.4 km/hour) every 20 minutes.²⁵ When the participants interrupted their sitting with walking breaks or just with standing behaviour, their blood glucose was 23% lower than in the continuous sitting condition. There was no difference between light and moderate-intensity walking conditions, suggesting that simply breaking up prolonged sitting with standing or low-intensity activities may be beneficial for ameliorating the postprandial blood glucose response.²⁵

Cross-sectional associations between high sedentary behaviour and less favourable CVD risk biomarker profiles have been observed in several studies. Much of the epidemiological literature around sedentary behaviour and cardiovascular biomarkers has involved associations with prolonged television viewing or other screen-based activities. Increased cholesterol, triglycerides, plasma glucose and fasting insulin are seen among individuals who report large amounts of television watching, which is independent of physical activity levels at other times in the day.²⁶⁻³¹

It is possible that different settings for sedentary behaviour may have different associations with cardiometabolic risk biomarkers. In studies from Denmark, Norway and Australia researchers have observed associations of daily sitting time with a range of cardiometabolic risk biomarkers (measures of obesity and waist circumference, total cholesterol, HDL-cholesterol, nonfasting blood glucose, triglycerides, diastolic blood pressure).^{27,30,31} Although similar associations were seen in a British cohort, television watching was more strongly associated with CVD biomarkers than was occupational sitting.²⁹

Two recent reviews have summarised the experimental literature and concluded there is moderate quality evidence to suggest that

prolonged uninterrupted sedentary behaviour has harmful effects on cardiometabolic biomarkers.^{32,33} These reviews found that breaking up prolonged sitting time shows promising beneficial effects on these cardiometabolic risk biomarkers.^{32,33}

Prolonged sitting and CVD

The very first study on 'exercise and heart disease', published in 1953, noted that London bus drivers had nearly twice the rates of heart disease compared with bus conductors.³⁴ This paper was seminal in launching the field of physical activity epidemiology because it was thought to demonstrate benefits of physical activity. However, it may have been the first study of prolonged sitting and CVD risk, rather than of 'exercise and health'.

Recently, a number of studies have examined the association between sedentary behaviour and CVD and health outcomes. In a 2011 meta-analysis of television viewing (four studies), which is a commonly reported sedentary behaviour, a 15% increased risk of CVD was reported per two hours of television watched.³⁵ In a 2012 meta-analysis, relative risks were 2.47 for CVD events (three studies) and 1.90 for CVD mortality (eight studies) among people with high sitting levels compared with those who had low sitting levels.³⁶

Overall, studies of sitting and mortality show a slight but consistent increase in risk for people with prolonged daily sitting (typically more than 7 or 8 hours/day).³⁰ Studies in large population cohorts have reported mixed findings, with some showing limited associations between sitting and CVD mortality,^{37,38} and several suggesting significant increases in the risk of incident or fatal CVD events.³⁹⁻⁴² A recent meta-analysis, showed a small but significant increase (17%) in the risk of CVD death and incident CVD (14% increase), and a larger effect of sitting at home (prolonged television watching) on the incidence of diabetes (90% increased risk).⁴³

A key feature of the epidemiological evidence is that the effects of sitting on CVD outcomes may be moderated by physical activity. In a Canadian cohort, the sitting-CVD association was shown to be stronger in those who were physically inactive as well, compared with those who were active in their leisure time.⁴⁴ The same attenuation of the relationship has been demonstrated in Denmark⁴² and in women in the USA³⁹; it was also observed in a 2012 review.⁴⁵ This suggests a possible relationship between sitting and subsequent incident or fatal CVD, and that it is much stronger in those who are not reaching the minimum recommendation of 150 minutes/week of moderate-intensity physical activity.

What can clinicians do about physical inactivity?

The RACGP's *Guidelines for Preventive Activities in General Practice* include physical activity recommendations from GPs as part of advice about healthy lifestyle and chronic disease management.^{46,47} Primary care advice is still recommended as one of the seven major strategies for a population approach to promoting physical activity.^{48,49} The promotion of physical activity is evidence based – even brief advice has been shown to result in significant short to medium term increases in activity among patients.⁵⁰ Therefore, widespread delivery of physical activity counselling and advice would be expected to

Interpreting the new guidelines: what has changed?*

Australia's Physical Activity and Sedentary Behaviour Guidelines for Adults (18 to 64 years), which were published in 2014,³ have been updated to reflect recent evidence and feature several changes from the previous Australian guidelines for physical activity, which were published in 1999. The new guidelines are available on the Australian Government's Department of Health website: www.health.gov.au/internet/main/publishing.nsf/content/health-pubhlth-strateg-phys-act-guidelines.

Physical activity

Doing any physical activity is better than doing none.

The previous guideline recommended half an hour of daily moderate-vigorous activity; there was no recommendation that 'any activity' is better than none. Evidence is starting to accumulate that even 'below the accepted threshold' activity (e.g. light walking, gardening) may have some benefits for cardiovascular health, especially for people who currently do no physical activity or almost no activity.

Be active on most, preferably all, days every week.

This guideline is consistent with the previous guideline. Physical activity needs to be regular, performed throughout the week, to normalise glucose metabolism and lower CVD risk.

Accumulate 150 to 300 minutes of moderate-intensity physical activity or 75 to 150 minutes of vigorous-intensity physical activity, or an equivalent combination of both moderate and vigorous activities, each week.

The previous guideline recommended 150 minutes/week of moderate activity (or 75 minutes/week of vigorous activity, or an equivalent combination of both moderate and vigorous activity). This is now considered to be 'the minimum for health' and still applies to CVD prevention. However, recent evidence suggests that there is an upper level of 300 minutes/week of moderate activity or 150 minutes/week of vigorous activity (or equivalent combination of both), and that activity, including walking, at this higher level (between half an hour and one hour per day) may confer additional health benefits, especially for preventing cancer and preventing weight gain. Activity beyond this level is not considered to confer further health gain (and may result in increased adverse effects, such as injury).

Do muscle strengthening activities on at least two days each week.

This is a new guideline. It is especially relevant to older adults for maintaining function and preventing falls. Resistance training independently contributes to reducing risk for diabetes and CVD.

Sedentary behaviour

Reduce time spent in prolonged sitting. Break up long periods of sitting as often as possible.

This is a new guideline, and the evidence for this guideline is discussed in detail in this article (see page 30). Prolonged sitting may confer additional cardiovascular risk that may be partly independent of participation in moderate or vigorous physical activity. 'Not sitting' (which involves reducing sitting time and replacing it with standing or moving around) improves glucose and lipid metabolism and increases total daily energy expenditure.

* Summary of the changes made to the guidelines are adapted from reference 4. Abbreviation: CVD = cardiovascular disease.



have an impact on population health.

The RACGP's guidelines recognise that doctors should assess physical activity as frequently as they assess other risk factors, such as smoking status, blood pressure and weight.⁴⁶ Nonetheless, serial representative sample surveys of Australian GPs from 1997 to 2007 have shown that although most GPs thought that providing advice about physical activity was part of their role, and felt confident about activity counselling, only 28 to 31% reported that they discussed it with their patients, and the rate did not change over time.⁵¹ In representative surveys of US patients regarding primary care advice they had received, fewer patients reported that exercise was discussed in the consultation, declining from 14% of patients in 1995 to 11% a decade later.⁵² Receiving advice about physical activity was more commonly reported among those with chronic disease, but in 2007 it still remained low among people with hypertension (14%), obesity (26%) and diabetes (16%), all of which are conditions that have activity as part of clinical management. The low reach of physical activity advice has been noted in other studies, and compared with the almost universal assessment of smoking, blood pressure, cholesterol and obesity.⁵⁰

Physical activity advice remains a challenge in primary care, with many studies identifying the same barriers, such as a perception of lacking the skills or motivation or of having insufficient time to counsel. Solutions may include the use of local referral schemes, advice from in-practice health professionals including practice nurses, or the use of tailored behaviour change resources, but these approaches remain to be scaled up.⁵³ This means that more GPs need to ask about, and recommend, physical activity, until it becomes as frequent as assessing patients for smoking and providing advice to quit, which is institutionalised in current practice for all smoking patients. More patients who have had uncomplicated cardiac events should be encouraged to attend cardiac rehabilitation exercise programs, and all people with diabetes should take physical activity as seriously as their dietary control.

Tools for assessing physical activity can be relatively brief. Usually, one to three questions can be used to classify people as 'inactive' or as 'regularly active and meeting the 150 minute guideline'. An example of such a tool, developed for and validated in general practice is the UK's *General Practice Physical Activity Questionnaire*, which is available online (www.patient.co.uk/doctor/general-practice-physical-activity-questionnaire-gppaq).⁵⁴ Other brief assessment tools have been developed.⁵⁵ GPs should take every opportunity to ask about physical activity, noting that moderate activity – and also walking – can be undertaken by almost everyone and that even small increases can be beneficial.⁴ Additional strategies include provision of information about physical activity opportunities in the local community, and referral to community or web-based programs, or to practice-based nurses or exercise scientists for more intensive and structured advice about changing behaviour.⁵⁶

Addressing prolonged sitting and sedentary behaviour

The concept of sedentary behaviour is a 'new risk factor' for consideration. Clinician awareness is key, especially regarding lifestyles and work practices that result in prolonged sitting. For overweight

and obese patients, it may be difficult to lose weight through increases in activity or decreases in sitting alone, but engaging in physical activity and reducing sitting time can improve metabolic health and reduce visceral adiposity, even in the absence of weight loss. These are worthy goals in terms of diabetes prevention.

The settings in which people spend much of their time sitting include workplaces, inactive travel and domestic settings. Although the workplace is a major setting in which prolonged sitting may occur,⁵⁷ it is unlikely that primary care advice could re-engineer workplaces with sit-stand desks or physical activity breaks; this is an issue for workplace and occupational health practice. It is easier and more realistic for clinicians to recommend active travel (e.g. using public transport, walking or cycling to work) and decreased sedentary (e.g. television watching) time at home. Other activities, such as regular walking of the family dog, can displace this prolonged sitting time.

The best clinical approach includes awareness of both the physical activity and sedentary behaviour patterns of every patient. For people who have low levels of physical activity and spend large amounts of time sitting, it seems that cardiovascular risk is maximised; for these individuals, efforts to increase activity are more important for metabolic and vascular health than for patients who spend a lot of time sitting at work but who are also meeting the physical activity guidelines. So the key target group for advice is those who sit, probably for more than 8 to 10 hours per day, and also do very little regular walking or other physical activity. For these patients, increasing activity should be the first clinical recommendation, as encouraging lifestyle activity (increased walking and other moderate-intensity activity in everyday life) is the most important thing to do for the health of individuals who are both inactive and sedentary.

Conclusion

Overall, physical activity remains an important, but still undervalued, strategy for the prevention of CVD. New guidelines for Australia identify the amount of activity required for health, which is now considered to be 150 to 300 minutes/week of moderate-intensity activity (or 75 to 150 minutes/week of vigorous activity, or an equivalent combination of both moderate and vigorous activity). A new potential risk factor, prolonged sitting (sedentary behaviour), may pose additional risk. Prolonged and uninterrupted sitting is associated with cardiometabolic risk factors, especially increased blood glucose and insulin levels, but this effect is reversible if the total sitting time is reduced and prolonged sitting is interrupted. Sitting confers an increased risk for cardiovascular events and mortality, which is particularly marked in people who do no physical activity. People who are both inactive and who sit for prolonged periods of the day should be advised to 'move more and sit less'. Clinical advice to promote physical activity is as important as advice to manage other cardiovascular risk factors, such as quitting smoking or reducing weight. **CT**

References

A list of references is included in the website version (www.medicinetoday.com.au) of this article.

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