

Articles

Statement on Exercise: Benefits and Recommendations for Physical Activity Programs for All Americans

A Statement for Health Professionals by the Committee on Exercise and Cardiac Rehabilitation of the Council on Clinical Cardiology, American Heart Association

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Introduction

Physical inactivity is recognized as a risk factor for coronary artery disease. Regular aerobic physical activity increases exercise capacity and plays a role in both primary and secondary prevention of cardiovascular disease.^{1 2 3 4 5} The known benefits of regular aerobic exercise and current recommendations for implementation of exercise programs are described in this revised report.⁶

Exercise training increases cardiovascular functional capacity and decreases myocardial oxygen demand at any level of physical activity in apparently healthy persons as well as in most subjects with cardiovascular disease. Regular physical activity is required to maintain these training effects. The potential risk of physical activity can be reduced by medical evaluation, risk stratification, supervision, and education.⁴

Exercise can help control blood lipid abnormalities, diabetes, and obesity. In addition, aerobic exercise adds an independent blood pressure–lowering effect in certain hypertensive groups with a decrease of 8 to 10 mm Hg in both systolic and diastolic blood pressure measurements.^{7 8 9 10} There is a direct relation between physical inactivity and cardiovascular mortality, and physical inactivity is an independent risk factor for the development of coronary artery disease.^{11 12 13 14} There is a dose-response

relation between the amount of exercise performed from approximately 700 to 2000 kcal of energy expenditure per week and all-cause mortality and cardiovascular disease mortality in middle-aged and elderly populations.^{14 15} The greatest potential for reduced mortality is in the sedentary who become moderately active.¹⁵ Most beneficial effects of physical activity on cardiovascular disease mortality can be attained through moderate-intensity activity (40% to 60% of maximal oxygen uptake, depending on age).^{14 15 16} The activity can be accrued through formal training programs or leisure-time physical activities. Although most of the supporting data are based on studies in men, more recent findings show similar results for women.^{13 17} Results of pooled studies reveal that persons who modify their behavior after myocardial infarction to include regular exercise have improved rates of survival.^{18 19} Recent studies have revealed that intensive multiple interventions such as smoking cessation, blood lipid reduction, weight control, and physical activity significantly decreased rate of progression and, in some cases, led to regression in the severity of atherosclerotic lesions in persons with coronary disease.^{20 21 22 23 24} In addition, limited data indicate that higher-intensity exercise compared with lower-intensity exercise improves left ventricular ejection fraction in persons with coronary artery disease.²⁵ Current activity status (ie, persons remaining physically active or having been sedentary and becoming physically active) revealed the greatest decline in coronary artery disease risk.^{14 15 26} Persons who remain sedentary have the highest risk for all-cause and cardiovascular disease mortality.

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▶ **Benefits of Exercise**

Healthy persons as well as many persons with cardiovascular disease, including those with heart failure,^{27 28 29 30 31 32} can improve exercise performance with training. This improvement is the result of increased ability to use oxygen to derive energy for work. Exercise training increases maximum ventilatory oxygen uptake by increasing both maximum cardiac output (the volume of blood ejected by the heart per minute, which determines the amount of blood delivered to the exercising muscles) and the ability of muscles to extract and use oxygen from blood. Beneficial changes in hemodynamic, hormonal, metabolic, neurological, and respiratory function also occur with increased exercise capacity. These changes can also benefit persons with impaired left ventricular function, in whom most adaptations to exercise training appear to be peripheral and may occur with low-intensity exercise.^{27 28 29 30 31 32 33}

Exercise training results in decreased myocardial oxygen demands for the same level of external work performed, as demonstrated by a decrease in the product of heart rate x systolic arterial blood pressure (an index of myocardial oxygen demand). These changes are also beneficial in persons with coronary artery disease, who after exercise training

may attain a higher level of physical work before reaching the level of myocardial oxygen requirement that results in myocardial ischemia.³⁴

Exercise training favorably alters lipid and carbohydrate metabolism. The exercise-induced increase in high-density lipoproteins is strongly associated with changes in body weight, and greater increases in high-density lipoproteins have been found in women who exercise at higher levels of recreational running.^{4 35 36 37} Regular exercise in overweight women and men enhances the beneficial effect of a low-saturated fat and low-cholesterol diet on blood lipoprotein levels.³⁸ Endurance training has effects on adipose tissue distribution,³⁹ and the effect on adipose tissue distribution is likely to be important in reducing cardiovascular risk.^{40 41 42 43} Exercise training also has an important effect on insulin sensitivity,^{44 45} and intense endurance training has a highly significant salutary effect on fibrinogen levels of healthy older men.⁴⁶ In addition, recent data support the role of physical activity in the prevention and treatment of osteoporosis and certain neoplastic diseases, notably colon cancer.⁴⁷

Developing and maintaining aerobic endurance, joint flexibility, and muscle strength is important in a comprehensive exercise program, especially as people age.^{48 49 50} Elderly women and men show comparable improvement in exercise training, and adherence to training in the elderly is high.⁵⁰ Resistance training exercise alone has only a modest effect on risk factors compared with aerobic endurance training, but it does aid carbohydrate metabolism through the development or maintenance of muscle mass and effects on basal metabolism.^{51 52} Furthermore, resistance training is currently recommended by most health promotion organizations for its effects on maintenance of strength, muscle mass, bone mineral density, functional capacity, and prevention and/or rehabilitation of musculoskeletal problems (eg, low back pain).⁵³ In the elderly, resistance training is both safe and beneficial in improving flexibility and quality of life.^{54 55 56} Persons with cardiovascular disease are usually asked to refrain from heavy lifting and forceful isometric exercises, but moderate-intensity dynamic strength training is safe and beneficial in persons at low risk.

Many activities of daily living require more arm work than leg work. Therefore, persons with coronary artery disease are advised to use their arms as well as their legs in exercise training. The arms respond like the legs to exercise training both quantitatively and qualitatively, although ventilatory oxygen uptake is less with arm ergometry. Although peak heart rates are similar with arm and leg exercise, heart rate and blood pressure response during arm exercise is higher than leg exercise at any submaximal work rate. Therefore, target heart rates are designated 10 beats per minute lower for arm training than for leg training.^{57 58 59} Dynamic arm ergometry is usually well tolerated by persons with coronary artery disease; however, there may be an increase in blood pressure that may be of concern in certain persons.

Maximum ventilatory oxygen uptake drops 5% to 15% per decade between the ages of 20 and 80,^{60 61 62} and a lifetime of dynamic exercise maintains an individual's ventilatory oxygen uptake at a level higher than that expected for any given age. The rate of decline in oxygen uptake is directly related to maintenance of physical activity level, emphasizing the importance of physical activity.⁶³

Middle-aged men and women who work in physically demanding jobs or perform moderate to strenuous recreational activities have fewer manifestations of coronary

artery disease than their less active peers.^{11 12} Meta-analysis studies of clinical trials reveal that medically prescribed and supervised exercise can reduce mortality rates of persons with coronary artery disease.^{18 19 64}

In addition to the physical benefits of exercise, both short-term exercise and long-term aerobic exercise training are associated with improvements in various indexes of psychological functioning. Cross-sectional studies reveal that, compared with sedentary individuals, active persons are more likely to be better adjusted,⁶⁵ to perform better on tests of cognitive functioning,⁶⁶ to exhibit reduced cardiovascular responses to stress,⁶⁷ and to report fewer symptoms of anxiety and depression.⁶⁸ In one report⁶⁹ persons who increased their activity levels between 1965 and 1974 were at no greater risk for depression than those individuals who were active all along; however, persons who were active and became inactive were 1.5 times as likely to become depressed by 1983 compared with those who maintained an active lifestyle.

Longitudinal studies have also documented significant improvement in psychological functioning. Exercise training reduces depression in healthy older men⁷⁰ and in persons with cardiac disease⁷¹ or major depression.⁷² Exercise also improves self-confidence and self-esteem,⁷³ attenuates cardiovascular and neurohumoral responses to mental stress,⁷⁴ and reduces some type A behaviors.⁷⁵ Although exercise training generally has not been found to improve cognitive performance,⁷⁶ short bouts of exercise may have short-term facilitative effects.⁷⁷

Despite the positive physical and mental health benefits of exercise, long-term adherence to exercise programs remains problematic. It is estimated that only 50% of all persons who initiate an exercise program will continue the habit for more than 6 months.⁷⁸ The issue of nonadherence is particularly important because exercise is only beneficial if it is maintained for extended periods of time. Thus, it is important to develop strategies to improve exercise initiation and adherence, especially for persons who are among the least active—some African-American women, the less educated, the obese, and the elderly.⁷⁹

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▶ **Implementation of Exercise Programs**

Persons of all ages should include physical activity in a comprehensive program of health promotion and disease prevention and should increase their habitual physical activity to a level appropriate to their capacities, needs, and interest.

Activities such as walking, hiking, stair-climbing, aerobic exercise, calisthenics, resistance training, jogging, running, bicycling, rowing, swimming, and sports such as tennis, racquetball, soccer, basketball, and "touch" football are especially beneficial when performed regularly. Brisk walking is also an excellent choice.^{80 81} The training effect of such activities is most apparent at exercise intensities exceeding 40% to 50% of exercise capacity. (Exercise capacity is defined as the point of maximum ventilatory oxygen uptake or the highest work intensity that can be achieved.) Evidence also supports that even low- to moderate-intensity activities performed daily can have some long-term health benefits and lower the risk of cardiovascular disease.^{81 82 83} Low-intensity activities generally range from 40% to 60% of maximum capacity. The 40% to 60% of maximum capacity range is similar for young, middle-aged, and elderly persons. Such activities include walking for pleasure, gardening, yard work, house work, dancing, and prescribed home exercise. For health promotion, dynamic exercise of the large muscles for extended periods of time (30 to 60 minutes, three to six times weekly) is recommended. This may include short periods of moderate intensity (60% to 75% of maximal capacity) activity (approximately 5 to 10 minutes) that total 30 minutes on most days.^{16 84} Resistance training using eight to 10 different exercise sets with 10 to 15 repetitions each (arms, shoulders, chest, trunk, back, hips, and legs) performed at a moderate to high intensity (for example, 10 to 15 pounds of free weight) for a minimum of 2 days per week is recommended.

Physical activity may have risks as well as benefits, although risks are relatively infrequent. Estimates of sudden cardiac death rates per 100 000 hours of exercise range from 0 to 2 per 100 000 in general populations and from 0.13 per 100 000 to 0.61 per 100 000 in cardiac rehabilitation programs.^{85 86 87} Studies have also demonstrated the cardiovascular safety of maximum strength testing and training in healthy adults and low-risk cardiac patients.⁸⁸ Falls and joint injuries are additional risks associated with physical activity (especially in older women), but most of these injuries do not require medical treatment. The incidence of such complications is less in those participating in low-impact activities such as walking.^{89 90}

Medical Professionals

Preventive services are an important component of the national health agenda. Physicians have the opportunity and responsibility to promote regular physical activity as well as the reduction of high blood pressure, weight control, management of abnormal blood lipids, and prevention and cessation of smoking.

Many physicians may delegate the task of providing preventive services to other members of the healthcare team. However, the physician must set and support the agenda, because staff members under a physician's supervision cannot deliver preventive services unless the physician defines the services as medically appropriate. Physical activity counseling protocols that require only a few minutes of physician time are available.⁹¹ The physician must not neglect this responsibility to promote regular exercise and other health promotion strategies. Sex bias in the referral of women to exercise programs has been described and should be avoided.⁹² In addition, women in cardiac rehabilitation programs have higher dropout rates and more compliance problems, and such issues must be addressed.⁹³

Nurses, an integral part of the healthcare team, may assess physical activity habits, prescribe exercise, and monitor responses to exercise in healthy persons and cardiac

patients. The services of physical and occupational therapists, exercise scientists, and other health professionals are also useful.⁹⁴

Persons with known or suspected cardiovascular, respiratory, metabolic, orthopedic, or neurological disorders should consult their personal physician before beginning or significantly increasing physical activity. Middle-aged or older sedentary persons with symptoms of cardiovascular disease should also seek medical advice. In turn, physicians should give advice according to recommended guidelines for exercise in such persons.^{60 86 95 96} In addition, physicians should encourage their sedentary patients to adopt a more active lifestyle, emphasizing the risks associated with inactivity. Walking should be advocated as a mode of exercise.⁸⁰ Physicians should assess each patient's physical activity pattern and, with the support of other health professionals, prescribe and give advice about physical activity with individual needs and capabilities in mind. They should also provide systematic follow-up. An appropriate medical evaluation, including an exercise test, may be necessary for some persons but not for the apparently healthy person less than 40 years old who has no coronary risk factors and plans to begin a moderate-intensity activity program.⁹⁷ The exercise test can, however, be an important basis for appropriate exercise prescription. In some instances it is recommended that persons with known cardiovascular disease undertake a prescribed, medically supervised exercise program to reduce morbidity and mortality.^{95 98} In addition to supervised group programs for coronary patients, alternative approaches to delivery of cardiac rehabilitation services such as home-based programs^{99 100} have been tested and shown to be safe and to provide beneficial outcomes in carefully selected and stable low- to moderate-risk persons. Annual exercise testing may be an important part of monitoring certain persons with coronary artery disease.

Medical schools, residency, and fellowship training programs should prepare physicians to recommend exercise. An individual's customary physical activity level should be an integral part of a comprehensive medical history.^{94 101 102 103} Professionals with a background in exercise science should work with medical personnel to establish appropriate exercise programs for persons with diagnosed health problems or who are at high risk for developing major health problems.

Parents

Parents must know the health benefits of regular physical activity and how exercise contributes to quality of life in order to incorporate physical activity into their daily lives and those of all family members. Moreover, parents should teach their children that proper physical activity is a fundamental part of normal healthy living. This commitment provides an incentive, sets an example, and creates in children a positive attitude toward physical activity. Parents and other family members must support each other's exercise habits by sharing responsibilities such as child care, food preparation, and shopping. Families at high risk for cardiovascular disease benefit from structured programs focused on specific health-behavior changes.

Schools

Children must be introduced to the principles of regular physical exercise and recreational activities at an early age. Schools at all levels must develop and encourage positive attitudes toward physical exercise, providing opportunities to learn physical skills and perform physical activities, especially those that can be enjoyed for many years. The school curriculum should not overemphasize sports and activities that

selectively eliminate children who are less skilled. Schools must teach the benefits of exercise and the development and maintenance of exercise and exercise conditioning throughout life.

Some studies demonstrate that organized school programs are not only feasible but successful.^{104 105} In addition, these programs can be used to promote proper nutrition and cigarette smoking prevention and cessation.

Employers and Community Groups

Employers and community organizations must develop both short- and long-term plans tailored to the needs of persons in the community and workplace. Communities should develop exercise programs using local club, park, recreational, church, and school facilities. There is increasing evidence that worksite programs with a comprehensive approach to employee health, including prevention and cessation of smoking, dietary intervention, and exercise, whether on-site or nearby, are not only effective in modifying coronary risk factors but also help reduce absenteeism, accidents, healthcare costs, hospital admissions, and days of rehabilitation.¹⁰⁴ Baseline assessment of an employee's health status can be performed at a relatively low cost and should include an assessment of physical conditioning. Public health interventions in the workplace have resulted in an increase in vigorous physical activity by participating employees that is associated with increases in objective measurements of physical conditioning.¹⁰⁶ As healthcare costs continue to increase, these programs will become more attractive to both small and large businesses.

Insurance Industry

The insurance industry, including managed care, and the medical community are encouraged to engage in a collaborative effort to provide policyholders with exercise programs that meet American Heart Association standards⁶⁰ and the Agency for Health Care Policy and Research Guidelines for Cardiac Rehabilitation.⁴

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▶ Additional Research and Future Issues

There is a large body of knowledge on exercise, but data on exercise and its effects on the cardiovascular system and long-term survival are still limited. The responsibility for conducting research lies with government, private health agencies, the insurance industry, employers, universities, and medical schools.

Basic knowledge of the anatomic, biochemical, and physiological changes that result from various patterns of physical activity (short and long term, sustained and

intermittent, isotonic and isometric, low and high intensity) in persons of different ages is needed, as is a determination of whether a certain minimum-intensity threshold of physical activity is required for benefit. The biomedical and economic impact of participation in exercise programs on coronary artery disease, cerebrovascular and peripheral vascular disease, heart failure, and hypertension should also be evaluated. The psychosocial functioning of persons with coronary artery disease and the potential value of exercise in enhancing the quality of life of cardiac and other patients warrants further study. Future studies should include adequate numbers of women, ethnic groups, and the elderly to better meet research objectives.

Furthermore, the presence and extent of coronary risk factors in the disabled and disadvantaged and in minority groups must be better identified and defined. Consequently, the effect of modifications such as increases in physical activity on members of these groups should be explored, and large studies should also include a significant number of these persons.

Research should be continued to establish the cost-effectiveness of physical activity programs for the enhancement of cardiovascular health,¹⁰⁷ with a focus on the type of promotional strategies required for initiating and maintaining physical activity (eg, insurance incentives, health personnel, public policy, and media materials) as well as the social context of such activity (eg, industry and business, rural and urban settings, schools, churches, and families). Research should also involve issues such as how physical activity can prevent (or decrease the duration of) hospitalization of patients with cardiovascular disease.

Societal, cultural, ethnic, and personal factors that affect development or maintenance of lifelong patterns of physical activity should be identified and incorporated into strategies of exercise promotion.

Research on better and more effective physical activity interventions that improve long-term compliance to a physically active lifestyle is urgently needed. Innovative, nontraditional methods of increasing physical activity in the population must be developed, implemented, and evaluated.

In summary, future developments and study should focus not only on the benefits of physical activity but also the methods used to facilitate dissemination of present and future knowledge to all members of society.



Footnotes

Requests for reprints should be sent to the Office of Scientific Affairs, American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231-4596. (Circulation. 1996;94:857-862.)

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