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Primary prevention of CVD: physical activity

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ABSTRACT

INTRODUCTION: Increasing physical activity has been associated with reduced risk of mortality and of cardiovascular disease (CVD). The proportion of people doing no physical activity in a week varies between countries, but can reach nearly 25% in Europe and the Americas. METHODS AND OUTCOMES: We conducted a systematic review and aimed to answer the following clinical questions: Does counselling people to increase physical activity lead to increased physical activity in healthy people without existing CVD? What are the health benefits of increasing physical activity in relation to cardiovascular outcomes in healthy people without existing CVD? We searched: Medline, Embase, The Cochrane Library, and other important databases up to September 2008 (Clinical Evidence reviews are updated periodically; please check our website for the most up-to-date version of this review). We included harms alerts from relevant organisations such as the US Food and Drug Administration (FDA) and the UK Medicines and Healthcare products Regulatory Agency (MHRA). RESULTS: We found 21 systematic reviews, RCTs, or observational studies that met our inclusion criteria. We performed a GRADE evaluation of the quality of evidence for interventions. CONCLUSIONS: In this systematic review, we present information relating to the effectiveness and safety of the following interventions: counselling people to increase physical activity, and to perform higher-intensity exercise programmes.

QUESTIONS

INTERVENTIONS

Key points

- Increasing physical activity has been associated with reduced risk of mortality and CVD.

  The proportion of people doing no physical activity in a week varies between countries, but can reach nearly 25% in Europe and the Americas.
- In this review, we have looked at healthy people older than 18 years who have no evidence of existing CVD.
- Counselling people to increase physical activity may increase people's activity levels over 3–12 months, particularly if accompanied by written materials and telephone follow-up.
- However, the nature of the counselling interventions varied widely among RCTs, and results varied by the exact counselling intervention employed.

  Counselling people to do higher-intensity exercise may increase activity levels more than counselling people to do lower-intensity exercise.

  People counselled to perform a higher-intensity exercise programme were also found to adhere to it better than those given a more moderate-intensity programme.
- We don't know whether counselling people to increase physical activity compared with no counselling reduces CVD, or whether counselling people to do higher-intensity exercise compared with counselling them to perform lower-intensity exercise reduces CVD, as we found insufficient evidence.

DEFINITION There are no internationally agreed definitions of physical activity. It has been defined as "any bodily movement produced by contraction of skeletal muscle that substantially increases energy expenditure". [1] Activities include formal exercise programmes as well as walking, hiking, gardening, sport, and dance. The common element is that these activities result in substantial energy expen-

diture, although the intensity and duration can vary considerably. Exercise is considered a subcategory of physical activity and may be defined as planned, structured, and repetitive bodily movements performed to improve or maintain one or more components of physical fitness. [1] Level of physical activity is important in the causes of many chronic diseases. Individual change in behaviour has the potential to decrease the burden of chronic disease, particularly CVD. This review focuses on the evidence that specific interventions may lead to increases in physical activity, and that these changes may prevent CVD. The relationship between physical activity and physical fitness is complex. There is consensus that increasing levels of both activity and fitness may reduce CVD. However, it is unclear whether activity or fitness is more important for health. [2] There are many types of physical fitness — cardiovascular fitness, muscular strength, muscular endurance, flexibility, coordination, speed, and power. The most common descriptor of physical fitness is cardiovascular fitness, which is usually determined using either prediction or direct measurement of maximum oxygen uptake. It is important to note that moderate-intensity physical activity may not necessarily lead to an increase in physical fitness (as defined by maximum oxygen uptake), but studies suggest that there will still be benefits from such activity in terms of lowering disease risk. We have therefore, in this review, assessed outcomes of both increases in intensity, frequency, and duration of physical activity, and increases in physical fitness. Primary prevention in this context is the long-term management of people at increased risk of CVD, but with no evidence of overt ischaemic CVD. We have only included studies in adults aged over 18 years who are free-living and healthy, and excluded studies if more than 10% of participants had a reported diagnosis such as obesity, diabetes, or hypertension. Prevention of cerebrovascular events is discussed in detail elsewhere in *Clinical Evidence* (see review on stroke prevention). In this review, we have included interventions involving counselling or advising people to increase physical activity however given (e.g., from a physician, exercise therapist, whether administered directly, by telephone, or through media [e.g., videos, television programmes]), but have excluded interventions where counselling did not form the major part of the intervention, involved intensive monitoring, or where incentives to change behaviour were a major focus of the intervention.

INCIDENCE/ PREVALENCE

For general health benefits, it is recommended in government guidelines that adults achieve a minimum of 30 minutes a day of at least moderate-intensity aerobic (endurance) physical activity on 5 or more days of the week, or vigorous-intensity aerobic physical activity for a minimum of 20 minutes on 3 days each week. [3] [4] [5] Combinations of moderate- and vigorous-intensity activity can be performed to meet this recommendation. The recommended levels of activity can be achieved either by doing all the daily activity in one session, or through several shorter bouts of 10 minutes or more. The activity can be lifestyle activity, or structured exercise or sport, or a combination of these. [3] [4] [5] In addition, all adults are advised to perform activities that maintain or increase muscular strength and endurance for a minimum of 2 days each week. [4] [5] Activity levels in England are low. About 60% of men and 70% of women report less than 30 minutes of moderate-intensity physical activity a day on at least 5 days per week. [6] Levels of physical activity in the UK fall just below the EU average. In a survey of 15 EU countries, the percentage of adults reporting no moderate physical activity (e.g., "carrying light loads, cycling at a normal pace, doubles tennis") ranged from 8% to 53%. [7] International comparisons of physical activity/inactivity are difficult, because there are no internationally agreed definitions. Some data are available from the WHO, however, and these indicate that the prevalence of complete inactivity ("doing no or very little physical activity at work, home, for transport or in discretionary [leisure] time") is: 11% to 12% in Africa; 20% to 23% in the Americas; 18% to 19% in the Eastern Mediterranean; 17% to 24% in Europe; 15% to 17% in South East Asia; and 16% to 17% in the Western Pacific region. [8]

AETIOLOGY/ RISK FACTORS

Low levels of physical activity and lack of physical fitness are strong risk factors for CHD. [3] [9] Both confer an increased risk similar to that associated with smoking, hypertension, and high blood cholesterol. The most frequently cited reasons for inactivity in the general population are increased urbanisation and mechanisation. Most occupations now involve little physical activity, while television viewing and computer use compete with more active pursuits in leisure time. Greater use of cars along with an increase in the use of labour-saving devices has also reduced the need for physical activity. There has been a decline in walking and cycling as modes of transport — a 2001 survey in the UK reported that the number of miles travelled by each person a year on foot and on bicycle declined by about a quarter between 1975–1976 and 1999–2001 (see figure 1, p 22). [10] One proposed reason for the decline in walking is increased fears over personal safety. Barriers to physical activity include physical barriers such as an injury, emotional barriers such as embarrassment, motivational barriers such as a perceived lack of energy, time barriers, and availability barriers such as lack of facilities. [11] [12]

PROGNOSIS

Increases in physical activity may lower the risk of CVD by exerting favourable changes on CVD risk factors (lowering blood pressure, triglyceride concentrations, and blood cholesterol concentrations, and raising high-density lipoprotein cholesterol concentrations) and by exerting direct effects

on the heart (reduced heart rate, increased stroke volume) and on blood vessels (improved endothelial function, which increases the ability of blood vessels to vasodilate and enhance blood supply when necessary). [9] In the Harvard Alumni Health study (10,269 men aged 45–84 years), men who reported changing their lifestyles after baseline to include moderately vigorous activity (4 METs or more) had a 23% lower risk of all-cause mortality at follow-up after about 20 years compared with men who continued not to engage in such activity (RR 0.77, 95% CI 0.58 to 0.96; P <0.02). [13] The main cause of death was CVD. In the Aerobics Centre Longitudinal Study (9777 men aged 20–82 years), men classified as unfit on their first examination but fit on their second (mean of 4.9 years between examinations) had a 52% lower risk of CVD mortality during follow-up (RR 0.48, 95% CI 0.31 to 0.74) than men classified as unfit on both examinations. [14] Fitness was assessed by a treadmill test, and the 20% of people with lowest treadmill times were classed as "unfit". The Nurses' Health Study (72,488 female nurses aged 40–65 years) assessed physical activity using a questionnaire. [15] It found that women reporting higher levels of energy expenditure had lower rates of coronary events over 6 years. Women who walked the equivalent of 3 hours or more a week at a brisk pace (5 km an hour [3 miles an hour] or more) had significantly lower rates of coronary events compared with women who walked infrequently (RR 0.65, 95% CI 0.47 to 0.91). [15] Similar results were found in the Women's Health Initiative prospective cohort study of 73,743 postmenopausal women. [16]

AIMS OF INTERVENTION

To increase intensity, frequency, and duration of physical activity; to increase physical fitness; and to reduce the risk of CVD, with minimal adverse effects.

OUTCOMES

Increasing physical activity/exercise: Increase in intensity, frequency, and duration of physical activity. Can be self-reported — for example, by using self-report questionnaires such as the Behavioral Risk Factor Surveillance System (BRFSS) in the USA, and the International Physical Activity Questionnaire (IPAQ), or by recording number of steps a day using a pedometer or movement counts using an accelerometer. **Rate of CVD**: Incidence of fatal and non-fatal cardiovascular events. **Cardiovascular risk factors**: Changes in individual risk factors: weight, BMI, blood pressure, and maximum oxygen uptake.

METHODS

Clinical Evidence search and appraisal September 2008. The following databases were used to identify studies for this systematic review: Medline 1966 to September 2008, Embase 1980 to September 2008, and The Cochrane Database of Systematic Reviews and Cochrane Central Register of Controlled Clinical Trials 2008, Issue 3 (1966 to date of issue). An additional search was carried out of the NHS Centre for Reviews and Dissemination (CRD) — for Database of Abstracts of Reviews of Effects (DARE) and Health Technology Assessment (HTA). We also searched for retractions of studies included in the review. Abstracts of the studies retrieved from the initial search were assessed by an information specialist. Selected studies were then sent to the contributor for additional assessment, using predetermined criteria to identify relevant studies. Study design criteria for evaluation in this review were: published systematic reviews of RCTs and RCTs in any language containing more than 20 individuals, of whom more than 80% were followed up for 6 months or more. We included studies described as "open", "open label", or not blinded, as blinding was impossible. We included systematic reviews of RCTs, and RCTs where harms of an included intervention were studied, applying the same study design criteria for inclusion as we did of benefits. In addition, we use a regular surveillance protocol to capture harms alerts from organisations such as the FDA and the MHRA, which are added to the reviews as required. We excluded studies in which more than 10% of the participants had CVD at baseline. We considered ages 70 years and above as a definition for older adults. We included studies of older adults if they were not the sole focus of the study and the group was generally healthy at baseline (e.g., age range was 40–79 years). To aid readability of the numerical data in our reviews, we round many percentages to the nearest whole number. Readers should be aware of this when relating percentages to summary statistics such as relative risks (RRs) and odds ratios (ORs). We have performed a GRADE evaluation of the quality of evidence for interventions included in this review (see table, p 23). The categorisation of the quality of the evidence (high, moderate, low, or very low) reflects the quality of evidence available for our chosen outcomes in our defined populations of interest. These categorisations are not necessarily a reflection of the overall methodological quality of any individual study, because the Clinical Evidence population and outcome of choice may represent only a small subset of the total outcomes reported, and population included, in any individual trial. For further details of how we perform the GRADE evaluation and the scoring system we use, please see our website (www.clinicalevidence.com).

QUESTION **Does counselling people to increase physical activity lead to increased physical activity in healthy people without existing CVD?**

OPTION **COUNSELLING PEOPLE TO INCREASE PHYSICAL ACTIVITY VERSUS NO COUNSELLING: EFFECTS ON LEVEL OF PHYSICAL ACTIVITY**

- For GRADE evaluation of interventions for Primary prevention of CVD: physical activity, see table, p 23 .
- Counselling people to increase physical activity may increase people's activity levels over 3 to 12 months, particularly if accompanied by written materials and telephone follow-up.
- However, the nature of the counselling interventions varied widely among RCTs, and results varied by the exact counselling intervention employed.
- Counselling does not seem to increase the risk of falls, injuries, or hospital admissions.

Benefits and harms

Counselling people to increase physical activity versus no counselling:

We found four systematic reviews (search date 2000, [17] search date not reported, [18] [19] search date 2004), [20] which between them identified 11 RCTs of sufficient quality. [21] [22] [23] [24] [25] [26] [27] [28] [29] [30] [31] We also found four subsequent RCTs. [32] [33] [34] [35] Three reviews [17] [18] [19] did not perform a meta-analysis because of the heterogeneity of the interventions employed, outcome measures, and populations assessed by the trials. The fourth review pooled data. [20] It included 27 RCTs including one-to-one counselling/advice or group counselling/advice, self-directed or prescribed physical activity (supervised or unsupervised), home-based or facility-based physical activity, ongoing face-to-face support, telephone support, written education/motivation support material, and self-monitoring, of which eight RCTs directly compared counselling versus no counselling. However, the review did not present a subgroup analysis of counselling versus no counselling (see comment). [20] We have therefore separately reported the results from the original RCTs included in the four reviews, as well as the results from the four subsequent RCTs.

Physical activity

Counselling people to increase physical activity compared with no counselling Counselling may be more effective than no counselling at increasing levels of physical activity. However, the counselling interventions used were diverse, and results varied by the exact intervention employed (very low-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Physical activity					
[21] RCT	847 people, mean age >52 years, 61% of whom exercised at least 3 times/week	**Total physical activity , 6 months** 331.1 minutes/week with Physician-Based Assessment and Counseling for Exercise (PACE) 330.7 minutes/week with usual care PACE involves a single counselling session from a physician based on participant's previous physical activity. For details of PACE intervention, see further information on studies	P = 0.99 People were active before intervention, which may be a factor in the lack of a significant difference between groups	⟷	Not significant
[21] RCT	847 people, mean age >52 years, 61% of whom exercised at least 3 times/week	**Total walking time/week** 186.9 minutes with PACE 201.8 minutes with control PACE involves a single counselling session from a physician based on participant's previous physical activity. For details of PACE intervention, see further information on studies	P = 0.41 People were active before intervention, which may be a factor in the lack of a significant difference between groups	⟷	Not significant

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
[22] RCT	355 sedentary people, mean age 65.6 years Participants were only included if able to walk. They were classed as sedentary if they did no physical activity or did physical activity irregularly (for <5 days/week for at least 30 minutes)	**Physical activity levels (measured by Physical Activity Scale for the Elderly [PASE]) , 6 weeks** with physician counselling session plus manual and follow-up with usual care Counselling intervention included single 5-minute advice from a physician to increase physical activity, plus patient manual with follow-up appointment with reinforcement and poster The review reported total PASE scores in each group, but it was unclear how these scores were calculated, and what the scores meant in clinical terms, so we have not reported them here	P = 0.94	⟷	Not significant
[22] RCT	355 sedentary people, mean age 65.6 years Participants were only included if able to walk. They were classed as sedentary if they did no physical activity or did physical activity irregularly (for <5 days/week for at least 30 minutes	**Physical activity levels (measured by PASE) , 8 months** with physician counselling session plus manual and follow-up with usual care Counselling intervention included single 5-minute advice from a physician to increase physical activity, plus patient manual with follow-up appointment with reinforcement and poster The review reported total PASE scores in each group, but it was unclear how these scores were calculated, and what the scores meant in clinical terms, so we have not reported them here	P = 0.74	⟷	Not significant
[23] RCT	Subgroup of people in "good health" (number of people not reported) Subgroup analysis Full trial included 4195 people aged 65–85 years, some in "good health", some in "poor health"; for definition of "good health", see further information on studies	**Physical activity , 2 years** 41.8% with annual physician visit 42.0% with no visit Absolute numbers not reported Counselling group received annual physician visits aimed at encouraging increased physical activity, smoking cessation, and reduction in alcohol intake	Reported as not significant P value not reported Results should be interpreted with caution; see further information on studies for full details	⟷	Not significant
[23] RCT	Subgroup of people in “poor” health (number of people not reported) Subgroup analysis Full trial included 4195 people aged 65–85 years, some in “good health”, some in “poor health”; for definition of "poor health", see further	**Physical activity , 2 years** 20% with annual physician visit 18% with no visit Absolute numbers not reported Counselling group received annual physician visits aimed at encouraging increased physical activity, smoking cessation, and reduction in alcohol intake	P = 0.48 Results should be interpreted with caution; see further information on studies for full details	⟷	Not significant

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
	information on studies				
[24] RCT	714 inactive people aged 45–74 years Participants were classed as inactive if they had done fewer than four 20-minute episodes of moderate or vigorous physical activity in the past 4 weeks, or did up to twelve 20-minute episodes of moderate or vigorous physical activity in the past 4 weeks, but less physical activity than current recommendations	**Mean number of episodes of physical activity in the 4 weeks before follow-up , measured at 8 months** 5.95 with single-session counselling 4.43 with no counselling Intervention comprised single-session counselling by an exercise-development officer to increase physical activity plus a 10-week supervised gym and home programme	Mean difference 1.52 95% CI 1.14 to 1.95 See further information on studies	○○○	counselling
[25] RCT	267 people aged 65 years or more who did about 5 hours of activity/week	**Total walking/week** with general practitioner education programme with usual care The general practitioner education programme was aimed at teaching them to counsel people on exercise, social activity, and vaccinations Mean increase of 44 minutes/week in people whose practitioner undertook the education programme (P = 0.03) Results in control group not reported			
[26] RCT	883 people aged 18–65 years with 1 or more cardiovascular risk factors Cardiovascular risk factors included regular cigarette smoking (>1/day), high serum cholesterol concentration (6.5–9.0 mmol/L), or combined high BMI (25–35) and low physical activity (<12 episodes of vigorous or moderate exercise for at least 20 minutes in the past 4 weeks)	**Physical activity sessions/month (mean) , 1 year** 14 sessions/month with nurse counselling 9 sessions/month with no counselling The intervention comprised 20-minute counselling sessions by a nurse over 3 days with follow-up telephone calls plus refresher counselling at 6 months	Mean difference: 3.9 sessions/month 95% CI 1.0 session/month to 6.8 sessions/month P <0.05	○○○	counselling
[27] RCT **5-armed trial**	523 adults aged 40–64 years in an urban general practice in Newcastle, UK, about 60% of whom undertook no physical activity	**Proportion with increased physical activity scores , 12 weeks** 123/335 (37%) with any counselling intervention 13/89 (15%) with usual care Data reported for "any counselling intervention" are combined	Difference 22% 95% CI 13% to 32% P <0.001	○○○	counselling

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
		from four different counselling interventions evaluated by the RCT; see further information on studies for full details of the four interventions See further information on studies for details on scoring of physical activity The RCT analysed only people who completed questionnaires (about 80%)			
[28] RCT	299 healthy sedentary adults aged 60 years or more, living in Adelaide, South Australia Participants were classed as sedentary if they walked or performed other forms of brisk exercise for at least 20 minutes/session <3 times a week	**Time spent walking** 30 minutes with counselling with exercise specialist 30 minutes with usual care Counselling was a 20-minute session with an exercise specialist plus a pamphlet containing a 3-month physical activity plan	Reported as not significant P value not reported	⟷	Not significant
[28] RCT	299 healthy sedentary adults aged 60 years or more, living in Adelaide, South Australia Participants were classed as sedentary if they walked or performed other forms of brisk exercise for at least 20 minutes/session <3 times a week	**Frequency of walking** 3 sessions/week with counselling with exercise specialist 2 sessions/week with usual care Counselling was a 20-minute session with an exercise specialist plus a pamphlet containing a 3-month physical activity plan	P <0.05	○○○	counselling
[28] RCT	299 healthy sedentary adults aged 60 years or more, living in Adelaide, South Australia Participants were classed as sedentary if they walked or performed other forms of brisk exercise for at least 20 minutes/session <3 times a week	**Time spent doing vigorous exercise (intensity of exercise not reported)** 20 minutes with counselling with exercise specialist 0 minutes with usual care Counselling was a 20-minute session with an exercise specialist plus a pamphlet containing a 3-month physical activity plan	P <0.05	○○○	counselling
[28] RCT	299 healthy sedentary adults aged 60 years or more, living in Adelaide, South Australia Participants were classed as sedentary if they walked or performed other forms of brisk exercise for at least 20 minutes/session <3 times a week	**Frequency of vigorous exercise** 2 sessions/week with counselling with exercise specialist 0 sessions/week with usual care Counselling was a 20-minute session with an exercise specialist plus a pamphlet containing a 3-month physical activity plan	P <0.05	○○○	counselling

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
[29] RCT	316 healthy people aged 18–65 years in the USA who exercised for <15 minutes/day and were interested in increasing their exercise	**Physical activity: mean PACE score (0–11) , 6 months** 5.37 with telephone counselling 4.98 with usual care (no telephone counselling or written materials) Telephone counselling included 3 telephone calls from a behavioural health specialist/month for 3 months, each call lasting 20–30 minutes, plus written self-help materials	P = 0.049	○○○	telephone counselling
[30] RCT **3-armed trial**	1658 healthy people aged 45–64 years from 2 medical centres in Wellingborough, UK who had done <4 sessions of moderate-intensity (not reported) physical activity in the previous 4 weeks	**Physical activity (self-reported) , 12 months** 124 kcal/kg/week with brief negotiation or direct advice 113 kcal/kg/week with no intervention The RCT compared 30 minutes of brief negotiation (based on motivational interviewing), direct advice, and no intervention. Brief negotiation and advice groups analysed together See further information on studies for details of recording of physical activity	P = 0.39	⟷	Not significant
[31] RCT	878 sedentary people aged 40–79 years in 42 rural and urban general practices in New Zealand People were classed as sedentary if they did <30 minutes of moderate or vigorous exercise such as walking or a sport on at least 5 days/week	**Mean change in total energy expenditure** 9.76 kcal/kg/week with counselling 0.37 kcal/kg/week with usual care Counselling consisted of a single-session of counselling with a physician plus follow-up by telephone and postal support from an exercise specialist	Absolute difference between groups 9.38 kcal/kg/week 95% CI 3.96 kcal/kg/week to 14.81 kcal/kg/week P <0.001	○○○	counselling
[32] RCT	178 sedentary people in Spain, expending <143 kcal/day in physical activity	**Caloric expenditure , 12 months** 766 kcal/week with single 20-minute counselling with nurse 488 kcal/week with usual care (no counselling)	P <0.001	○○○	counselling
[32] RCT	178 sedentary people in Spain, expending <143 kcal/day in physical activity	**Proportion who undertook intense physical activity of >286 kcal/day** 69/87 (79%) people with single 20-minute counselling with nurse 15/91 (16%) people with usual care	P <0.001 See further information on studies for details of increase in physical activity at 1 year	○○○	counselling
[32] RCT	178 sedentary people in Spain, expending <143 kcal/day in physical activity	**Proportion of participants who achieved 2.5 hours of moderate or vigorous leisure physical activity a week** 66/451 (15%) with single 20-minute counselling with nurse	P <0.003	○○○	counselling

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
		21/427 (5%) with usual care			
[33] RCT	186 people aged 65 years or older, who participated in <30 minutes of activity on 5 or more days per week and had no unstable major health problem	**Total leisure time physical activity , 3 months** with telephone counselling with no counselling Telephone counselling comprised 8 telephone counselling sessions over 12-week period to encourage activity individually tailored to person Outcomes assessed by telephone questionnaire	Difference +48.9 minutes/week P = 0.02	○○○	telephone counselling
[33] RCT	186 people aged 65 years or older, who participated in <30 minutes of activity on 5 or more days per week and had no unstable major health problem	**Moderate leisure time activity (including leisure walking) , 3 months** with telephone counselling with no counselling Telephone counselling comprised 8 telephone counselling sessions over 12-week period to encourage activity individually tailored to person Outcomes assessed by telephone questionnaire	Difference +42.6 minutes/week P = 0.04	○○○	telephone counselling
[33] RCT	186 people aged 65 years or older, who participated in <30 minutes of activity on 5 or more days per week and had no unstable major health problem	**Leisure walking activity alone , 3 months** with telephone counselling with no counselling Telephone counselling comprised 8 telephone counselling sessions over 12-week period to encourage activity individually tailored to person Outcomes assessed by telephone questionnaire	Difference +41.3 minutes/week P = 0.001	○○○	telephone counselling
[33] RCT	186 people aged 65 years or older, who participated in <30 minutes of activity on 5 or more days per week and had no unstable major health problem	**Moderate leisure activity (including leisure walking) , 12 months** with telephone counselling with no counselling Telephone counselling comprised 8 telephone counselling sessions over 12-week period to encourage activity individually tailored to person Outcomes assessed by telephone questionnaire	Difference +86.8 minutes/week P = 0.007	○○○	telephone counselling
[33] RCT	186 people aged 65 years or older, who participated in <30 minutes of activity on 5 or more days per week and had no unstable major health problem	**Total leisure activity , 12 months** with telephone counselling with no counselling Telephone counselling comprised 8 telephone counselling sessions over 12-week period to encourage activity individually tailored to person Outcomes assessed by telephone questionnaire	P = 0.05	⟷	Not significant

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
[33] RCT	186 people aged 65 years or older, who participated in <30 minutes activity on 5 or more days per week and had no unstable major health problem	**Leisure walking activity alone , 12 months** with telephone counselling with no counselling Telephone counselling comprised 8 telephone counselling sessions over 12-week period to encourage activity individually tailored to person Outcomes assessed by telephone questionnaire	P = 0.68	⟷	Not significant
[34] RCT **3-armed trial**	239 healthy but sedentary adults (<90 minutes per week of at least moderate or vigorous physical activity) aged 18–65 years The third arm evaluated print advice	**Mean time devoted to physical activity per week , 6 months** 123 minutes with telephone counselling 78 minutes with usual care Telephone group received contact by health educator, counselling messages to increase physical activity plus baseline material and tip sheets, and feedback reports by telephone Control group received mailings unrelated to physical activity (general health mailings) on same schedule as phone and print groups	P <0.01 for telephone counselling *v* usual care Activity self-reported by monthly survey, for which $10 incentive was paid for return	○○○	telephone counselling
[34] RCT **3-armed trial**	239 healthy but sedentary adults (<90 minutes per week of at least moderate or vigorous physical activity) aged 18–65 years The third arm evaluated telephone counselling	**Mean time devoted to physical activity per week , 6 months** 129 minutes with print advice 78 minutes with usual care Print group received baseline material and tip sheets to increase physical activity and feedback reports by mail Control group received mailings unrelated to physical activity (general health mailings) on same schedule as phone and print groups	P <0.01 for print advice *v* usual care Activity self-reported by monthly survey, for which $10 incentive was paid for return	○○○	print advice
[34] RCT **3-armed trial**	239 healthy but sedentary adults (<90 minutes per week of at least moderate or vigorous physical activity) aged 18–65 years The third arm evaluated print advice	**Mean time devoted to physical activity per week , 12 months** 101 minutes with telephone counselling 82 minutes with control Telephone group received contact by health educator, counselling messages to increase physical activity plus baseline material and tip sheets, and feedback reports by telephone Control group received mailings unrelated to physical activity (general health mailings) on same schedule as phone and print groups	Reported as not significant for telephone counselling *v* usual care P value not reported Activity self-reported by monthly survey, for which $10 incentive was paid for return	⟷	Not significant
[34] RCT	239 healthy but sedentary adults (<90 minutes per	**Mean time devoted to physical activity per week , 12 months** 162 minutes with print advice 82 minutes with control	P <0.001 for print advice *v* usual care Activity self-reported by monthly survey, for which $10 incentive was paid for return	○○○	print advice

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
3-armed trial	week of at least moderate or vigorous physical activity) aged 18–65 years The third arm evaluated telephone counselling	Print group received baseline material and tip sheets to increase physical activity and feedback reports by mail Control group received mailings unrelated to physical activity (general health mailings) on same schedule as phone and print groups			
[35] RCT **3-armed trial**	313 women considered sedentary or inactive based on telephone screening	**Minutes walked per week , 12 months** with telephone counselling with telephone calls with no counselling content with video-based education Absolute results reported graphically The RCT reported that there was an increase in minutes walked per week from baseline to 6 months with a moderate maintenance of activity from 6–12 months which "held true across all groups" (multivariate analysis) The RCT reported that "there was no between-group difference across time in minutes walked per week" (further details not reported) 199 women in analysis; 113 women (36%) with physical condition that could be aggravated by walking or who walked >90 minutes per week were excluded from the analysis (an exclusion criterion of the review) See further information on studies for full details of interventions	P = 0.56 for among group difference (in minutes walked per week) High rate of exclusion limits the generalisability of the results Participants paid $5 at baseline, $10 at 6 months, $15 at one year		

Adverse effects

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Adverse effects					
[31] RCT	878 sedentary people aged 40–79 years in 42 rural and urban general practices in New Zealand People were classed as sedentary if they did <30 minutes of moderate or vigorous exercise such as walking or a sport on at least 5 days/week	**Falls or injury in the previous month** with counselling with usual care Absolute results not reported Counselling consisted of a single-session of counselling with a physician plus follow-up by telephone and postal support from an exercise specialist	Reported as not significant RR not reported	⟷	Not significant

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
[31] RCT	878 sedentary people aged 40–79 years in 42 rural and urban general practices in New Zealand People were classed as sedentary if they did <30 minutes of moderate or vigorous exercise such as walking or a sport on at least 5 days/week	**Admission to hospital over the previous year** with counselling with usual care Absolute results not reported Counselling consisted of a single-session of counselling with a physician plus follow-up by telephone and postal support from an exercise specialist	Reported as not significant RR not reported	⟷	Not significant
[33] RCT	186 people aged 65 years or older, who participated in <30 minutes of activity on 5 or more days per week and had no unstable major health problem	**Falls , 12 months** 9/83 (11%) with intervention 12/82 (15%) with control Telephone counselling comprised 8 telephone counselling sessions over 12-week period to encourage activity individually tailored to person Outcomes assessed by telephone questionnaire	Reported as not significant P value not reported	⟷	Not significant

No data from the following reference on this outcome. [21] [22] [23] [24] [25] [26] [27] [28] [29] [30] [32] [34] [35]

Further information on studies

[21] PACE (Physician-Based Assessment and Counseling for Exercise) involves a single counselling session from a physician based on participant's previous physical activity. Participants are rated as "pre-contemplator", "contemplator", or "active", and counselling is targeted in response. Counselling is followed by reinforcement of physical activity goals at subsequent physician visits. One third of PACE participants were randomised to also receive telephone calls at 2, 3, 4, and 5 months.

[23] Results analysed separately for people in "good health" and "poor health" defined on the Quality of Well-Being Scale (range 1 = perfect health, 0 = death; "good health" defined as within greater than or equal to 1 standard deviation of the mean score of the group as a whole; "poor health" defined as <1 standard deviation). **Interpretation of results** In total, 89% of people in the intervention group had review and/or discussion of engaging in adequate physical activity. Overall, of 4195 people enrolled, results were analysed for 3097 people at 2 years (74%). However, absolute numbers of withdrawals in "good" and "poor" health groups not reported. Hence, results should be interpreted with caution.

[27] **Counselling interventions evaluated** Brief (1 interview) motivational interviewing *v* intensive motivational interviewing (6 interviews over 12 weeks) *v* brief interviewing plus 30 vouchers entitling free access to leisure facilities *v* intensive interviewing plus 30 vouchers entitling free access to leisure facilities. **Physical activity score** Physical activity score was based on the number of sessions of moderate or vigorous physical activity lasting a minimum of 20 minutes in the previous 4 weeks. Physical activity was defined as walking, cycling, other sports, or leisure activities but not home-based activities such as housework and gardening.

[30] **Physical activity** Self-reported physical activity was assessed from a logbook containing 36 activities, including gardening, housework, walking, cycling, and various sports. An energy cost was assigned to each activity and this was used to calculate kcal/kg/week.

[32] Completer analysis found that brief negotiation significantly increased their physical activity at 12 months compared with no intervention (P <0.01). The highest increase (55%) was observed in people offered 6 interviews plus vouchers. These increases were not sustained at 1 year (mean difference in physical activity score with intervention *v* control: +3, 95% CI –7 to +13; no further data reported).

[35] **Interventions evaluated** Telephone counselling over 24 weeks by trained research assistants lasting 15 minutes each (total of 16 calls); brief telephone call on same schedule as telephone counselling intervention but including no counselling and asking for report on physical activity only lasting 2–5 minutes; video education control group having 20-minute general video on the importance of walking at baseline but no telephone calls or counselling. **Time taken to walk one mile** The RCT reported a decrease in the time to walk a mile between baseline and 6 months, with a maintenance of that level of performance from 6 months to 12 months (199 women, multivariate analysis, results presented graphically, P = 0.921) "suggesting that this same pattern of change across time was found in all 3 intervention groups" (further details not reported).

Comment:

The fourth systematic review included a range of different interventions, but did not present a separate analysis of counselling versus no counselling. [20] Overall, it found that interventions to encourage people to increase physical activity significantly increased self-reported physical activity compared with control (17 RCTs in total, 7598 people [analysis including 5 RCTs, 3817 people, comparing counselling *v* no counselling]; SMD 0.28, 95% CI 0.15 to 0.41). [20] The control group consisted of a no-contact group (10 RCTs), a non-specific general health advice group (5 RCTs), or comparison control group receiving advice or written information about physical activity (2 RCTs). However, there was significant statistical heterogeneity among the RCTs included in the analysis (P <0.0001; I^2 83.5%), and the interventions employed in the different RCTs were clinically diverse. [20] Therefore, it is unclear how the results of this meta-analysis can be directly applied in clinical practice.

Many of the RCTs included in the systematic reviews provided limited details on the counselling intervention. It is unclear how much direct contact physicians/counsellors had with the people in some of these RCTs. The trials undertook a variety of counselling, some performed by physicians and some by other health professionals or exercise specialists. Some studies involved follow-up telephone calls over several weeks or months; others did not. Few RCTs had follow-up periods lasting longer than 1 year; thus, the long-term (longer than 1 year) effectiveness of counselling is uncertain. A limitation of most RCTs is that physical activity was not directly determined, but was assessed using self-report questionnaires, as people may overestimate the amount of physical activity they have done.

OPTION COUNSELLING PEOPLE TO PERFORM HIGHER- VERSUS LOWER-INTENSITY EXERCISE PROGRAMMES: EFFECTS ON LEVEL OF PHYSICAL ACTIVITY

- For GRADE evaluation of interventions for Primary prevention of CVD: physical activity, see table, p 23 .
- Counselling people to do higher-intensity exercise may increase activity levels more than counselling people to do lower-intensity exercise.
- People counselled to perform a higher-intensity exercise programme were also found to adhere to it better than those given a more moderate-intensity programme.

Benefits and harms

Counselling people to perform higher- versus lower-intensity exercise:

We found no systematic review but found two RCTs. [36] [37]

Physical activity

Counselling people to perform higher-intensity exercise programmes compared with lower-intensity programmes

Intensive counselling to perform hard-intensity, higher-frequency exercise may be more effective at increasing physical activity than intensive counselling to perform less-intense, less-frequent exercise at 6 months in sedentary people aged 30–69 years. Intensive telephone counselling to use a high-intensity exercise programme may be more effective than intensive counselling to use a moderate-intensity exercise programme at maintaining exercise adherence at 2 years in sedentary people aged 50–65 years (low-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Physical activity					
[36] RCT **5-armed trial**	492 healthy, sedentary men and women aged 30–69 years, living in Florida, USA People were classed as sedentary if they spent <1 hour/week engaged in physical activity in the previous year The remaining arm evaluated control advice from a physician	**Metabolic equivalent hours/week , 6 months** 6.77 hours with hard-intensity, high-frequency walking advice 5.02 hours with moderate-intensity, high-frequency walking advice 4.00 hours with hard-intensity, low-frequency walking advice 3.64 hours with moderate-intensity, low-frequency walking advice The exercise interventions involved intensive counselling (17 sessions) to walk for 30 minutes a day at varying intensities and durations All the interventions took place over 24 months See further information on studies for definition of physical activity and metabolic equivalent hours/week	P <0.05 for all exercise activities *v* each other	○○○	advice to carry out higher-intensity exercise
[37] RCT	140 healthy, initially sedentary men and women aged 50–65 years living in California, USA People were classed as sedentary if they had done no "physical conditioning" (not defined) 2 or more times/week for at least 20 minutes/session, or had not participated in sport at least twice a week during the preceding 6 months	**Exercise adherence (average adherence) , during year 2** 73% with telephone counselling to do high-intensity exercise (73–88% of peak heart rate, 7.0–7.5 METs) 57% with telephone counselling to do moderate-intensity exercise (60% to 73% of peak heart rate, 4–4.5 METs) Telephone counselling consisted of 16 telephone calls over 1 year advising using high-intensity or moderate-intensity exercise After 1 year, all participants were randomised to a second year of contact by telephone and mail or predominantly mail Exercise in both groups involved about 2 sessions/week	P <0.02	○○○	telephone counselling to do high-intensity exercise

Adverse effects

No data from the following reference on this outcome. [36] [37]

Further information on studies

[36] **Physical activity** Physical activity was defined as 30 minutes/day of moderate-intensity activity on most days of the week. Hard intensity = 65% to 75% of heart rate reserve (maximum heart rate minus resting heart rate); moderate intensity = 45% to 55% of heart rate reserve; high frequency = 5–7 days/week; low frequency = 3–4 days/week. Heart-rate monitors were provided to participants in each of the exercise groups, but not to the

control single-session counselling group. **Metabolic equivalent hours/week** Metabolic equivalent hours/week is a physical activity marker determined by the volume (frequency × time) and intensity (METs) of exercise.

Comment: Physical activity was self-reported in both RCTs, which is a limitation, as people may overestimate the amount of physical activity they have done.

QUESTION **What are the health benefits of increasing physical activity in relation to cardiovascular outcomes in healthy people without existing CVD?**

OPTION **COUNSELLING PEOPLE TO INCREASE PHYSICAL ACTIVITY VERSUS NO ADVICE: EFFECTS ON CARDIOVASCULAR OUTCOMES**

- For GRADE evaluation of interventions for Primary prevention of CVD: physical activity, see table, p 23 .
- We don't know whether counselling people to increase physical activity compared with no counselling reduces CVD.
- We found no direct information from RCTs about the effects of counselling to increase physical activity versus no counselling on the incidence of fatal and non-fatal cardiovascular events.

Benefits and harms

Counselling people to increase physical activity versus no advice:

We found no systematic review but found three RCTs. [28] [30] [31] None of the RCTs assessed the effects of counselling to increase physical activity on the incidence of fatal and non-fatal cardiovascular events.

Cardiovascular risk factors

Counselling people to increase physical activity compared with no counselling Counselling people to increase physical activity may be no more effective than usual care at reducing BMI or blood pressure (low-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Body mass index					
[30] RCT **3-armed trial**	1658 healthy people aged 45–64 years from 2 medical centres in Wellingborough, UK who had done <4 sessions of moderate-intensity (not reported) physical activity in the previous 4 weeks The third arm evaluated no treatment	**Mean change in body mass index (BMI) , 12 months** 0 with brief negotiation 0.01 with direct advice Brief negotiation was based on motivational interviewing and took place over 30 minutes	Mean difference –0.03 95% CI –0.36 to +0.30 P = 0.86	⟷	Not significant
[31] RCT	878 sedentary people aged 40–79 years in 42 rural and urban general practices in New Zealand People were classed as sedentary if they did <30 minutes of moderate or vigorous exercise such as walking or a sport on at least 5 days of the week	**Mean reduction in BMI , 12 months** +0.11 with counselling –0.05 with usual care Counselling was single-session physician counselling plus follow-up telephone and postal support from an exercise specialist	P = 0.5	⟷	Not significant

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Weight					
[28] RCT	299 healthy sedentary adults aged 60 years or more, living in Adelaide, South Australia People were classed as sedentary if they walked or performed other forms of brisk exercise <3 times a week for at least 20 minutes a session	**Body weight** 76.0 kg with counselling 73.6 kg with usual care Counselling consisted of a 20-minute session with an exercise specialist plus a pamphlet containing a 3-month physical activity plan	Reported as not significant P value not reported	⟷	Not significant
Systolic blood pressure					
[28] RCT	299 healthy sedentary adults aged 60 years or more, living in Adelaide, South Australia People were classed as sedentary if they walked or performed other forms of brisk exercise <3 times a week for at least 20 minutes a session	**Systolic blood pressure** 147.4 mmHg with counselling 146.6 mmHg with usual care Counselling consisted of a 20-minute session with an exercise specialist plus a pamphlet containing a 3-month physical activity plan	Reported as not significant P value not reported	⟷	Not significant
[30] RCT **3-armed trial**	1658 healthy people aged 45–64 years from 2 medical centres in Wellingborough, UK who had done <4 sessions of moderate-intensity (not reported) physical activity in the previous 4 weeks The third arm evaluated no treatment	**Change in systolic blood pressure , 12 months** –3.2 mmHg with brief negotiation –2.9 mmHg with direct advice Brief negotiation was based on motivational interviewing and took place over 30 minutes	Mean difference –0.03 mmHg 95% CI –2.5 mmHg to +1.9 mmHg P = 0.81	⟷	Not significant
Diastolic blood pressure					
[28] RCT	299 healthy sedentary adults aged 60 years or more, living in Adelaide, South Australia People were classed as sedentary if they walked or performed other forms of brisk exercise <3 times a week for at least 20 minutes a session	**Diastolic blood pressure** 86.1 mmHg with counselling 86.3 mmHg with usual care Counselling consisted of a 20-minute session with an exercise specialist plus a pamphlet containing a 3-month physical activity plan	Reported as not significant P value not reported	⟷	Not significant
[30] RCT **3-armed trial**	1658 healthy people aged 45–64 years from 2 medical centres in Wellingborough, UK who had done	**Change in diastolic blood pressure , 12 months** –2.5 mmHg with brief negotiation –0.2 mmHg with direct advice	Mean difference –2.3 mmHg 95% CI –3.8 mmHg to –0.8 mmHg P <0.01	○○○	brief negotiation

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
	<4 sessions of moderate-intensity (not reported) physical activity in the previous 4 weeks The third arm evaluated no treatment	Brief negotiation was based on motivational interviewing and took place over 30 minutes			
Estimated cardiovascular risk					
[31] RCT	878 sedentary people aged 40–79 years in 42 rural and urban general practices in New Zealand People were classed as sedentary if they did <30 minutes of moderate or vigorous exercise such as walking or a sport on at least 5 days of the week	**Mean percentage change in 4-year risk of coronary heart disease (assessed using standard equations) , 12 months** 0.42% with counselling 0.52% with usual care Counselling was single-session physician counselling plus follow-up telephone and postal support from an exercise specialist	P = 0.6	⟷	Not significant

Rate of cardiovascular disease

No data from the following reference on this outcome. [28] [30] [31]

Adverse effects

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Injury					
[31] RCT	878 sedentary people aged 40–79 years in 42 rural and urban general practices in New Zealand People were classed as sedentary if they did <30 minutes of moderate or vigorous exercise such as walking or a sport on at least 5 days of the week	**Falls or injury in the previous month** with counselling with usual care Absolute results not reported	Reported as not significant RR not reported	⟷	Not significant
[31] RCT	878 sedentary people aged 40–79 years in 42 rural and urban general practices in New Zealand People were classed as sedentary if they did <30 minutes of moder-	**Admission to hospital over the previous year** with counselling with usual care Absolute results not reported	Reported as not significant RR not reported	⟷	Not significant

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
	ate or vigorous exercise such as walking or a sport on at least 5 days of the week				

No data from the following reference on this outcome. [28] [30]

Further information on studies

Comment: None.

OPTION COUNSELLING PEOPLE TO PERFORM HIGHER- VERSUS LOWER-INTENSITY EXERCISE PROGRAMMES: EFFECTS ON CARDIOVASCULAR OUTCOMES

- For GRADE evaluation of interventions for Primary prevention of CVD: physical activity, see table, p 23 .
- We don't know whether counselling people to do higher-intensity exercise compared with counselling them to perform lower-intensity exercise reduces CVD, as we found insufficient evidence.

Benefits and harms

Counselling people to perform higher- versus lower-intensity exercise programmes:

We found no systematic review but found one RCT. [36]

Cardiovascular risk factors

Counselling people to perform higher-intensity exercise programmes compared with lower-intensity programmes

Counselling people to perform hard-intensity, high-frequency exercise may be more effective than counselling people to perform moderate-intensity, low-frequency exercise in improving cardiovascular fitness (as measured by maximum oxygen uptake) at 6–24 months in people aged 30–69 years (low-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Cardiovascular fitness					
[36] RCT **5-armed trial**	492 healthy, sedentary men and women aged 30–69 years, living in Florida, USA People were classed as sedentary if they spent <1 hour/week engaged in physical activity in the previous year The remaining arms evaluated: hard-intensity, low-frequency walking advice; moderate-intensity, high-frequency walking advice; and physician advice	**Maximum oxygen uptake (mean) , 6 months** 0.15 with hard-intensity, high-frequency walking advice 0.02 with moderate-intensity, low-frequency walking advice The exercise interventions involved intensive counselling (17 sessions) to walk for 30 minutes a day for four different intensities and frequencies All interventions took place over 24 months	P <0.01 for high-intensity, high-frequency *v* moderate-intensity, low-frequency walking advice	◯◯◯	advice to carry out higher-intensity exercise

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
[36] RCT **5-armed trial**	492 healthy, sedentary men and women aged 30–69 years, living in Florida, USA People were classed as sedentary if they spent <1 hour/week engaged in physical activity in the previous year The remaining arms evaluated: hard-intensity, low-frequency walking advice; moderate-intensity, high-frequency walking advice; and moderate-intensity, low-frequency walking advice	**Maximum oxygen uptake (mean) , 6 months** 0.15 with hard-intensity, high-frequency walking advice 0.04 with physician advice The exercise interventions involved intensive counselling (17 sessions) to walk for 30 minutes a day for four different intensities and frequencies Physician advice involved quarterly sessions of 5 minutes of physician advice plus a lecture All interventions took place over 24 months	P <0.01 for high-intensity, high-frequency *v* physician advice	○○○	advice to carry out higher-intensity exercise
[36] RCT **5-armed trial**	492 healthy, sedentary men and women aged 30–69 years, living in Florida, USA People were classed as sedentary if they spent <1 hour/week engaged in physical activity in the previous year The remaining arms evaluated: hard-intensity, low-frequency walking advice; moderate intensity, high-frequency walking advice; and physician advice	**Maximum oxygen uptake (mean) , 24 months** 0.10 with hard-intensity, high-frequency walking advice 0.03 with moderate-intensity, low-frequency walking advice The exercise interventions involved intensive counselling (17 sessions) to walk for 30 minutes a day for four different intensities and frequencies All interventions took place over 24 months	P <0.01 for high-intensity, high-frequency *v* moderate-intensity, low-frequency walking advice	○○○	advice to carry out higher-intensity exercise
[36] RCT **5-armed trial**	492 healthy, sedentary men and women aged 30–69 years, living in Florida, USA People were classed as sedentary if they spent <1 hour/week engaged in physical activity in the previous year The remaining arms evaluated: hard-intensity, low-frequency walking advice; moderate intensity, high-frequency walking advice; and moderate-intensity, low-frequency walking advice	**Maximum oxygen uptake (mean) , 24 months** 0.10 with hard-intensity, high-frequency walking advice 0.04 with physician advice The exercise interventions involved intensive counselling (17 sessions) to walk for 30 minutes a day for four different intensities and frequencies Physician advice involved quarterly sessions of 5 minutes of physicians advice plus a lecture All interventions took place over 24 months	P <0.01 for high-intensity, high-frequency *v* physician advice	○○○	advice to carry out higher-intensity exercise

Rate of cardiovascular disease

No data from the following reference on this outcome. [36]

Adverse effects

No data from the following reference on this outcome. [36]

Further information on studies

[36] **Physical activity** This was defined as 30 minutes/day of moderate-intensity activity on most days of the week. Hard intensity = 65% to 75% of heart rate reserve (maximum heart rate minus resting heart rate); moderate intensity = 45% to 55% of heart rate reserve; high frequency = 5–7 days/week; low frequency = 3–4 days/week. Heart-rate monitors were provided to participants in each of the exercise groups but not to the control single-session counselling group.

Comment: The outcome of maximum oxygen uptake is included on the basis that it reflects increases in physical fitness, and low levels of physical fitness are associated with increased risk of CVD independently of other risk factors.

GLOSSARY

BMI A measure of body composition defined as weight (kg) divided by the square of the height (m^2).

Low-quality evidence Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

MET A multiple of the resting metabolic rate. 1 MET is the energy expenditure at rest. An exercise intensity of 3 METs indicates an energy expenditure that is three times higher than at rest. A MET may be quantified as 3.5 mL of oxygen per kilogram of body mass per minute (mL/kg/minute).

Maximum oxygen uptake The maximum amount of oxygen that can be consumed by the body. This is usually expressed in litres of oxygen per minute (L/minute) or in millilitres of oxygen per kilogram of body mass per minute (mL/kg/minute). Maximum oxygen uptake can be assessed by direct laboratory or field test where participants are exercised to maximum effort. It can also be predicted from submaximal tests, usually involving stepping, walking, running, or cycling below maximum effort.

Moderate-intensity physical activity is defined as activity that produces an increase in breathing rate; an increase in heart rate, to the level where the pulse can be felt; and a feeling of warmth, possibly accompanied by sweating on hot or humid days. [3] This equates to an intensity of 3–6 METs. Examples include painting/decorating (3.0 METs), walking at 5 km an hour (3 miles an hour; 3.3 METs), walking at 6 km an hour (4 miles an hour; 5.0 METs), using a vacuum cleaner (3.5 METs), doubles tennis (5.0 METs), and cycling at 16–18 km an hour (10–12 miles an hour; 6.0 METs).

Very low-quality evidence Any estimate of effect is very uncertain.

SUBSTANTIVE CHANGES

Counselling people to increase physical activity versus no counselling: effects on level of physical activity One systematic review [20] and three RCTs [33] [34] [35] added to the existing reporting of three systematic reviews and 12 RCTs. The added systematic review did not pool data in our group of interest, and the three RCTs were therefore reported separately. Two of the added RCTs found that counselling increased physical activity, [33] [34] whereas the third found no significant difference among groups in physical activity. [35] Categorisation unchanged (Likely to be beneficial).

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Competing interests: DS declares that he has no competing interests.

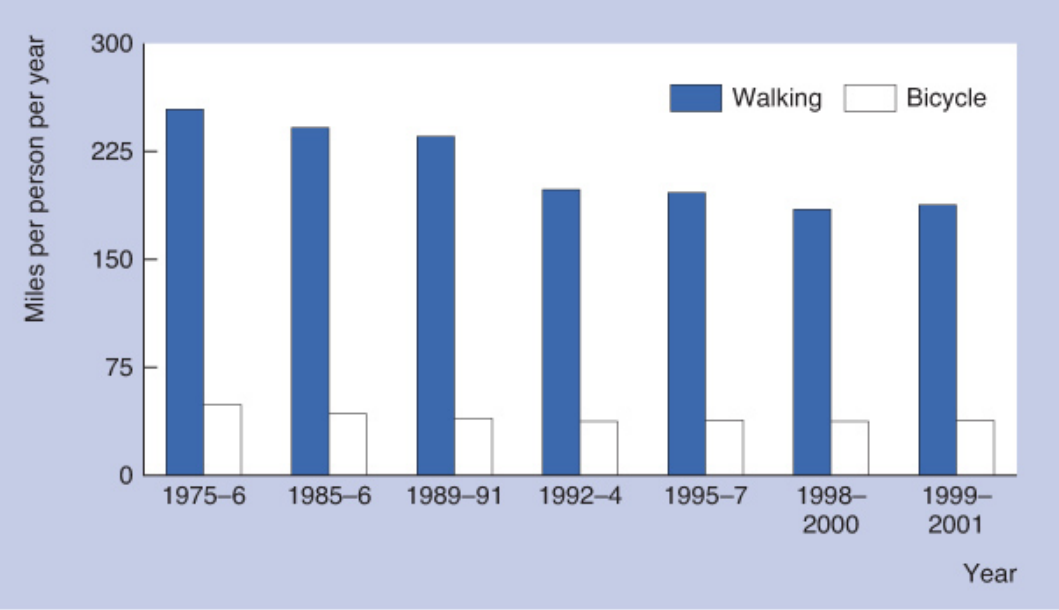

FIGURE 1 **Trends in average miles travelled per person per year on foot and by bicycle, England, 1975–1976 to 1999–2001.**

Disclaimer

GRADE **Evaluation of interventions for Primary prevention of CVD: physical activity.**

Important outcomes	Cardiovascular risk factors, Physical activity, Rate of cardiovascular disease								
Studies (Participants)	Outcome	Comparison	Type of evidence	Quality	Consistency	Directness	Effect size	GRADE	Comment
Does counselling people to increase physical activity lead to increased physical activity in healthy people without existing CVD?									
15 (11,851) [21] [22] [23] [24] [25] [26] [27] [28] [29] [30] [31] [32] [33] [34] [35]	Physical activity	Counselling people to increase physical activity versus no counselling	4	–2	–1	–2	0	Very low	Quality points deducted for incomplete reporting of results and unclear description of counselling intervention. Consistency point deducted for conflicting results. Directness points deducted for diverse interventions and subjective outcome assessment
2 (632) [36] [37]	Physical activity	Counselling people to perform higher- versus lower-intensity exercise	4	0	0	–2	0	Low	Directness points deducted for short-term results in 1 RCT (at 6 months) and limited outcomes reported in 1 RCT (adherence to exercise)
What are the health benefits of increasing physical activity in relation to cardiovascular outcomes in healthy people without existing CVD?									
3 (1335) [28] [30] [31]	Cardiovascular risk factors	Counselling people to increase physical activity versus no advice	4	–1	0	–1	0	Low	Quality point deducted for incomplete reporting of results. Directness point deducted for no statistical comparison with no intervention group in 1 RCT
1 (492) [36]	Cardiovascular risk factors	Counselling people to perform higher- versus lower-intensity exercise programmes	4	–1	0	–1	0	Low	Quality point deducted for incomplete reporting of results. Directness point deducted for use of surrogate outcome (maximum oxygen uptake)

We initially allocate 4 points to evidence from RCTs, and 2 points to evidence from observational studies. To attain the final GRADE score for a given comparison, points are deducted or added from this initial score based on preset criteria relating to the categories of quality, directness, consistency, and effect size. Quality: based on issues affecting methodological rigour (e.g., incomplete reporting of results, quasi-randomisation, sparse data [<200 people in the analysis]). Consistency: based on similarity of results across studies. Directness: based on generalisability of population or outcomes. Effect size: based on magnitude of effect as measured by statistics such as relative risk, odds ratio, or hazard ratio.