Physical activity, sedentary behaviour and heart health

Heart Foundation™

This position statement outlines key findings and recommendations from the Heart Foundation on the relationship between physical activity, sedentary behaviour, and heart disease for adults. This position was guided by three research questions and replaces the organisation's physical activity (2009) and sedentary behaviour (2012) position statements.

Research questions:

1. What is the association between physical activity and cardiovascular disease (CVD) risk and mortality in adults?
2. What is the association between sedentary behaviour and CVD risk and mortality in adults?
3. What s the relationship between physical activity and health-related outcomes in adults with established CVD[1]?

RECOMMENDATIONS

Messages for all New Zealand (NZ) adults for heart health

- **Sit less and move more** every day to improve your heart health.
- Any physical activity and all efforts to reduce and break up long periods of sitting will lower your risk of heart disease.

1. Limit the amount of time you spend sitting each day. Replace sitting time with any type of physical activity whenever you can.
2. Aim to do **at least 150 minutes (2.5 hours)** of physical activity each week that makes you breathe harder than normal but still able to talk OR **at least 75 minutes (1 ¼ hours)** of physical activity where it is hard to say more than a few words.
3. Move your body where possible and aim to be physically active every day. The more physical activity you do above these recommendations – the better your heart health.
4. **Adults who use a wheelchair or are unable to** stand should be active your own way. Focus on moving your body often and including physical activity each week that makes you breathe harder than normal but still able to talk.
5. There are endless ways to meet the recommendations for physical activity. Focus on activities you enjoy, building in physical activity as part of your daily habit and reducing sitting time (see ideas in Table 1).

[1] For research question 3) the Heart Foundation is most interested in the following cardiovascular diseases: coronary heart disease, atrial fibrillation and heart failure.

Messages for NZ adults at increased risk of developing heart disease or living with a heart condition

- **Sit less and move more** every day to improve your heart health.
- Any physical activity and all efforts to reduce and break up long periods of sitting will improve your heart health.

1. Move your body where possible and aim to be physically active every day. The more you move – the better for your heart health.
2. Limit the amount of time you spend sitting each day. Replace sitting time with any type of physical activity whenever you can.
3. **Adults living with heart disease** should:
    a. Consult your doctor before starting to increase your physical activity. Ask for advice on the type and amount of activity that is appropriate for your personal needs, ability, functional limitations, medications, and overall treatment plan.
    b. Gradually build your activity levels with aim of doing **at least 150 minutes (2.5 hours)** of physical activity each week. Physical activities should make you breathe harder, but you should still be able to talk. Any progress will improve your heart health.
    c. Be referred to an exercise-based cardiac rehabilitation programme or the Green Prescription programme for supervised exercise (where available).
    Visit hhdirectory.heartfoundation.org.nz to find your nearest heart support group.
4. **Adults living with controlled hypertension** should aim to do **at least 150 minutes (2.5 hours)** of physical activity each week that makes you breathe harder than normal but still able to talk, OR **at least 75 minutes (1¼ hours)** of physical activity each week where it is hard to say more than a few words.
5. **Adults who have been inactive for some** time should start with small amounts of light physical activity, and gradually increase the number of days and the length of time you are active.
6. **Adults with advanced or uncontrolled heart disease and other health conditions such as uncontrolled hypertension** may need to reduce their goal for physical activity. Speak to your doctor before starting any physical activity.

WAYS TO ACHIEVE THE RECOMMENDATIONS

Types of physical activity

Below are ideas for different activities that can help you meet these recommendations. They can be done by yourself or with others and include a mix of aerobic, strength, flexibility, and balance activities.

Table 1: Ideas for physical activity for all ages and abilities

Walking	Jogging / running	Cycling
Household jobs: sweeping, mopping, vacuuming, cleaning	Mowing lawns, gardening, chopping firewood, raking leaves, washing the car	Active travel i.e. walking, cycling or walking to the bus-stop
Carrying shopping	Climbing stairs	Aerobics
Dancing / Zumba®	Organised sports i.e. touch, netball, volleyball	Yoga
Social sports like tennis	Kapa haka	Pilates
Swimming	Stretching exercises	Tai Chi
Lawn bowls	Weight training	Golf
Waka ama	Hunting	Fast cycling / spin classes
Rowing	Hiking	Kilikiti (Samoan cricket)
Boxing	Body weight exercises i.e. squats, sit-ups, press-ups	High Intensity Interval Training (HIIT)
Mau Rākau		
Chair-based exercises	Gathering kai	Horse riding
Mahi ā rehia	Kī o Rahi	Skateboarding
Scootering (without a motor)	Roller skating / inline skating	Chair-based exercises

What about intensity?

Light intensity: 1.6 – <3 Metabolic Equivalent of Task (METs)[2]

An intensity that does not cause a noticeable change in breathing rate and can be sustained for an extended period of time. An example is hanging out the washing.

[2] Metabolic equivalent of task (MET) is a physiological measure expressing the intensity of physical activities. One MET is equivalent to the energy expended at rest.

Moderate intensity: 3-6 METs[3]

Makes you feel warmer, breathe harder and makes your heart beat faster than usual, but you should still be able to carry on with a conversation uninterrupted. An example is brisk walking.

How can you do 150 minutes (2.5 hours) of moderate intensity physical activity a week?

- 10 minutes of vacuuming, 20 minutes of dancing, 60 minutes of gardening and 60 minutes of walking
- 2 minutes of climbing stairs, 10 minute walk around the block and 10 minutes of cleaning everyday
- 15-minutes walking, 5-minutes carrying groceries and 10 minutes cleaning everyday
- 30 minute walk on five days of the week
- 15 minute walk to and from the bus stop on five days of the week

Vigorous intensity: >6 METs[3]

Means you can't say more than a few words before pausing for a breath. If you have established or advanced heart disease you may need to slow down to stay safe while exercising. An example is jogging.

How can you do 75 minutes (1 ¼ hours) of vigorous intensity physical activity a week?

- 20 minute run on four days of the week
- 40 minute exercise class (i.e. aerobics or HIIT) on two days of the week

How can you reduce and break up long periods of sitting each week?

- Build in breaks when watching TV i.e. get up during an ad break or between episodes
- Plan movement for when you usually sit down i.e. a walk in the evening
- Get off the bus or train a stop earlier
- Park further away from work, the shops or when dropping kids at school
- At work, build in movement away from your desk i.e. visit a colleague instead of sending an email

[3] Metabolic equivalent of task (MET) is a physiological measure expressing the intensity of physical activities. One MET is equivalent to the energy expended at rest.

KEY MESSAGES

Sitting less and moving more is associated with better heart health outcomes (1-3). Over the last few decades, changes in how we live, work and play have led to many people doing less physical activity and sitting more. Despite the prevalence of heart disease reducing over time it is still the leading cause of death in NZ and physical inactivity is one of the top five risk factors contributing to 'health loss' (4, 5). To improve heart and overall health we need to integrate more achievable physical activity into our lifestyles. People who are inactive have the most to gain when increasing physical activity, however additional benefits accrue when more physical activity is incorporated into the day; even in those who meet the physical activity guidelines (1). People who are already active, but are not meeting recommended levels of physical activity should consider how they can sit less and move more.

BACKGROUND

Definition of physical activity

Physical activity is defined as 'any bodily movement performed by muscle that requires an increase in energy expenditure' (6). It refers to all kinds of movement, including recreational and occupational activity (part of a person's job), housework or active travel. There are many ways to be active including walking, organised sports, gardening, kapa haka and many household chores (see Table 1). All types of physical activity provide health benefits if it is regular in frequency and of sufficient duration (7).

Definition of sedentary behaviour

Sedentary behaviour is a distinct concept from too little physical activity or exercise with its own adverse health consequences (8). It is defined as 'any waking behaviour characterised by an energy expenditure of <1.5 METs[4] while in a sitting, reclining, or lying posture' (9). Sitting, driving, computer use and screen time are all sedentary behaviours (10).

Definition of active travel

Active travel (or active transport) includes any type of travel that involves physical activity such as walking, running, cycling, use of non-motorised vehicles and incidental activity associated with the use of public transport. It may be for commuting to work, school, university, or any other destination.

Physical inactivity and sedentary behaviour in NZ

Over the past 10 years, physical activity levels of NZ adults have remained relatively stable with little change. In the latest 2019/20 NZ Health Survey, around half of all adults (51.7%) self-

[4] Metabolic equivalent of task (MET) is a physiological measure expressing the intensity of physical activities. One MET is equivalent to the energy expended at rest.

reported physical activity for at least 2.5 hours within the past week with men more likely to be physically active (55.3%) than women (48.3%) (11).

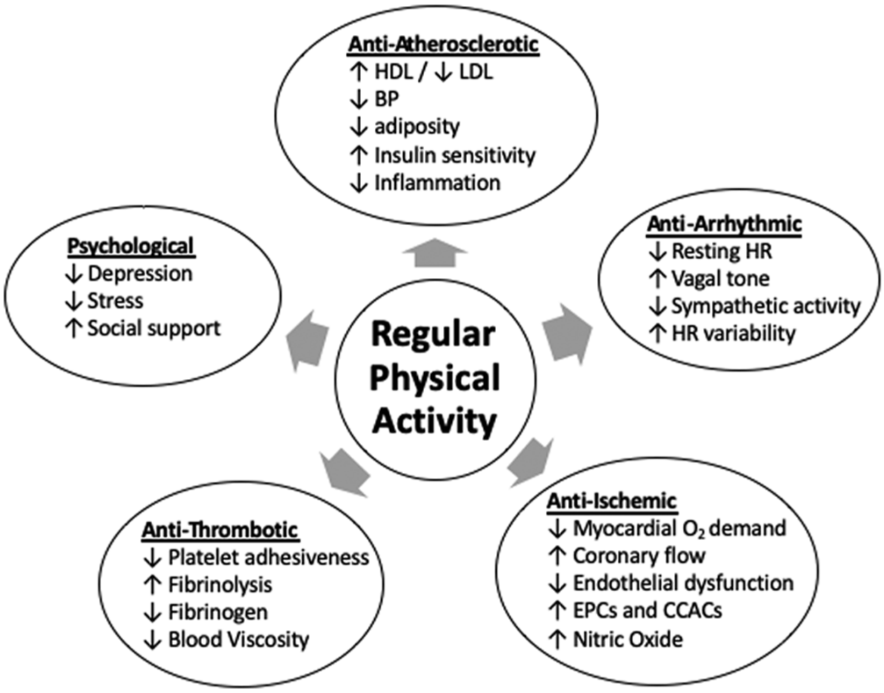
Data from the 2019/20 NZ Health Survey showed one in eight adults (12.5%) performed less than 30 minutes of physical activity across the week and this was disproportionately higher in people who were disabled (39.7%) and in Pasifika (17.9%), Māori (13.9%) and Asian (14.6%) populations (11).

There is a lack of recent data on sedentary behaviour in NZ adults. However, over the past few decades, more time has been spent in sedentary behaviour due to changes in jobs, transport, and greater use of labour-saving devices and technology (i.e. computers, phones). A global comparative study found that between 2002 and 2004, NZ adults spent a median of 4 hours a day sitting. Younger adults, highly educated people and less physically active adults were more likely to sit for longer (12). According to the 2019/20 NZ Health Survey, young people aged 10-14 years have high levels of screen time with 91.6% watching more than two hours a day (11).

Cardioprotective effects of regular physical activity

Figure 1: Cardioprotective effects of regular physical activity

(↑ indicates increase ↓ indicates decrease)



Source: Franklin et al 2020 (13)

BP: blood pressure; CCACs: cultured/circulating angiogenic cells; EPCs: endothelial progenitor cells; HDL: high-density lipoprotein; HR: heart rate; and LDL: low-density lipoprotein

Physical activity triggers many physiological responses that result in beneficial short- and long-term adaptations within the body, reducing the risk of cardiovascular events (see Figure 1) (10, 13). Regular physical activity has a favourable effect on many of the established risk factors for CVD such as blood pressure, cholesterol, insulin sensitivity and body weight along with helping to increase cardio-respiratory fitness (CRF) (14). Less is known around the biological systems impacted by prolonged, uninterrupted sitting; however, it is likely to detrimentally affect vascular function, blood pressure, blood glucose and blood flow to the brain (8).

Risks of physical activity

There is an association between more recreational physical activity and greater musculoskeletal injuries (10). The risk of these injuries can be reduced by gradually increasing activity levels and giving time for your body to adjust. This is especially relevant to people who are inactive and starting to increase activity (6). There is evidence of a relationship between greater recreational physical activity and a lower risk of fractures and osteoarthritis, demonstrating a protective effect on muscles and joints (10) .

When people with a high risk of developing heart disease or pre-existing heart disease go from doing no or very little physical activity to undertaking vigorous to high-intensity activity, they have a higher risk of experiencing an acute cardiovascular event (13). The risk of a sudden cardiac event reduces when low or moderate intensity physical activity is undertaken, and when increases in physical activity frequency, intensity and duration are gradual (10, 13). For some people, further increasing the intensity of exercise may be appropriate following consultation with a health professional.

Several studies have shown inactive people with pre-existing heart disease have the highest mortality risk when increasing their activity levels, however the risk is small and any increase in risk is outweighed by the long-term benefit of safely undertaking physical activity (13, 15). For people living with heart disease general advice is to work with your doctor or a clinical exercise physiologist to safely build toward the recommended levels of activity focusing on the regularity and duration of activity (13). Supervised exercise training (via cardiac rehabilitation) and regular physical activity are recommended due to evidence that higher CRF and higher volumes of physical activity are associated with improved survival and a lower risk of adverse outcomes (13).

Overall, the health benefits of being physically active, outweigh the risk of injury and adverse events when physical activity is undertaken safely.

EVIDENCE FOR PHYSICAL ACTIVITY, SEDENTARY BEHAVIOUR AND HEART HEALTH

To inform this updated position, the Heart Foundation’s Expert Nutrition Policy (ENP) working group with co-opted expertise in physical activity followed the process outlined below to consider the available scientific evidence. The resulting position statement is supported by the evidence synthesis from the recently released World Health Organisation (WHO) 2020 guidelines on physical activity and sedentary behaviour (10).

The ENP working group accepted the WHO evidence assessment and use of GRADE (Grading of Recommendations Assessment, Development and Evaluation) for outcomes identified as relevant to the Heart Foundation. The GRADE method is a framework to assess the certainty of the body of evidence for each outcome and uses the following scale: high, moderate, low, or very low to describe confidence in the certainty of the effect related to each outcome (16, 17). Evidence related to the research questions and prioritised health outcomes were extracted from the WHO Evidence Profiles for discussion along with a modified version of the Evidence to Decision framework (18).

The WHO evidence assessment did not specifically consider the use of physical activity for those with pre-existing heart disease. An additional search was therefore conducted to identify systematic reviews and meta-analyses of controlled trials on physical activity interventions for people with heart disease. Three additional Cochrane reviews were selected and incorporated into the ENP discussions around evidence for this population subgroup (19-21). The ENP accepted the strength of the evidence from these reviews as they were consistent with the GRADE methodology (16, 17). A summary of the GRADE assessments used to inform the position statement can be found in **Appendix 1**.

Physical activity and CVD mortality

CVD mortality is commonly used to describe the underlying cause of death from CVD and includes heart, stroke, and blood vessel disease (4). Coronary heart disease (CHD) accounts for over half of all CVD mortality in NZ (22).

The inverse association between physical activity and CVD in adults is well-established (23). Evidence for the association between physical activity and CVD mortality came from a 2019 meta-analysis by Blond et al (1). Findings from 48 observational studies, that measured physical activity either by self-report or accelerometery demonstrated an inverse dose-response relationship between the amount of physical activity undertaken and CVD mortality with higher activity levels reducing incidence. Those who did little or no physical activity had a risk of CVD mortality that was 34% higher than those who were meeting current guidelines. However, the risk of CVD mortality was lower across all levels of physical activity above the reference level of 750 MET[5] min/week[6], which is equivalent to meeting current physical activity guidelines. The greatest benefit was seen in people who moved from being inactive to becoming active, and the benefits accumulated with increasing amounts of physical activity.

Participation in 2000 MET min/week[6], which is equivalent to 60 minutes of moderate intensity activity on 7 days of the week was associated with a 19% risk reduction in CVD mortality. There did not appear to be a threshold effect above which additional physical activity was not associated with lower CVD mortality (1). The WHO assessed this evidence as moderate certainty using the GRADE framework.

[5] Metabolic equivalent of task (MET) is a physiological measure expressing the intensity of physical activities. One MET is equivalent to the energy expended at rest.

[6] 750 MET min/week is equivalent to meeting current physical activity guidelines or five days of physical activity at moderate intensity (5 METs) for 30 min per day.

Physical activity and CHD incidence

Evidence on CHD risk came from a 2011 meta-analysis by Sattelmair et al of four pooled cohort studies (n=64,733) which demonstrated occupational, and leisure-time physical activity were associated with a risk reduction. The pooled risk among all studies that assessed leisure-time physical activity, indicated a 26% reduced risk of developing CHD when the highest and lowest categories of physical activity were compared (3). The WHO assessed this evidence as moderate certainty using the GRADE framework.

Physical activity and mental health

Evidence for the benefits of physical activity on mental health came from two systematic reviews by Schuch et al (24, 25). In 49 prospective cohorts of 266,939 adults, people with high self-reported physical activity (versus low physical activity) had 22% lower odds of developing depression (24). Similarly, in 14 prospective cohorts of 75,831 adults, people with high self-reported physical activity (versus low physical activity) had 20% lower odds of developing anxiety (25). The WHO assessed the evidence from both studies as moderate certainty using the GRADE framework.

Sedentary behaviour and CVD incidence and mortality

The evidence for the association between sitting time and CVD incidence came from a 2019 meta-analysis by Bailey et al of five studies (n= 224,414) (26). The highest categories of total daily self-reported sitting time varied between studies from >7.1 hours to ≥16 hours per day. The thresholds for being included in the lowest category of sitting time ranged from <4 hours to <8 hours of sitting a day. Those in the highest category of daily sitting time had a risk of CVD that was 29% greater than those in the lowest category. The risk was attenuated but remained significant (14% increased risk of CVD) when physical activity was accounted for. The WHO assessed this evidence as moderate certainty using the GRADE framework.

Evidence for the relationship between sedentary behaviour and CVD mortality came from a systematic review and harmonised meta-analysis by Ekelund et al 2019 of nine studies (n=850,000) (2). A dose-response association between sitting time and TV time with CVD mortality was found in those who were 'inactive' (lowest category of physical activity (<2.5 MET/hours per week)). People who sat for more than 8 hours per day had a 32% increased risk of CVD mortality when compared to those who sat <4 hours per day. An increased risk in those in the highest category of sitting was not apparent in those in the highest category of physical activity, indicating that 60-70 min of moderate-to-vigorous physical activity a day may mitigate the risk associated with high amounts of sitting (2).

Five studies (n=458,127) examined the relationship between TV-viewing time and CVD mortality. In the lowest category of physical activity (<2.5 MET/hours per week) those who watched TV for >5 hours/day had a 59% increased risk of CVD mortality when compared to those who watched TV for <1 hour/day (2). The WHO assessed this evidence as high certainty using the GRADE framework.

Sedentary behaviour, physical activity, and all-cause mortality

Evidence for the relationship between physical activity, sedentary time and all-cause mortality came from a systematic review and harmonised meta-analysis by Ekelund et al 2019 (27). Eleven studies (n=36,383) demonstrated that any physical activity regardless of intensity (including light intensity), was associated with a lower risk of mortality. A dose response association was observed between total sedentary time and all-cause mortality. Risk of mortality gradually increased from 7.5 to 9 hours of sedentary time and was more pronounced over 9.5 hours. Sedentary time of 10 hours was associated with a 48% increased risk of mortality (27). The WHO assessed this evidence as high certainty using the GRADE framework.

Physical activity for people at increased risk of CVD

There is a clear dose-response relationship between physical activity and CVD mortality for people living with hypertension (high blood pressure) (28). Evidence regarding the effectiveness of aerobic exercise on high blood pressure (hypertension) was derived from a 2019 meta-analysis by Cao et al of 13 randomised controlled trials (n=757 people with hypertension)(29). When compared to people with hypertension who did not participate in an exercise intervention, people with hypertension who participated in an exercise intervention reduced systolic blood pressure by 12.26 mmHg and diastolic blood pressure by 6.12 mmHg (29). Duration of exercise interventions varied, but most were between 8-12 weeks. The WHO assessed this evidence as high certainty using the GRADE framework.

A systematic review and meta-analysis by Costa et al 2018 of 9 randomised controlled trials (n=245) compared the efficacy of HIIT versus moderate-intensity continuous training (MICT) for reducing blood pressure. Patients with chronic heart failure, CHD, metabolic syndrome, abdominal obesity, and pre-diabetes were included. HIIT and MICT provided comparable reductions in resting systolic and diastolic blood pressure in both pre-hypertensive and hypertensive adults. Limited data were available to compare the incidence of adverse events (30). The WHO assessed this evidence as moderate certainty using the GRADE framework.

A 2021 Cochrane systematic review and meta-analysis of the effects of walking on blood pressure in both hypertensive and normotensive adults involved 73 trials (n=5,763) (20). The walking interventions, on average involved walking 153 min a week at a moderate intensity for 15 weeks. The authors concluded that there was moderate certainty evidence that walking reduced systolic blood pressure by 4.11 mmHg across all ages and sexes, compared to no walking (20).

Exercise-based cardiac rehabilitation

A 2016 systematic review and meta-analysis compared the effectiveness of exercise-based cardiac rehabilitation with no exercise control (63 trials) in people with CHD (n=14,486) (19). The median duration of cardiac rehabilitation was 6 months and follow-up were 12-months, with mainly middle-aged male participants following myocardial infarction (MI), angioplasty or cardiopulmonary bypass graft surgery. The authors concluded there was low to moderate certainty evidence that exercise-based cardiac rehabilitation led to a 26% reduction in CVD mortality (27 trials) and a 18% reduction in hospital admissions (15 trials), compared to no exercise (19).

A 2019 Cochrane systematic review and meta-analysis compared the effectiveness of exercise-based cardiac rehabilitation with no exercise (control) in people with heart failure (21). The review included 44 trials (n= 5,783) with a median of 6 months follow-up and mainly people with heart failure due to reduced ejection fraction (HFrEF). The authors concluded there was low to moderate certainty evidence that exercise-based cardiac rehabilitation led to a 30% reduction in hospital admissions (21 trials) and that heart failure-specific admissions were reduced by 41% (14 trials), compared to no exercise (21).

DISCUSSION

This position statement provides clear scientific evidence that greater duration and frequency of physical activity and lower amounts of sedentary behaviour were associated with a lower risk for premature mortality from CVD. If inactive New Zealanders increased their physical activity by even a small amount, it would have an important public health impact. Physical activity promotion should consider the type, nature and context of physical activity, which are discussed in detail below.

Summary of main results

There was adequate evidence to demonstrate the heart health benefits of participating in at least 150 minutes of moderate-intensity physical activity per week. There was a clear dose-response relationship between moderate-intensity physical activity and heart health, with greater heart health benefits when the duration was greater than 300 minutes per week (1). People who did little or no physical activity had a risk of CVD mortality that was 34% higher than those meeting the current guidelines and have the most to gain (1).

There was adequate evidence to recommend that all adults minimise sedentary behaviour by sitting less. Sitting occupies many adults waking hours and excessive sitting increases CVD risk, particularly among people who don't meet current physical activity recommendations (2, 8, 26). Higher levels of total physical activity accumulated through the day, at any intensity and less time spent sedentary was associated with a substantially reduced risk for premature all-cause mortality (27). One of the ways to reduce sedentary time is to build in more movement throughout the day. Although the evidence is limited, any type of movement that displaces sedentary behaviour (e.g. breaking up long periods of sitting) is likely to contribute to the reduction of CVD risk. Incidental physical activity such as taking the stairs, and short walks can help people to break up sitting and accumulate physical activity towards recommended levels (7, 31). Although there was a lack of evidence, people living with any form of heart disease should be encouraged to reduce sitting; similar to the general population.

Physical activity is important for both the primary prevention and management of hypertension with evidence showing that physical activity not only lowers blood pressure, but improves physical function, reduces CVD progression, and reduces CVD mortality in people living with hypertension (20, 29).

There was evidence supporting the benefits of exercise-based cardiac rehabilitation for people with CHD and heart failure (19, 21, 32). This is consistent with international guidelines. which recommend regular aerobic exercise in patients with heart failure to improve symptoms and functional capacity (Class 1A evidence) (21, 33, 34). Exercise (a component of physical activity) may also help to avoid muscle wasting, which is a serious complication that affects a large proportion of people with heart failure (21, 35, 36). There was a lack of evidence for people with other heart conditions, however emerging evidence suggested a benefit of exercise-based cardiac rehabilitation for people with atrial fibrillation and post-valve heart surgery (37). Long-term sustained weight loss was associated with significant reduction of atrial fibrillation burden and severity and exercise was likely to be a key part of supporting and maintaining any reductions in weight (38).

Green prescription

The Green Prescription program is an effective primary care intervention that is tailored to local communities and supports people to become more physically active (39, 40). People at high risk of CVD and people with stable chronic disease such as heart disease, hypertension, and diabetes can be referred to Green Prescription. A retrospective study interviewed past participants by phone (n=147) and found Green Prescription increased physical activity by an additional 64 minutes per week over the long term for those who completed the programme (41).

Health benefits of strength and balance activities

This position statement has focused on encouraging all types of activities with emphasis on regularity and duration. The additional health benefits of strength and balance activities in addition to meeting the recommended levels of physical activity must be stated.

Strength-based exercises may involve body weight (i.e. press-ups, sit-ups), use of weights or resistance bands within a gym or home environment or day to day activities like carrying shopping. Muscle-strengthening physical activity, independent of aerobic physical activity, is associated with a lower risk of all-cause mortality (42). Many forms of exercise incorporate both aerobic and strength activities. In a cardiac rehabilitation setting, combined training that incorporates both strength and aerobic activity may be more effective than aerobic training alone in improving body composition, strength and some aspects of CRF (43).

Older adults can reduce falls by 28% by including physical activity that combines balance, strength and functional training (44). Regular physical activity can help maintain physical, social, and mental health, prevent falls, and enable healthy ageing (45).

Priority groups

Māori, Pasifika, and Asian adults are priority populations and important groups to work with to co-design physical activity messages and interventions (11).

In Pasifika communities, barriers to physical activity may include lack of knowledge of facilities and opportunities to be active, time, financial constraints, language, competing responsibilities (church, family), fear of making changes, poor health, and motivation (46). Pacific mothers appear not to view physical activity as important and therefore culturally appropriate approaches aimed at increasing awareness around the benefit of activity across all life stages is needed (46). Activities that are church and community-linked (i.e. dance, music) may provide greater acceptance (47).

In Māori communities, physical activity is an important aspect of Hauora. Many people may keep fit and active through structured exercises like cross fit, martial arts, mau rākau, kapa haka, Kī o Rahi, waka ama, gyms and sport clubs. The Sport NZ Active NZ Survey 2019 found that young Māori aged between 5-17 years (especially males) spend more weekly time in both organised sports and informal sports and activities than non-Māori (48). Spaces that resonate with Māori like the marae, sports field and community spaces are places that encourage whānau to be active and can play a role in supporting whānau to do physical activity (*korikori tinana*). Hapū leaders who are well respected by their whānau are in a good position to promote the positive Kaupapa of physical activity, hauora and wellbeing. A qualitative study of Māori men (aged 28-72 years) found that sedentary Māori men understand the importance of physical activity well and have a desire to be more active however common barriers include time, family and money (49). Whānau, hapū and iwi leaders or community leaders who are a seen and trusted face can help communities to be active and well. Approaches need to be culturally relevant and to address the enablers and barriers to Māori participating in sport and physical activity.

Physical activity for people with physical disability may be often overlooked but is also important. For people who are unable to stand or walk due to their condition, the focus should be on regular chair-based activities to build fitness and strengthen muscles and for messages to use inclusive language (50).

Green space and safe active travel

Recommendations for physical activity need to consider the local environment. Most people in NZ have good access to green open space regardless of socio-economic level although some disparities exist (51). Active travel can be an effective way to achieve physical activity recommendations. NZ-based research has shown that people who walked or cycled to their main weekday activity were 76% more likely to meet recommended physical activity levels than those who travelled by car (52). However, active travel relies on the local infrastructure and may not be relevant or feasible for everyone in NZ, particularly people living rurally (53, 54). There may be wider benefits to safe active travel such as supporting traffic decongestion and sustainability initiatives associated with less car use (54). Walking is low impact, low cost, requires no equipment, does not need to be done at a set time of the day, and the pace can be set by each person based on their ability. Walking may be helpful for people post-heart event or who have not exercised in a long time who need to slowly increase physical activity.

Impact of the workplace

Many adults spend from a third to a half of their waking hours at work. The work type and workplace environment are key drivers of daily movement (55). Naturally, some jobs such as nursing, or hospitality lend themselves to greater incidental physical activity whereas some jobs like office work and bus driving lend themselves to sitting for long periods. The workplace is a key setting for supporting the health of workers, which can contribute to increased productivity, less injuries and reduced absenteeism (56). Workplace physical activity programmes can help to address barriers to physical activity participation such as not having time or lack of social support.

Working from home appears to be more common post COVID-19 (coronavirus) and is likely to have an impact on physical activity habits (8). For some people, working from home may provide greater opportunity for physical activity, however for others it may mean less. People working from home may sit more and miss out on incidental physical activity associated with car or public transport use and from moving within their workplace environment. Further research on how working from home impacts physical activity and sedentary behaviour would be useful.

Implications for practise

There are wider health and social benefits to physical activity across all age groups. Physical activity offers people from all walks of life opportunities to meet others, addressing social isolation and combating loneliness (particularly in older age groups) and has profound positive benefits on mental health, stress and sleep, which are also associated with CVD (28). Evidence for physical activity needs to be considered within the context of other lifestyle factors that support optimal heart health including good nutrition, managing stress, and getting enough sleep (57, 58).

Despite clear guidelines around the minimum duration of physical activity for good health, around half of New Zealanders are not meeting these recommendations. Barriers to physical activity can vary and depend on life stage but the most common barriers include work and family commitments, lack of energy and difficulty maintaining motivation (48).

Ways to support people to be more active:

- Acknowledge the barriers and the challenge to increase physical activity and how this may vary between individuals and cultural groups. Make everyone aware of the health benefits of small amounts of activity accumulated across a week along with reducing sitting and all the activities that count (i.e. housework, parking further away).
- Encourage people that any progress made towards meeting the physical activity and sedentary behaviour recommendations will benefit their heart health no matter what age or level of risk.

- Where appropriate, prescribe physical activity as a first-line lifestyle treatment for patients with raised blood pressure, or as adjunct therapy with antihypertensive medication (59, 60).

- Where possible, refer all people living with a heart condition including those with CHD to a cardiac rehabilitation programme or to the Green Prescription programme for supervised exercise training (19, 21, 39-41).

  Medical evaluation before starting physical activity is recommended to reduce the risk of an adverse event. Contraindications may include unstable angina, uncontrolled/severe hypertension, severe aortic stenosis, uncontrolled diabetes, complicated acute myocardial infarction, uncontrolled heart failure, symptomatic hypotension, resting tachycardia, or arrhythmias (61). Following medical clearance, people should be supported to gradually build up the frequency and duration of activity over several weeks.

Across all settings, digital technologies may promote and support people of all ages to be more active. Mobile health (mHealth) initiatives like text messaging and applications (apps) have potential to help promote, support, and monitor physical activity with real time and personalised data. Participation in cardiac rehabilitation programmes is often low and telehealth approaches have proven to be effective at increasing physical activity and other modifiable CVD risk factors (32, 62, 63).

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Appendix 1

Evidence related to the research questions 1 and 2 were extracted from the WHO Evidence Profiles (18).

Question 1: What is the evidence for physical activity and cardiovascular disease risk and mortality in adults?
Bibliography: Blond et al (2019) and Sattelmair et al (2011)

Certainty assessment							**№ of patients**	**Effect**		**Certainty**	**Importance**
№ of studies	**Study design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**		**Relative (95% CI)**	**Absolute (95% CI)**		
Association between physical activity and CVD mortality among adults when 2000 MET min/week compared with 750 MET min/week											
48	Observational studies	No serious risk of bias	Serious inconsistency	Not serious indirectness	No serious imprecision	Possible publication bias Dose response relationship[a]	NR	HR: 0.81 (0.77 to 0.85)	5 less deaths per 10,000 person years (from -6 to -4)	⊕⊕⊕ MODERATE[b]	CRITICAL
Occurrence of coronary heart disease when each type of physical activity at recommended levels is compared with no physical activity											
4[c]	Observational studies	Serious[d]	Not serious	Not serious	Not serious	None	NR	OPA: RR = 0.84 (0.79 to 0.90) LTPA: RR = 0.74 (0.69 – 0.78)	NR	⊕⊕⊕ MODERATE[e]	CRITICAL

Blond K et al. Association of high amounts of physical activity with mortality risk: a systematic review and meta-analysis. Br J Sports Med. 2020;54(20):1195-201. Epub 2019 Aug 12.
Sattelmair J et al. Dose response between physical activity and risk of coronary heart disease: a meta-analysis. Circulation. 2011;124(7):789-95.

OPA = occupational physical activity, LTPA = leisure time physical activity
a Dose–response relationship between metabolic equivalent of task (MET) min/week (with 750 MET min/week as the reference)
b Certainty of evidence upgraded given no serious risk of bias of included studies and evidence of dose-response relationship; serious inconsistency (high between study variance, I^2>77%) present; possible small studies effects/publication bias not judged as sufficient to warrant additional downgrading
c Eaton 1995; Rosengren 1997; Hu 2007; Virkkunen 2007
d Serious; primary source of potential residual confounding is likely to stem from confounding variables that were either unmeasured or insufficiently measured in the individual studies themselves. For instance, dietary intake was rarely assessed in the studies reviewed
e certainty downgraded form high to moderate because of serious risk of bias

Question 2: What is the evidence for sedentary behaviour and cardiovascular disease risk and mortality in adults?
Bibliography: Bailey et al (2019), Ekelund, Brown et al (2019), Ekelund, Tarp et al (2019)

Certainty assessment							**№ of patients**	**Effect**		**Certainty**	**Importance**
№ of studies	**Study design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**		**Relative (95% CI)**	**Absolute (95% CI)**		
Association between occurrence of cardiovascular disease and total daily sitting time											
5	Observational studies	No serious risk of bias	No serious inconsistency	Serious indirectness	No serious imprecision	None	224,414	HR = 1.29[f] (1.27 to 1.30)	NR	⊕⊕⊕ MODERATE[g]	CRITICAL
Association between sedentary behaviour and CVD mortality in adults											
11	Observational studies	No serious risk of bias	NA[h]	No serious indirectness	No serious imprecision	Dose response relationship	888,327	NR	NR	⊕⊕⊕⊕ HIGH[j]	CRITICAL
Association between sedentary behaviour and all-cause mortality among adults when the highest versus the lowest quartiles of sedentary time were compared											
8	Observational studies	No serious risk of bias	No serious inconsistency	No serious indirectness	No serious imprecision	Dose response relationship	36,383	HR = 2.63 (1.94 to 3.56)	NR	⊕⊕⊕ HIGH[k]	IMPORTANT

Bailey DP et al. Sitting Time and Risk of Cardiovascular Disease and Diabetes: A Systematic Review and Meta-Analysis. Am J Prev Med. 2019;57(3):408-16.
Ekelund U, Brown WJ et al. Do the associations of sedentary behaviour with cardiovascular disease mortality and cancer mortality differ by physical activity level? A systematic review and harmonised meta-analysis of data from 850 060 participants. Br J Sports Med. 2019;53(14):886-94.
Ekelund U, Tarp J et al. Dose-response associations between accelerometry measured physical activity and sedentary time and all cause mortality: systematic review and harmonised meta-analysis. Br Med J. 2019;366:l4570.

f incidence when not adjusted for physical activity
g Certainty of evidence upgraded given no significant study limitations
h Not able to assess given data presented in article and supplemental materials
i for the relationship between sitting time and CVD mortality and TV-viewing time and CVD mortality only
j Certainty of evidence upgraded given no serious limitations of included evidence and indication of dose-response relationship
k Certainty of evidence upgraded given no serious limitations in the body of evidence, individual participant-level data meta-analysis, and evidence of a dose response relationship

Question 3: What is the relationship between physical activity and health-related outcomes in adults with established heart disease?
Evidence related to research question 3 were extracted from the WHO Evidence Profiles (18) and three additional Cochrane reviews (19-21).

Bibliography: Cao et al (2019), Costa (2018), Anderson et al. (2016), Long (2019), Lee (2021)

Certainty assessment							**№ of patients**	**Effect**		**Certainty**	**Importance**
№ of studies	**Study design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**		**Mean difference (95% CI)**			
Association between exercise and CVD progression in patients with hypertension when exercise intervention was compared to no exercise											
14	Randomised trials	No serious risk of bias	Serious inconsistency	No serious indirectness	No serious imprecision	None	860	SBP MD = -12.26 mmHg (-15.17 to -9.34) DBP = -6.12 mmHG (-7.76 to -4.48)		⊕⊕⊕⊕ HIGH[l]	CRITICAL
Association between type of exercise and CVD progression in patients with hypertension when HIIT and MICT were compared											
9	Randomised trials	No serious risk of bias	Serious inconsistency	No serious indirectness	No serious imprecision	None	245	SBP MD = -0.22 mmHg (-5.36 to 4.92) DBP MD = 0.38 mmHg (-3.31 to 2.54)		⊕⊕⊕ MODERATE[m]	CRITICAL
Association between exercise-based cardiac rehab with CVD mortality for CHD patients								**Relative (95% CI)**	**Absolute (95% CI)**		
27	Randomised trials	NR	NR	NR	NR	NR	7469	RR = 0.74 (0.64 to 0.86)	NR	⊕⊕⊕ MODERATE[n]	CRITICAL
Association between exercise-based cardiac rehab for heart failure patients with hospital admissions up to 12 months follow-up											
21	Randomised trials	NR	NR	NR	NR	NR	2182	RR = 0.70 (0.60 to 0.83)	166 per 1000 (142 to 197)	⊕⊕⊕ MODERATE[o]	IMPORTANT
Association between walking interventions and hypertension in adults with or without hypertension								**Mean difference (95% CI)**			
73	Randomised trials	NR	NR	NR	NR	NR	5060	SBP MD = -4.11 mmHg (-5.22 to -3.01)		⊕⊕⊕ MODERATE[pq]	CRITICAL

Cao L et al. The effectiveness of aerobic exercise for hypertensive population: A systematic review and meta-analysis. J Clin Hypertens. 2019;21(7):868-876.
Costa EC et al. Effects of High-Intensity Interval Training Versus Moderate-Intensity Continuous Training On Blood Pressure in Adults with Pre- to Established Hypertension: A Systematic Review and Meta-Analysis of Randomized Trials. Sports Med. 2018;48(9):2127-42.
Anderson L et al. Exercise-based cardiac rehabilitation for coronary heart disease. Cochrane Database of Systematic Reviews. 2016(1).
Long L et al et al. Exercise-based cardiac rehabilitation for adults with heart failure. Cochrane Database of Systematic Reviews. 2019(1).
Lee LL et al. Walking for hypertension. Cochrane Database of Systematic Reviews. 2021(2).

MD = mean difference, SBP = systolic blood pressure, DBP = diastolic blood pressure, HIIT = High intensity interval training, MICT = moderate intensity continuous training
l Certainty of evidence not downgraded
m Certainty of evidence downgraded given serious inconsistency (inconsistency in direction of effects across studies)
n Random sequence generation, allocation concealment or blinding of outcome assessors were poorly described in over 50% of included studies; bias likely
o Some concerns with random sequence generation, allocation concealment, and groups balanced at baseline; bias likely - therefore quality of evidence downgraded by one level
p Not downgraded one level for risk of bias even though more than half of included studies failed to report details of randomisation and allocation concealment. This is because a sensitivity analysis based on trials judged as being at low risk of bias also showed a statistically significant reduction of SBP: Weighted Mean Difference=-4.31, 95% CI:-7.99 to -0.63, P=0.02, I^2=0%, n=235
q Downgraded one level for inconsistency on the basis of statistically significant heterogeneity

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