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Physical activity in the prevention, treatment and rehabilitation of diseases

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Contents

The guideline has been extensively revised

The fundamentals of physical exercise

- The physiological effects of exercise are most certain and greatest in those parts of the organism that are loaded most: muscles, joints, bones, energy metabolism, circulation, and

hormonal and neural regulation and control.

- For the effects to persist, physical activity must be regular. The attained effects persist even if the amount of exercise is reduced somewhat, particularly if the intensity remains the same.
- Physical activity is the most certain and necessary way of ensuring the maintenance of physical functional capacity. Physical activity is thus especially important in the prevention of the detrimental effects of ageing and chronic illnesses.
- Excessive or faulty strain may cause organ failure, stress injuries and traumas. The threshold of suitable and excessive loading, the therapeutic range of physical activity, may be narrow, especially in sick persons.
- The beneficial effects of endurance-type activity (aerobic exercise) to health and functional capacity have been studied most. To derive many of these benefits, its threshold intensity in healthy adults should be at least 50%, preferably 60% of maximal aerobic capacity (maximal oxygen consumption, VO_2max). This type of activity, for example brisk walking, is perceived as somewhat or moderately intense. Physical activity that improves endurance (energy metabolism and circulation) typically includes rhythmic movement of large muscle groups that is continuous and is maintained for a long time (altogether tens of minutes). Walking, cross-country skiing, cycling and swimming are examples of endurance sports.
- Physical activity is significant in the prevention of coronary artery disease and other arterial diseases, hypertension, type 2 diabetes, osteoporosis and osteoporotic fractures, and some types of cancer (colon cancer and possibly also breast cancer)[1].

Exercise programmes

Cardiorespiratory (aerobic) fitness

- American College of Sports Medicine (ACSM), 1998[2]
- Moderate (intensity 50 - 85% VO_2max (effect more certain if the minimum intensity is 60%)) endurance-type activity 3 - 5 times per week (see table 1).

Table 1. ACSM exercise recommendation[2]

For improving and maintaining the condition of the cardiorespiratory system and for achieving and maintaining an advantageous body composition	**For improving and maintaining muscle fitness and agility and mobility**
Endurance training • 3 - 5 times per week • (55 -) 65 - 90% of HRmax • (40) 50 - 85% of the VO_2 reserve (or HR reserve) • 20 - 60 min at a time (at one time or in at least 10-min bouts) • large muscle groups (rhythmical, aerobic)	Resistance training • 8 - 10 repeats, 1 series, 2 - 3 times per week. Each movement is repeated 8 - 12 times, the elderly 10 - 15 repeats.

	Mobility (maintenance of the range of movement) • at least 2- 3 times/week

1=VO_2max = maximal oxygen consumption
2=VO_2 = reserve, difference between maximal and resting oxygen consumption
3=HRmax = maximal heart rate
4=HR reserve = difference between maximal and resting heart rate

Health maintenance

- American College of Sports Medicine (ACSM) and Center for Disease Control and Prevention (CDC), 1995[3]
- All physical activity that produces health benefits and does not cause significant health problems is considered health maintenance. The intensity of such physical activity is moderate, and brisk walking is a typical example. When the intensity is moderate persons who are not used to physical training avoid the possible disadvantages of exercise (sports traumas and haemodynamic problems associated with insidious coronary artery disease).
- Recommendation: Every adult should engage in moderate-intensity physical activity for 30 minutes or longer on most days of the week, preferably daily. Moderate intensity is defined as 40 - 60% of maximal oxygen consumption (VO_2max). This 30-minute activity can consist of shorter sessions (at least 10 minutes) that involve various daily activities (travel to work etc)[4].

Prevention of coronary artery disease

- There is an inverse relationship between the occurrence of coronary artery disease and large amounts of exercise or good aerobic capacity[5].
- Physical activity can have a beneficial effect on the following risk factors of coronary artery disease: hypertension, dyslipidaemias, obesity, insulin resistance and factors affecting thrombosis formation such as the function of the vascular endothelium and possibly also the electric stability of the heart. The most versatile way of producing these effects is large amounts of frequent, moderate-intensity physical activity. In practice this means physical activity, such as brisk walking for 30 to 60 minutes almost every day.

Prevention and treatment of hypertension

- Persons who exercise much have lower blood pressure than those who exercise only little[1]. Endurance-type physical training lowers blood pressure on average by 5/3 mmHg (usual one-time measurement) (Level of Evidence = B; Evidence Summary available on the EBM Web site). When BP is measured ambulatorily the difference is 50% smaller (Level of Evidence = C; Evidence Summary available on the EBM Web site). Muscle fitness or resistance training with a light load may also lower elevated blood pressure in the manner of endurance exercise[6].
- The exercise recommendation of ACSM[7] for mildly or moderately elevated blood pressure
    - 40 - 70% of VO_2max, i.e. 55 - 80% of the maximal heart rate. The lower range of

intensity is sufficient particularly for the aged
    - 3 or 4 times weekly for at least 30 minutes at a time
    - Various endurance sports are suitable; resistance muscle training (preferably circuit type) should not be the only form of training but should be combined with a endurance sport.

Effect of physical activity on blood lipids

- Endurance training may increase blood HDL cholesterol concentration and lower the concentrations of triglycerides and total cholesterol (Level of Evidence = B; Evidence Summary available on the EBM Web site). In order to produce a favourable effect on HDL cholesterol physical activity must be ample and brisk over several months. Physical activity does not usually lower LDL cholesterol concentration unless the diet is not changed simultaneously (reduced intake of saturated fats). Weight loss may also promote the above-mentioned changes that reduce the risk of coronary artery disease.

Rehabilitation of a coronary artery disease patient

- Cardiac rehabilitation is a multi-professional treatment programme in which physical activity is one of many facets. Cardiac rehabilitation may reduce both total and cardiac mortality by around 20% (Level of Evidence = B; Evidence Summary available on the EBM Web site). Cardiac rehabilitation with emphasis on physical activity does not differ clearly from traditional rehabilitation when it comes to effect on total mortality.
- Recommendation (American Heart Association, AHA, 1995)[8]
    - Mainly exercise that builds endurance
        - at an intensity of 50(-60) -75% of symptom-limited VO_2max (or heart rate reserve, which is the difference of maximal and resting heart rate) for 30 minutes 3 or 4 times weekly (minimum), full benefit is obtained with 5 - 6 times/week
    - resistance training in addition
        - at an intensity of 30 - 50% (up to 60 - 80%) of maximal one-time performance, 12 - 15 repeats, 1 - 3 series twice weekly.

Other atherosclerotic diseases

Stroke

- Epidemiological research has shown that physical activity reduces the risk of stroke, and regular physical activity is one of the recommended methods of stroke prevention[9]. Physical activity influences the risk factors of stroke, such as hypertension, HDL cholesterol, insulin resistance and blood coagulation factors, that underlie both atherosclerosis and haemorrhage caused by rupture of arterial walls. An exercise programme for the prevention of stroke is similar to the programme recommended for preventing coronary heart disease.
- In rehabilitation after stroke, specific motor and physical exercises designed by experts in neurology and physiotherapy have a significant role in the training of motor skills.

Treatment and rehabilitation of peripheral arterial disease (claudication)

- Regular physical activity may protect against claudication.
- In lower limb arteriosclerosis, physical exercise lengthens painless walking distance (Level of Evidence = B; Evidence Summary available on the EBM Web site).
- In addition to smoking cessation, walking exercises to the point of severe pain several times per day are central in the treatment, secondary prevention, and post-treatment rehabilitation after possible surgery. Other types of exercise, such as muscle training, have not been shown to be clearly beneficial for the functional capacity of the lower limbs.

Prevention and treatment of obesity

- Management of obesity always requires permanent changes to the diet. It is important to distinguish between the phases of weigh loss and weight control. The aim of weight control is to prevent weight gain after successful dieting. It may be best to increase the amount of physical activity when actual dieting ends.
- Exercise alone (usually endurance-type) without a change of diet reduced overweight by only a few kilograms (Level of Evidence = A; Evidence Summary available on the EBM Web site). Muscle training affects body composition beneficially (amount of muscle tissue, i.e. fat-free mass (FFM), increases and that of fat tissue decreases), even if actual weight loss is limited. During weight loss by diet muscle training spares a few kilograms of FFM compared with endurance training (Level of Evidence = A; Evidence Summary available on the EBM Web site). Exercise combined with a low-energy diet does not improve the result compared with diet alone; the additional weight loss is at the most only a few kilograms (Level of Evidence = B; Evidence Summary available on the EBM Web site).
- Physical training (increased physical activity) combined with a healthy low-energy diet may improve the results of weight control after weight loss compared with diet alone (Level of Evidence = C; Evidence Summary available on the EBM Web site).
- In intervention studies the effects of physical training on weight have been rather modest compared with epidemiological follow-up studies in which increased physical activity appears to reduce weight gain[10].
- In the prescribing of exercise the aim has usually been a weekly increase in energy expenditure of 4.2 - 8.4 MJ (1000 - 2000 kcal) (see Table 2 below). However, it has been suggested that amounts as high as 10.5 - 11.7 MJ (2500 - 2800 kcal) of weekly energy expenditure may be required for preventing weight gain [B510, 511]. However, even small amounts of physical activity (so-called health maintenance activity) have been shown to have health benefits (regardless of whether the person loses weight or not) particularly on the risk factors of coronary artery disease.

Table 2. Total energy expenditure (kJ or kcal) of a person weighing 70 kg during one hour of exercise in different modes of exercise

Mode of exercise	kJ/h	kcal/h
Running (12 km/h)	3,570	850
Cycling (20 km/h)	2,690	640

Jogging (9 km/h)	2,520	600
Swimming (50 m/min)	2,310	550
Tennis	1,760	420
Cycling (15 km/h)	1,680	400
Brisk walking (6 km/h)	1,390	330
Table tennis	1,180	280
Volley ball	880	210
Dancing	880	210
Slow walking	800	190
Bowling	800	190

1=The above examples of energy expenditure are suggestive. The most important factors affecting expenditure are the weight of the person, the intensity of the exercise and the technique of performance. AN overweight person consumes more energy than a person weighing 70 kg in all sports that require bearing body weight, such as running or walking. The target energy expenditure of exercise for weight loosing should be 1.3 kJ (300 kcal) daily.

Prevention and treatment of type 2 (adult-onset) diabetes

- Large amounts of frequent, moderate-intensity endurance training and possibly also resistance muscle training and ample physical activity integrated into daily activities have a beneficial effect on the various components of the metabolic syndrome, such as obesity, hypertension, disturbances of lipid and glucose metabolisms and insulin resistance. Increased physical activity reduces the risk of atherosclerotic artery diseases and type 2 diabetes.
- Often repeated (3 - 5 times a week), at least moderate-intensity endurance exercise increases insulin sensitivity, decreases the plasma insulin level and enhances glucose tolerance. These disturbances precede type 2 diabetes. Insulin sensitivity is also increased by resistance-type activity. Large amounts of physical activity produce weight loss or prevent obesity.
- This type of exercise prevents the development of type 2 diabetes and reduces the need for other treatments. The benefits of exercise are most prominent in persons with the highest risk of developing diabetes, for example, those with impaired glucose tolerance (Level of Evidence = B; Evidence Summary available on the EBM Web site).
- Physical activity can also be assumed to reduce the risk of developing diabetic complications, such as coronary artery disease. On the other hand, the possibility or existence of these diseases must be taken into account when prescribing exercise. In people with type 2 diabetes the risk of exercise-induced hypoglycaemia is almost nonexistent.

Prevention and treatment of type 1 diabetes

- Regular, well-timed physical activity that has been adjusted according to insulin and nutrition intake can improve glucose balance. In addition, it has a beneficial effect on the risk factors of

coronary heart disease. Physical activity may, however, also impair treatment balance: use of glucose is greatly enhanced at a time when the insulin levels in the patient´s blood may be already be high and may remain high, leading to hypoglycaemia. This can be prevented by consuming an extra dose of carbohydrates before exercise, and by taking a dose of 20 - 40 g per hour during an exercise bout, by reducing the insulin dose, by avoiding physical activity at the peak of insulin action, and by using an injection site that is not in an area where exercise (muscle work with increased circulation) would fasten its mobilization.

- If the patient´s insulin levels during exercise are low, muscle glucose uptake does not increase, but instead the liver produces large amounts of glucose. This may lead to hyperglycaemia. Vigorous activity may also induce delayed hyperglycaemia.
- Diabetics with good glucose balance can practise almost any type of physical activity, and such activity has a beneficial effect on their life expectancy. However, risk factors of common diabetic complications, such as neuropathies, atherosclerosis, retinopathy, and poor recovery from infections, should be taken into account when planning an exercising programme.

Prevention of osteoporosis

- Bone is strengthened when loading induces microscopic transient relative remodelling in it. The changes occur only at the sites that are loaded.
- The mineral content of the bone is increased (or maintained) and the strength of the bone is improved by exercise that is versatile, weight bearing and that requires at least moderate strength. Physical activity should preferable include rapid, multidirectional movements, and controlled impacts or shocks (Level of Evidence = A; Evidence Summary available on the EBM Web site). Examples of such exercise modes are aerobics and other sports with jumping and rapid racket games, such as racket ball. The development of an ideal exercise programme requires further studies. The weaker the bones, the smaller the absolute loading needed to influence their strength. For example, even walking maintains the bone mineral content in the elderly.

Prevention of osteoporotic fractures

- The aim is to maintain adequate bone mass and, in addition, security of locomotion to prevent falls.
- Physical activity that maintains versatile muscle control, moderate velocity and strength as well as balance and agility, such as walking on uneven terrain, gymnastics, aerobics, dancing, and racket games, is recommended within the limits of physical condition and skills.

Arthrosis

- Normal daily activity probably loads the joints sufficiently. Prevention or reduction of overweight is probably beneficial in the prevention of arthrosis.
- Sudden overloading, erratic loading and exercise-related traumas predispose to osteoarthritis.
- It has been shown that individually designed exercise programmes implemented under the supervision of a health care professional are beneficial in terms of overall fitness, joint problems, and functional capacity and reduce the need for other treatments. Regular activity appears to be particularly beneficial in the treatment of arthrosis of the knee (Level of Evidence = B; Evidence Summary available on the EBM Web site).

Rheumatoid arthritis

- Physical training (dynamic muscle work) improves endurance, muscle strength and joint motility in rheumatoid arthritis, but evidence on its effect on functional capacity is still uncertain (Level of Evidence = B; Evidence Summary available on the EBM Web site). Physical exercise has often been feared to have a harmful effect on disease activity, but radiological evidence for this is lacking.

Prevention and rehabilitation of low back problems

- Regular exercise may prevent episodes of low back pain. For now being there is no consensus on the contents of an efficient exercise programme, however, it is essential to load the muscles of the back, trunk and lower extremities and to maintain the mobility of the back by moderate and regular physical activity. In the prevention of back problems the endurance of the muscles associated with the function of the back seems to be more important that their strength.
- In rehabilitation, quick return to normal physical activity has been shown to be more beneficial than passive bed rest (Level of Evidence = B; Evidence Summary available on the EBM Web site).

Asthma

- Endurance training improves the physical condition of an asthma patient, but its connection to overall health and quality of life remains uncertain (Level of Evidence = C; Evidence Summary available on the EBM Web site). In addition to traditional training programmes, interval exercises have been used as they may reduce exercise-induced asthma. Swimming (high air humidity) may cause less exercise-induced asthma than e.g. jogging.

COPD

- In COPD, physical exercise combined with traditional treatment improves functional capacity, which is commonly measured with the 6-minute walking test (distance walked increases)[11]. The quality of life also improves, there is less dyspnoea and the mastery of the disease improves.

Psyche

- Physical activity may reduce anxiety moderately. Both endurance and resistance training may improve mood and cognitive function in the elderly[12].
- Physical exercise may reduce the symptoms of depression (Level of Evidence = C; Evidence Summary available on the EBM web site). In studies the training has usually been rather short lasting, only a few months. The study group has been heterogeneous, consisting of either clinically depressed persons or voluntary subjects who have filled in a depression questionnaire. Thus far there is no knowledge of the most effective mode of exercise; it is important to suggest exercise that the patient does not dislike.

Sleep

- Physical activity can have both acute and chronic beneficial effects on sleep. Exercise can increase the duration of both slow-wave and total sleep and may reduce REM sleep and sleep onset latency[13].

Cessation of smoking

- Physical training may increase the success of smoking cessation as a part of other withdrawal therapy (Level of Evidence = C; Evidence Summary available on the EBM Web site).
- References[1, 14, 15].

Related evidence

- Exercise-based cardiac rehabilitation reduces cardiac deaths and possibly also total mortality (Level of Evidence = B; Evidence Summary available on the EBM Web site).
- Exercise promotion has the potential to be highly cost-effective in individuals aged 45 and over (Level of Evidence = B; Evidence Summary available on the EBM Web site).
- Exercise training significantly improves maximum oxygen consumption in older people (Level of Evidence = B; Evidence Summary available on the EBM Web site).
- Treatment including exercise for elderly reduce the risk of falls (Level of Evidence = B; Evidence Summary available on the EBM Web site).
- Dynamic exercise therapy has a positive effect on physical capacity in rheumatoid arthritis (Level of Evidence = C; Evidence Summary available on the EBM Web site).
- There is some evidence that aerobic exercise has beneficial effects on patients with osteoarthritis of the knee (Level of Evidence = C; Evidence Summary available on the EBM Web site).
- There is some evidence that different forms of exercise may be beneficial for cognitive performance (Level of Evidence = C; Evidence Summary available on the EBM Web site).
- Home-based interventions may have some efficacy in promoting physical activity (Level of Evidence = C; Evidence Summary available on the EBM Web site).

Bibliography

1. U.S. Department of Health and Human Services. Physical activity and health: A report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 1996
2. ACSM (American College of Sports Medicine). Position stand: The recommended quantity and quality of exercise for developing and maintaining cardiorespiratory and muscular fitness and flexibility in healthy adults. Med Sci Sports Exerc 1998;30:975-91
3. Pate RR, Pratt M, Blair SN, Haskell WL, Macera CA, Bouchard C, ym. Physical activity and public health: a recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. JAMA 1995;273:402-7
4. Dunn AL, Andersen RE, Jakicic JM. Lifestyle physical activity interventions. History, short- and long-term effects, and recommendations. Am J Prev Med 1998;15:398-412
5. Williams PT. Physical fitness and activity as separate heart disease risk factors: a meta-

analysis. Med Sci Sports Exerc 2001;33:754-61
6. Kelley GA, Kelley KS. Progressive resistance exercise and resting blood pressure. A meta-analysis of randomized controlled trials. Hypertension 2000;35:838-43
7. ACSM (American College of Sports Medicine). Position stand: Physical activity, physical fitness and hypertension. Med Sci Sports Exerc 1993;25(10):i-x
8. Fletcher GF, Balady G, Froelicher VF, Hartley LH, Haskell WL, Pollock ML. Exercise standards: a statement for healthcare professionals from the American Heart Association. Circulation 1995;91:580-615
9. Gorelick PB, Sacco RL, Smith DB, Alberts M, Mustone-Alexander L, Rader D, ym. Prevention of a first stroke. A review of guidelines and a multidisciplinary consensus statement from the National Stroke Association. JAMA 1999;281:1112-20
10. Wing R. Physical activity in the treatment of the adulthood overweight and obesity: current evidence and research issues. Med Sci Sports Exerc 1999;31(11, suppl.):S547-52
11. Lacasse Y, Wong E, Guyatt GH, King D, Cook DJ, Goldstein RS. Meta-analysis of respiratory rehabilitation in chronic obstructive pulmonary disease. Lancet 1996;348:1115-9
12. Fox KR. The influence of physical activity on mental well-being. Publ Health Nutr 1999;2:411-8
13. Kubitz KA, Landers DM, Petruzzello SJ, Han M. The effects of acute and chronic exercise on sleep. A meta-analytic review. Sports Med 1996;21:277-91
14. Fletcher GF, Balady G, Froelicher VF, Hartley LH, Haskell WL, Pollock ML. Exercise standards. A statement for healthcare professionals from the American Heart Association. Circulation 1995;91(2):580-615
15. Vuori I, Fentem P. Health. In: Council of Europe. The significance of sport for society. Health, socialisation, economy. Strasbourg, Council of Europe 1995:11-87
16. Halbert JA, Silagy CA, Finucane P, Withers RT, Hamdorf PA, Andrews GR. The effectiveness of exercise training in lowering blood pressure: a meta-analysis of randomised controlled trials of 4 weeks or longer. J Hypertens 1997;11:641-9
17. Kelley G. Effects of aerobic exercise on ambulatory blood pressure: a meta-analysis. Sports Med Training Rehab 1996;7:115-31
18. Halbert JA, Silagy CA, Finucane P,Withers RT, Hamdorf PA. Exercise training and blood lipids in hyperlipidemic and normolipemic adults: A meta-analysis of randomized, controlled trials. Eur J Clin Nutr 1999;53:514-22
19. Jolliffe JA, Rees K, Taylor RS, Thompson D, Oldridge N, Ebrahim S. Exercise-based rehabilitation for coronary heart disease (Cochrane Review). CD-Romilla: The Cochrane Library, Issue 1, 2001. Oxford: Update Software. (Viimeinen muutos 22.11.2000)
20. Leng Gc, Fowler B, Enrnst E. Exercise for intermittent claudication (Cochrane Review). CD-Romilla: The Cochrane Library, Issue 1, 2001. Oxford: Update Software. (Viimeinen muutos 16.12.1999)
21. National Institutes of Health and National Heart, Lung, and Blood Institute. Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults. Evidence Report. Obes Res 1998;6(suppl. 2):51S-209S
22. Garrow JS , Summerbell CD. Meta-analysis: effect of exercise, with or without dieting, on the body composition of overweight subjects. Eur J Clin Nutr 1995;49:1-10
23. Miller WC, Koceja DM, Hamilton EJ. A meta-analysis of the past 25 years of weight loss research using diet, exercise or diet plus exercise intervention. Int J Obes 1997;21:941-7
24. Ballor DL, Keesey RE. A meta-analysis of the factors affecting exercise-induced changes in body mass, fat mass and fat-free mass in males and females. Int J Obes 1991;15:717-26
25. Fogelholm M, Kukkonen-Harjula K. Does physical activity prevent weight gain - a systematic review. Obes Rev 2000;1:95-111
26. Tuomilehto J, Lindström J, Eriksson JG, Valle TT, Hämäläinen H, Ilanne-Parikka P, ym. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. N Engl J Med 2001;344:1343-50
27. Wallace BA, Cumming RG. Systematic review of randomized trials of the effect of exercise on

bone mass in pre- and postmenopausal women. Calcif Tissue Int 2000;67:10-8
28. Petrella RJ. Is exercise effective treatment for osteoarthritis of the knee? Br J Sports Med 2000;34:326-31
29. Van den Ende CMH, Vliet Vlieland TPM, Munneke M, Hazes JMW. Dynamic exercise therapy for rheumatoid arthritis (Cochrane Review). CD-Romilla: The Cochrane Library, Issue 2, 2001. Oxford: Update Software. (Last update 19.8.1998)
30. Tulder MW van, Malmivaara A, Esmail R, Koes BW. Exercise therapy for low back pain (Cochrane review). CD Rom: The Cochrane Library, Issue 1, 2001. Oxford: Update Software. (Last update 09.02.2000)
31. Ram FSF, Robinson SM, Black PN. Physical training for asthma (Cochrane Review). CD Rom: The Cochrane Library, Issue 2, 2001. Oxford: Update Software. (Last update 19.11.1999)
32. Lawlor DA, Hopker SW. The effectiveness of exercise as an intervention in the management of depression: systematic review and meta-regression analysis of randomised controlled trials. BMJ 2001;322:763-67
33. Ussher MH, West R, Taylor AH, McEwen A. Exercise interventions for smoking cessation (Cochrane Review). CD-Rom: The Cochrane Library, Issue 1, 2001. Oxford: Update Software. (Last update 28.02.2000)
34. Marcus BH, Albrecht AE, King TE, Parisi AF, Pinto BM, Roberts M, ym. The efficacy of exercise as an aid for smoking cessation in women. A randomized controlled trial. Arch Intern Med 1999;159:1229-34
35. Jolliffe JA, Rees K, Taylor RS, Thompson D, Oldridge N, Ebrahim S. Exercise-based rehabilitation for coronary heart disease. The Cochrane Database of Systematic Reviews, Cochrane Library number: CD001800. In: The Cochrane Library, Issue 2, 2002. Oxford: Update Software. Updated frequently
36. Nicholl JP, Coleman P, Brazier JE. Health and healthcare costs and benefits of exercise. Pharmacoeconomics 1994;5:109-122
37. The Database of Abstracts of Reviews of Effectiveness (University of York), Database no.: DARE-940055. In: The Cochrane Library, Issue 4, 1999. Oxford: Update Software
38. Green JS, Crouse SF. The effects of endurance training on functional capacity in the elderly: a meta-analysis. Med Sci Sports Exercise 1995;27:920-926
39. The Database of Abstracts of Reviews of Effectiveness (University of York), Database no.: DARE-965383. In: The Cochrane Library, Issue 4, 1999. Oxford: Update Software
40. Province MA, Hadley EC, Hornbrook MC, Lipsitz LA, Miller JP. Mulrow CD. The effects of exercise on falls in the elderly: a preplanned meta-analysis of the FICSIT trials. JAMA 1995;273:1341-1347
41. The Database of Abstracts of Reviews of Effectiveness (University of York), Database no.: DARE-954030. In: The Cochrane Library, Issue 4, 1999. Oxford: Update Software
42. Van den Ende CMH, Vliet Vlieland TPM, Munneke M, Hazes JMW. Dynamic exercise therapy for rheumatoid arthritis. The Cochrane Database of Systematic Reviews, Cochrane Library number: CD000322. In: The Cochrane Library, Issue 2, 2002. Oxford: Update Software. Updated frequently.
43. La Mantia K, Marks R. The efficacy of aerobic exercises for treating osteoarthritis of the knee. N Z J Physiother 1995;23:23-30
44. The Database of Abstracts of Reviews of Effectiveness (University of York), Database no.: DARE-945024. In: The Cochrane Library, Issue 4, 1999. Oxford: Update Software
45. Ethier JL, Salazar W, Landers DM, Petruzzello SJ, Han M, Nowell P. The influence of physical fitness and exercise upon cognitive functioning: a meta-analysis. Journal of Sport and Exercise Psychology 1997;19:249-277
46. The Database of Abstracts of Reviews of Effectiveness (University of York), Database no.: DARE-988818. In: The Cochrane Library, Issue 1, 2001. Oxford: Update Software
47. Hillsdon M, Thorogood M. A systematic review of physical activity promotion strategies. Br J Sports Med 1996;30:84-89

48. The Database of Abstracts of Reviews of Effectiveness (University of York), Database no.: DARE- . In: The Cochrane Library, Issue 4, 1999. Oxford: Update Software

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