



Preventing cardiovascular disease in women: How much physical activity is “good enough”?

Introduction

The term *cardiovascular disease* is used by medical professionals to refer to both coronary heart disease (CHD) and stroke; both conditions are usually caused by insufficient blood supply. In most cases, the reduced blood flow results from atherosclerosis, or the accumulation of fatty plaques in artery walls that causes arteries to narrow and harden. If a blood clot or plaque rupture blocks a narrowed artery leading to the heart, it can cause a heart attack; if the artery that is blocked instead leads to the brain, it can cause a stroke.

Until recently, cardiovascular disease, especially CHD, was widely perceived to be less of a public health problem for women than for men. Although CHD tends to appear later in women than it does in men (10 years later for total CHD and 20 years later for its most serious manifestations such as heart attack), CHD nevertheless becomes the leading killer of U.S. men by 45 years of age and of women by 65 years of age. In fact, once women develop CHD, they have a markedly worse prognosis than men. For example, 38% of women but only 25% of men die within one year after having a first heart attack. Moreover, 64% of women but only 50% of men who die suddenly from CHD have no prior symptoms of the disease. In recent years, declines in cardiovascular deaths have also been less pronounced among women than among men (Figure 1).¹ Boosting prevention and treatment efforts among women is necessary to forestall potentially widening gender disparities in cardiovascular outcomes. One potent protective factor that should be targeted for promotion is physical activity.

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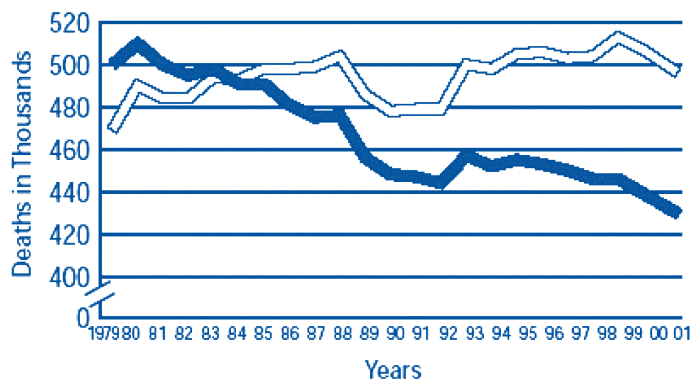
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Source: CDC/NCHS.

■ Males □ Females

Figure 1.

Cardiovascular Disease Mortality Trends for Males and Females
United States: 1979-2001

Reprinted from American Heart Association, *Heart Disease and Stroke Statistics—2004 Update*. Dallas, Texas: American Heart Association, 2003.
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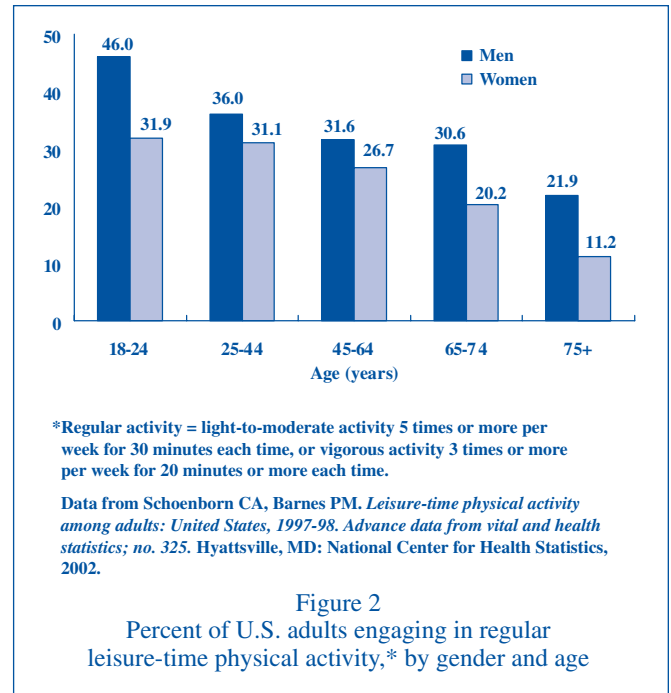
Researchers generally agree that physical activity provides cardiovascular benefits. In 1990, a quantitative review of 27 longitudinal studies in mostly male populations concluded that physically active individuals have about half the CHD risk of those who are sedentary, and studies conducted within the last 15 years also indicate that physically active women are less likely to develop CHD than their inactive counterparts. However, there is still debate on the amount or “dose”—a function of duration, frequency, and intensity—of physical activity required for optimal health.

Duration refers to how long one exercises; frequency, how often. Intensity refers to how “hard” one exercises and is typically measured in kilocalories (kcal) burned per minute or in a unit called the metabolic equivalent (MET). One MET is the amount of energy (oxygen) that the body expends while sitting quietly, and is taken as a constant of 1 kcal·kg⁻¹·hr⁻¹. A 2-MET activity expends twice the energy of sitting quietly; a 3-MET activity expends three times the energy of sitting quietly; and so forth. Moderate-intensity activities, such as brisk walking, are those that burn 3.5 to 7 kcal per minute (for a 70-kg person) or, equivalently, those that expend 3 to 6 METs. Vigorous activities, such as running, are those that burn more than 7 kcal per minute or expend more than 6 METs.

Physical activity guidelines

The longstanding belief that physical activity must be vigorous to be healthful has been overturned in the last decade by epidemiologic studies indicating otherwise. Earlier guidelines advocating vigorous exercise for at least 20 minutes three times per week have been supplemented by a widely publicized 1995 recommendation by the Centers for Disease Control (CDC) and the American College of Sports Medicine (ACSM) that adults engage in 30 minutes of moderate-intensity physical activity on most, preferably all, days of the week (see Corbin, Le Masurier, and Franks, *PCPFS Research Digest*, December 2002, at www.fitness.gov). This has also been the standard endorsed by the U.S. Surgeon General since 1996. In 2002, the influential Institute of Medicine (IOM) concurred that moderately intense activity is beneficial. However, the IOM concluded that one half-hour is not sufficient to maintain a healthy weight nor to achieve maximal health benefits and therefore recommended a 60-minute standard. The IOM guideline was issued as part of a report focused on providing diet and nutrition goals for the American public; the report is available at <http://www.nap.edu/books/0309085373/html/>.

Although the IOM has been praised for promoting physical activity as an essential part of a healthy lifestyle, its recommendation has also been criticized for failing to balance the issue of efficacy (the most effective amount of exercise) with that of feasibility (the amount of exercise people are actually likely to do), both of which are necessary to achieve a public health goal. A recent national survey conducted by the U.S. Department of Health and Human Services found that 73% of women and 66% of men fail to meet the 30-minute guideline; and 41% of women and 35% of men engage in no leisure-time physical activity at all (Figure 2).² Setting the standard even higher, to 60 minutes, may erode the motivation the sedentary public—already largely unable to fulfill the 30-minute goal—might marshal to adopt a more active lifestyle. Based both on this fact and our review of scientific data regarding the salutary effect of even modest amounts of exercise, we, along with many researchers and policymakers, believe that the public health message should continue to be that 30 minutes per day of moderately intense exercise confers significant and measurable health benefits. Indeed, physical activity guidelines issued in 2003 by the American Heart Association (AHA) and endorsed by the ACSM espouse the 30-minute goal for the prevention of cardiovascular disease, as do the AHA’s February 2004 cardiovascular prevention guidelines specifically targeted to women. In June 2004, the AHA reiterated the 30-minute guideline in a joint statement with the American Diabetes Association and the American Cancer Society regarding strategies for preventing cardiovascular

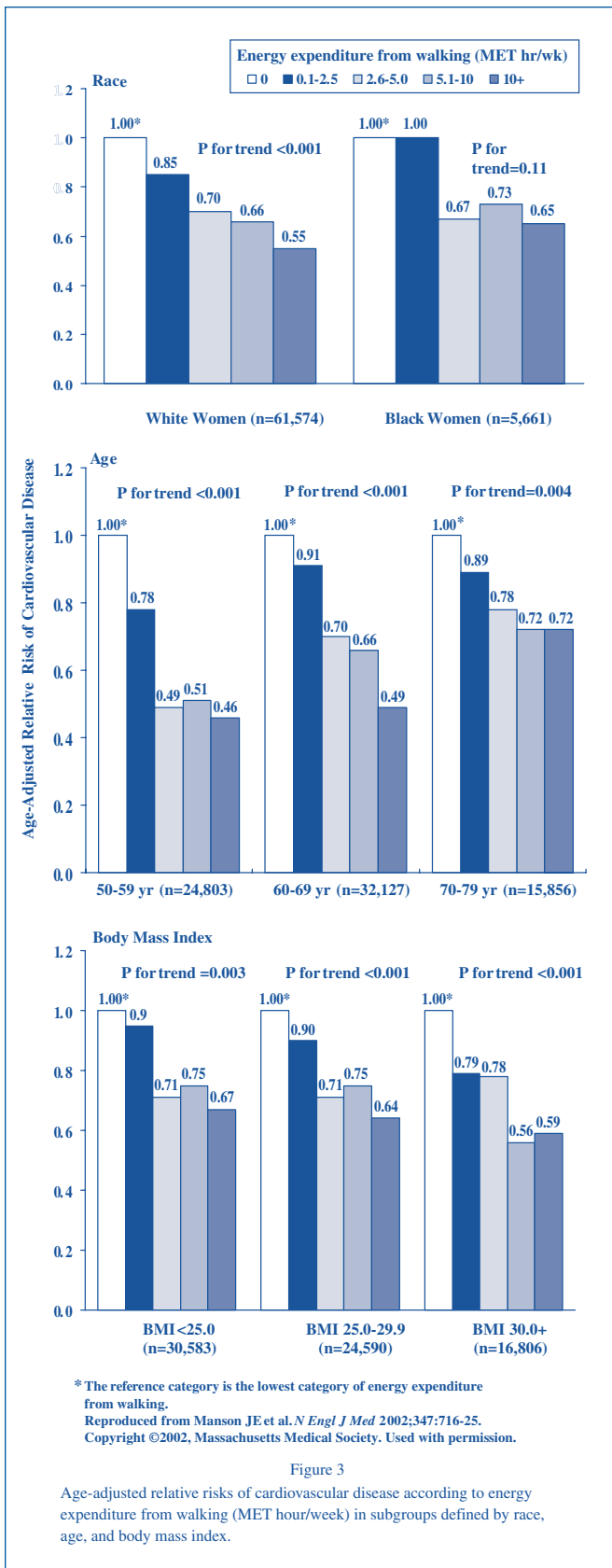


disease, diabetes, and some types of cancer. The World Health Organization also included the 30-minute recommendation in its 2004 global blueprint for fighting these and other chronic diseases.

30 minutes of moderate exercise per day lowers the risk of cardiovascular disease

Findings from epidemiologic studies strongly support the prescription of 30 minutes per day of moderate-intensity activity to reduce the risk of CHD. For example, among nearly 74,000 postmenopausal women aged 50 to 79 years participating in the Women’s Health Initiative, walking briskly for at least 2 1/2 hours per week (i.e., a half-hour five times per week)—or expending an equivalent amount of energy through more vigorous exercise—was associated with a 30% reduction in cardiovascular events over 3 years of follow-up.³ The protective effect of walking was observed in both white and black women, in middle-aged and older women, and in lean and overweight women (Figure 3).

The cardiovascular benefits of walking—the most common leisure activity among U.S. adults—have also been demonstrated in other studies of women. In the Nurses’ Health Study, which followed 72,000 healthy middle-aged female nurses for 8 years, women who walked briskly for 3 hours per week or, alternatively, exercised more vigorously for 1 1/2 hours per week, had a 30 to 40% lower incidence of heart attack than did sedentary women.⁴ In the Women’s Health Study, a 7-year follow-up of 39,000 healthy middle-aged female health professionals, walking at least 1 hour per week was associated with a 50% reduction in CHD risk in women reporting no vigorous physical activity.⁵ Among 1,564 middle-aged University of Pennsylvania alumnae followed for 30 years, walking 10 or more blocks per day as compared with walking less than 4 blocks per day was associated with a one third reduction in cardiovascular disease incidence.⁶ Among community-dwelling women and men aged 65 years and older, walking more than 4 hours per week, as compared with walking less than 1 hour per week,



as well, albeit somewhat less strongly, perhaps due to generally higher physical activity levels for men as compared with women. Nevertheless, in the Health Professionals Follow-up Study, a 12-year follow-up of 44,000 healthy male health professionals aged 40 to 75 years, a half-hour per day or more of brisk walking was associated with an 18% reduction in CHD incidence.⁸ In the Honolulu Heart Program, men aged 71 to 93 years who walked 1 1/2 miles per day experienced half the risk of CHD of those who walked less than 1/4 mile per day.⁹ In the Zutphen Elderly Study, men aged 64 to 84 years who walked or cycled at least 3 times per week for 20 minutes were 31% less likely to die from CHD over a 10-year follow-up period, compared with their counterparts who did not meet this activity criterion.¹⁰ Studies in men suggest that vigorous exercise is associated with even greater reductions in the risk of cardiovascular disease than is moderate-intensity exercise.^{8,10}

Physical activity is also associated with a reduced risk of stroke, although available data are less extensive than for CHD outcomes. A quantitative review of 18 longitudinal studies that included a high proportion of women found that moderately active and highly active persons were 17% and 25% less likely, respectively, to have a stroke or die of stroke-related causes than were persons with low activity.¹¹ In the Nurses' Health Study, women in the highest activity category experienced only half the risk of ischemic stroke as the least active respondents.¹² Ischemic strokes, which are caused by blood vessel blockages in the brain, account for about 80% of strokes in the U.S. Other studies, including the Physicians' Health Study, an 11-year follow-up of nearly 22,000 male physicians aged 40 to 84 years, indicate that physical activity may also be beneficial in preventing hemorrhagic stroke, a type of stroke that can occur when blood vessels in the brain burst and saturate surrounding tissues with blood.¹³

Physical activity versus cardiorespiratory fitness

The above studies examined self-reported physical activity levels in relation to cardiovascular outcomes and thus offer direct support for public health guidelines on cardiovascular disease prevention. Such guidelines are framed in terms of physical activity, a behavior, rather than physical fitness, a biologic state. However, a high level of cardiorespiratory fitness, defined as the ability of the body's circulatory and respiratory systems to supply energy (oxygen) during sustained activity, has also been shown to predict lower cardiovascular death rates in initially healthy women and men. Cardiorespiratory fitness, also known as exercise capacity, is commonly measured by treadmill exercise testing and expressed in METs. In a 20-year follow-up of 2,994 women aged 30 to 80 years in the Lipid Research Clinics Study, the risk of death from cardiovascular causes and from all causes decreased by 17% and 11%, respectively, for each 1-MET increase in exercise capacity, after factoring out the effects of other cardiovascular risk factors.¹⁴ In an 8-year follow-up of 5,721 women aged 35 and older (the St James Women Take Heart Study), death from all causes declined by 17% for each 1-MET increase in exercise capacity.¹⁵

Although regular physical activity boosts physical fitness, the degree to which being inactive and being unfit represent distinct risk factors for cardiovascular disease is uncertain. Indeed, the intensity and amount of exercise an individual needs to reduce his or her cardiovascular risk likely depends

significantly reduced the risk of hospitalization for cardiovascular reasons.⁷

Benefits of walking have been observed in male populations

on his or her baseline fitness level. This explanation may account for the above-mentioned gender differences in epidemiologic findings regarding the level of exercise intensity necessary for CHD risk reduction. In general, studies that indicate that moderate-intensity activity is sufficient to decrease cardiovascular risk have been carried out in women or older men, who tend to be less fit, whereas studies that have reported that vigorous activity is required to reduce such risk have been conducted in young or middle-aged men, who tend to be more fit.

A “good-enough” level of physical activity

In light of the above data, how do we resolve the discrepancy between the 30-minute physical activity guideline of the CDC/ACSM, Surgeon General, and AHA and the 1-hour recommendation of the IOM? The answer is by recognizing that there is in fact no actual discrepancy, only an apparent one arising from differences in which aspect of scientific findings were emphasized by the guideline authors and subsequently publicized by the media (see Corbin, Le Masurier, and Franks *PCPFS Research Digest*, December 2002, at www.fitness.gov). Moderately intense exercise for one half-hour per day confers significant and measurable cardiovascular health benefits, as the data on walking show. It is also true, however, that a dose-response relationship between physical activity and cardiovascular outcomes exists such that *another* half-hour of exercise would, on average, be expected to confer additional protection against the development of cardiovascular disease in sedentary societies such as ours. This fact was clearly acknowledged by the CDC/ACSM and the Surgeon General, even as they issued their 30-minute-per-day guideline: “People who already meet the recommendation are also likely to derive some additional health and fitness benefits from becoming more physically active.” By contrast, the IOM, in advocating a higher exercise dose for the optimization of health, may not have sufficiently credited the role of more modest physical activity achievements in lowering disease risk.

Physical activity and weight control

Whether a person is overweight or obese is often measured with a statistic known as body mass index (BMI), calculated by dividing one’s weight in kilograms (kg) by the square of height in meters (m). Using commonly accepted cut points, individuals with BMI of 18.5 to 24.9 kg/m² are classified as having a healthy weight; those with BMI of 25 to 29.9 kg/m² are classified as overweight; and those with a BMI of 30 kg/m² or greater are classified as obese. The primary rationale given by the IOM for its physical activity recommendation is that one half-hour of exercise per day has not been consistently shown to ensure maintenance of a healthy weight or to foster weight loss in the absence of curtailing caloric intake.

Some evidence does suggest that an hour of activity per day may be necessary to control weight when dietary restraint is not practiced concurrently. In an IOM-compiled database of some 400 healthy stable-weight adults whose energy expenditures had been estimated using a biochemical method considered to be the gold standard of energy expenditure measurement, individuals with a BMI between 18.5 and 24.9 kg/m² expended a daily energy equivalent of at least one hour of moderate physical activity—or, as the IOM phrased it, walking at least 4.4 miles per day at the rate of 2 to 4 miles per hour. (This energy expenditure could also result from lighter activity over a longer duration or more vigorous

activity over a shorter duration.) Moreover, descriptive studies of formerly obese individuals suggest that 80 minutes per day of moderately intense activity or 35 minutes per day of vigorous activity is required for long-term maintenance of weight loss. In the National Weight Control Registry, a sample of 629 women and 155 men who lost an average of 30 kg and maintained a minimum weight loss of 13.6 kg for 5 years, the self-reported median energy expenditure was approximately 2800 kcal per week, or about 1.5 hours of brisk walking per day for a 65-kg woman.¹⁶

On the other hand, findings from randomized trials of exercise in overweight, sedentary individuals who were asked to adhere to their usual eating pattern suggest that lesser amounts of physical activity can also have a beneficial effect on weight control. For example, a one-year trial that randomly assigned 173 postmenopausal women with an average BMI of 30.5 kg/m² to 45 minutes of moderate-intensity exercise 5 days per week or to a stretching control group found significant reductions in weight even among women whose exercise amounts fell short of the prescribed intervention.¹⁷ Women in the intervention group, who exercised an average of 3 1/2 days for 176 minutes per week, experienced an average BMI reduction of 0.3 kg/m², whereas BMI of the controls increased by 0.3 kg/m². Moreover, women who were highly active (exercised more than 195 minutes per week) or moderately active (135 to 195 minutes per week) each lost more total body fat and abdominal fat than did women in the control group. Another recent study using nationally representative data has estimated that a mere 100 kcal per day change in energy balance could prevent weight gain in the majority of 20- to 40-year-old Americans, and that modest increases in physical activity, such as walking an additional 15 minutes per day, or reductions in food intake, such as consuming a few less bites per meal, would bring about the desired change.¹⁸ These data indicate that an hour of exercise per day may not be necessary to derive measurable benefits with respect to weight control.

Other mechanisms by which physical activity reduces cardiovascular disease risk

Physical activity reduces cardiovascular risk not only by promoting weight maintenance or loss but also by processes that are, at least in part, independent of weight regulation. Regular exercise lowers blood pressure, reduces the risk of developing type 2 diabetes, and boosts levels of high-density lipoprotein (HDL) cholesterol (the “good” cholesterol). For example, among Nurses’ Health Study participants who did not engage in vigorous physical activities, walking briskly for 3 hours per week was predictive of a 26% reduction in the incidence of type 2 diabetes, after adjusting for the effects of excess body weight and other variables.¹⁹

Blood pressure. Findings from randomized trials indicate that moderate-intensity exercise is at least as effective as high-intensity exercise at lowering blood pressure; such effects occur in persons with normal blood pressure and those with hypertension (high blood pressure) and are largely independent of weight change. In a quantitative review of 54 randomized trials that enrolled 2419 participants, exercise led to an average reduction of 3.9 mm Hg in systolic blood pressure (the top number in a blood pressure reading) and 2.6 mm Hg in diastolic blood pressure (the bottom number). Among participants with hypertension, the reduction was even greater—4.9 and 3.7 mm Hg for systolic and diastolic pressures, respectively.²⁰ In an analysis of 16 trials (650 participants) that employed walking as the sole activity

intervention, systolic/diastolic blood pressure decreases of 3/2 mm Hg were observed after an average of 25 weeks of treatment in people with normal blood pressure and in those with hypertension.²¹ Both analyses included trials with a large percentage of female participants and found that the effectiveness of the exercise intervention did not vary by gender.

Type 2 diabetes. Type 2 diabetes mellitus, a metabolic disorder characterized by excess glucose (sugar) in the blood resulting from defects in insulin action, is a major risk factor for cardiovascular disease, especially among women. Whereas men with diabetes are 2 to 3 times more likely to develop cardiovascular disease than are men without diabetes, women with diabetes are 3 to 7 times more likely to do so than are their counterparts without the condition. Moderate- and high-intensity exercise appear to be equally effective in improving blood glucose control and insulin action and lowering diabetes risk. In the Nurses' Health Study, brisk walking and more vigorous activity were associated with comparable reductions in type 2 diabetes risk, after adjustment for total exercise energy expenditure.¹⁹ A 6-year follow-up of 1,728 Pima Indians in Arizona, a community with one of the world's highest rates of type 2 diabetes and a high prevalence of obesity, found that recreational physical activity at levels meeting the 30-minute, moderate-intensity public health guideline was associated with a 26% reduction in diabetes risk in women and a 12% reduction in men, after factoring out the effect of BMI.²² Clinical trials conducted in high-risk populations also indicate that physical activity lowers the risk of diabetes. For example, in the Da Qing Impaired Glucose Tolerance and Diabetes Study, 577 middle-aged Chinese women and men with impaired glucose tolerance—a condition in which blood glucose levels are higher than normal but not high enough to be classified as full-fledged diabetes—were randomized to one of three treatment groups—diet only, exercise only, or diet plus exercise—or to a control group.²³ Over 6 years, the three interventions were associated with reductions of 31%, 46%, and 42% in diabetes risk, respectively. Notably, overweight and lean participants experienced similar reductions in diabetes risk. The U.S. Diabetes Prevention Program, a 3-year follow-up of 3,234 women and men aged 25 to 85 years with impaired glucose tolerance and BMI of 24 kg/m² or more, reported a 58% reduction in diabetes risk among the intervention group, whose members, on average, performed moderate-intensity exercise for 30 minutes per day (most chose walking) and lost 5 to 7% of their body weight during the trial.²⁴ This study oversampled older persons, as well as members of racial/ethnic groups that suffer disproportionately from diabetes (black, Hispanic, and Asian Americans; Pacific Islanders; and American Indians), and found that the lifestyle intervention was effective in reducing diabetes risk in all of these groups. Indeed, among people aged 60 and older—a group with a diabetes prevalence of nearly 20%—the intervention was associated with a 71% reduction in diabetes risk.

An estimated 75% of people who have diabetes eventually die from cardiovascular complications. However, several long-term studies, including the large Nurses' Health Study,²⁵ suggest that people with diabetes who engage in regular moderate-intensity physical activity can sharply cut their odds of developing, or dying from, cardiovascular disease. Among 2,449 adults with diabetes in the National Health Interview Survey, walking 2 or more hours per week, as compared with not walking, was predictive of a 41% reduction

in the cardiovascular death rate during 8 years of follow-up.²⁶ A large ongoing trial, the Look AHEAD (Action for Health in Diabetes) study funded by the National Institute of Diabetes and Digestive and Kidney Diseases, should provide valuable randomized data about the long-term (11 1/2 years) effects of regular exercise and decreased caloric intake on the risk of developing cardiovascular disease in obese persons with diabetes.²⁷

Lipid profile. In contrast to the findings for blood pressure and glucose control, stronger dose-response relationships between exercise intensity and blood lipids—specifically, HDL cholesterol and triglycerides—have been reported in observational studies. Nevertheless, a recent 8-month trial that assigned overweight middle-aged women and men to various exercise regimens or to a nonexercising control group found that, although improvements in lipid profile were far more striking among the “high-amount/high-intensity” exercise group than among either the “low-amount/high-intensity” and “low-amount/moderate-intensity” groups, a comparison of the latter two groups showed that they experienced similar improvements in lipid profile to each other.²⁸ On the basis of these results, the investigators conclude that lipid profile is related more strongly to the amount, rather than the intensity, of exercise. Favorable effects of brisk walking (three 50-minute sessions per week) on blood lipids were also found in a 10-week randomized trial of women aged 70 to 87 years.²⁹ In these trials, the beneficial effects of exercise occurred in the absence of concurrent dietary change.

Novel risk factors. Accumulating data indicate that exercise favorably influences not only the established risk factors for cardiovascular disease described above but also a variety of newly recognized risk factors. Although comparable studies in women are lacking, studies in healthy men suggest that both moderate-intensity and vigorous exercise alter the body's production of various factors that work in concert to regulate blood clotting. That is, exercise helps maintain the proper balance between substances that stimulate clot formation—including proteins called coagulation factors and viscous (sticky) blood cells called platelets—and those that counteract this effect by promoting blood thinning. Trials of men with hypertension, diabetes, or preexisting heart disease suggest that exercise can also improve the functioning of the cells that line the blood vessel walls. Collectively termed the endothelium, these cells have been shown to respond to regular exercise by producing more nitric oxide, a substance that relaxes blood vessels, thereby increasing the ability of the vessels to dilate in response to blood flow. Improved regulation of blood coagulation and viscosity and improved endothelial function are believed to lessen the risk of unhealthy blood clots and thus of heart attack and ischemic stroke.

The protective effect of physical activity may also be a result of its influence on inflammation. In large observational studies of women and men, exercise has been linked to lower levels of various inflammatory markers in the blood, including C-reactive protein and interleukin-6. Inflammation is thought to destabilize fatty atherosclerotic plaques in heart and brain arteries. By reducing inflammation, exercise may promote the stability of these plaques, thus reducing the odds that they will rupture and precipitate a heart attack or stroke.

Taken in the aggregate, these findings suggest that the cardiovascular benefits derived from physical activity are not solely a function of weight regulation. Indeed, in the large-scale Nurses' Health Study, walking was associated with a

reduced incidence of cardiovascular disease even after factoring out the effects of changes in participants' BMI over time. Thus, focusing on excess weight—as powerful a cardiovascular disease risk factor as it is—as the primary guidepost yields an incomplete picture when assessing the impact of physical activity on cardiovascular health.

Other efficacy and feasibility issues

Calorie control. Indeed, if obesity rather than cardiovascular disease is the outcome of interest, then it should be kept in mind that energy output from physical activity, is only one half of the energy balance equation. Energy input is the other half, and this topic, rather than physical activity, is the main focus of the aforementioned IOM report. The most effective weight-loss programs combine calorie control with physical activity. Given the trend of ever-increasing portion sizes, reinforcing the importance of dietary moderation is crucial to halt the pandemic of obesity, the prevalence of which jumped from 14.5% in 1980 to 30.4% in 2002.³⁰ Otherwise, recommended exercise doses will creep inexorably upward in an attempt to keep waistlines from expanding. It is plausible that one half-hour of exercise per day, in combination with modest-to-moderate dietary restraint, will confer cardiovascular benefits of equal magnitude to those conferred by one hour of exercise per day in the absence of caloric restriction. The former prescription may be more feasible to achieve than the latter in our time- but not food-deprived society. This issue is particularly salient for U.S. women, as national data indicate that their average caloric intakes increased by a much larger percentage than did those of U.S. men during the past 3 decades. From 1971 to 2000, the daily caloric intake of the typical woman rose 22%, from 1542 to 1877 kcal, while the typical man increased his intake by 7%, from 2450 to 2618 kcal.³¹ Although comparable data on national trends in physical activity during this period are lacking, activity levels among U.S. women and men remained relatively stable during the 1990s,³² suggesting that diet is at least as important as exercise in controlling weight.

Short vs. long bouts of exercise. Because exercise must be current and habitual to confer cardiovascular protection, the ability to incorporate it into one's daily schedule is crucial. Especially welcome news to time-pressured individuals should be findings from studies showing that short durations (as short as 10 minutes) of exercise favorably affect cardiovascular risk factors. To date, only one longitudinal study has examined the relationship between short bouts of exercise and the risk of cardiovascular disease itself. Among 7,337 middle-aged and elderly men followed for 5 years in the Harvard Alumni Health Study, exercising in 15-, 30-, or 45-minute bouts all offered similar protection against cardiovascular disease, given an equivalent total exercise energy expenditure per week.³³ To date, no parallel studies have been conducted in female populations. However, it is not unreasonable to speculate that comparable findings would be observed among similarly aged women. From a public health perspective, this knowledge may help busy individuals to consider exercise a manageable part of their daily routine rather than a "production number" to be undertaken only on rare occasions.

Effect of age. For aging populations, additional motivation to exercise is provided by data that strongly support the adage "it's never too late." Several long-term studies suggest that adopting a physically active lifestyle even in late adulthood may lower cardiovascular risk. The British Regional Heart

Study, which examined changes in physical activity over 14 years among 5,934 men aged 40 to 59 years at baseline, found that men who took up even light activity in later life experienced a 34% reduction in cardiovascular death over the subsequent 4 years as compared with men who remained inactive.³⁴ Similarly, the Study of Osteoporotic Fractures, which assessed physical activity changes over 6 years among 7,553 women aged 65 years and older at baseline, reported that women who increased their physical activity level were 36% less likely to die of cardiovascular causes during the subsequent 7 years than were women who stayed sedentary.³⁵ Nevertheless, both studies also indicate that exercise must be current and habitual to confer cardiovascular protection; men and women who became inactive in later life had a similar risk of cardiovascular death to those who had remained inactive over the course of follow-up.

Effect of race/ethnicity. There are sparse data on the relationship between physical activity and cardiovascular disease in nonwhite populations. However, results from the Women's Health Initiative, one of the few studies to include a sufficient number of black participants to permit an examination of the association between physical activity and CHD in this group, show that black women derive comparable cardiovascular benefits from exercise as do white women.³ In both racial groups, 30 minutes per day of brisk walking, or more vigorous exercise, was associated with an approximate 30% reduction in CHD risk. Such evidence regarding the applicability of national activity guidelines to black Americans is important because of the high prevalence of physical inactivity, obesity, hypertension, type 2 diabetes, and cardiovascular disease in this group. In a recent national survey, 55% of black women and 44% of black men reported no leisure-time physical activity, as compared with 36% of white women and 33% of white men.¹ An estimated 40% of black women and 41% of black men have cardiovascular disease, whereas the corresponding figures for whites are 24% and 30%.¹ Although the reasons for racial disparities in health are not completely understood, with differing physical activity patterns being only one piece of a complex puzzle, targeted initiatives to increase physical activity among U.S. blacks may help ameliorate their disadvantaged cardiovascular status vis-à-vis U.S. whites.

Strength training. Most epidemiologic studies of physical activity have focused on aerobic exercise such as walking. However, resistance exercise, also known as strength training, may also reduce CHD risk. In the Health Professionals Follow-up Study, men who trained with weights for at least 30 minutes per week were 23% less likely to develop CHD during 8 years of follow-up than were men who did not train with weights.⁸ Resistance exercise is known to improve blood glucose control and may also improve blood lipid profile and lower blood pressure. Resistance exercise also confers noncardiovascular benefits, most notably the preservation of bone and muscle, which may be particularly important for women, who are at higher risk for bone thinning and fractures than are men. It is therefore of great concern that only 16% of U.S. women aged 45 to 64 years and less than 10% of women aged 65 years and older report ever engaging in strengthening activities.²

Prolonged sitting and other sedentary behaviors. Recent studies demonstrate the health benefits not only of obtaining adequate aerobic and resistance exercise but also avoiding sedentary behaviors such as prolonged sitting. Highlighting

this distinction in future public health messages would seem to be warranted, given that the typical U.S. adult spends 4 to 5 hours per day watching television,³⁶ and many individuals sit for an additional 8 or more hours while at work.

Prolonged sitting predicts an increased risk for diabetes and cardiovascular disease, even after accounting for time spent in recreational exercise. Among women in the Nurses' Health Study, each 2-hour-per-day increment in television watching was associated with a 14% increase in the risk of diabetes.³⁷ Among participants in the Women's Health Initiative, those who spent 16 or more hours per day sitting were 68% more likely to develop cardiovascular disease than those who spent less than 4 hours per day sitting.³

Clinician counseling and other interventions. Because of a lack of research, it is not known whether brief counseling by primary care physicians during routine office visits is effective in producing sustained physical activity increases among their patients. Nonetheless, it is sobering to note that, despite the fact that 2 of 3 U.S. adults do not exercise enough to meet the 30-minute-per-day guideline, only 1 in 3 adults who saw a physician in the prior year were counseled about physical activity at their last visit.³⁸ Data from randomized clinical trials suggest that so-called "lifestyle activity" interventions, which encourage sedentary individuals to incorporate short bouts of physical activity into their daily life (e.g., taking short walks during lunch or coffee breaks; doing yard work or gardening; and using the stairs instead of the elevator), can be more effective than traditional exercise programs (e.g., structured workout sessions at the gym) in boosting activity levels and improving physical fitness and cardiovascular risk profiles.³⁹ Urgently needed are additional studies to identify specific characteristics of interventions—both interventions implemented at the individual level (e.g., one-on-one counseling of patients by healthcare providers) and those implemented at the community level (e.g., increasing the availability of walking trails, bike paths, and other recreation-friendly spaces in urban and suburban

environments)—that can bring about lasting improvements in exercise behaviors.

Safety issues

In addition to issues of efficacy and feasibility, initiatives to boost physical activity must adequately address safety concerns. Exercise is not an unqualified boon with respect to either cardiovascular or muscle and bone health, especially among persons who already have heart disease or diabetes or who are not accustomed to exercising. Risks of overexercise, especially vigorous exercise, include sudden cardiac death, fall-related injuries, other muscle and bone injuries, and, for women, menstrual and reproductive problems. While physical inactivity and overeating exact a far greater toll on the health of U.S. adults than do excessive exercise and overzealous dieting, these factors must not be ignored by healthcare providers and public health professionals.

Conclusion

To lead to tangible improvements in health, the findings of scientific research must be skillfully translated into healthcare practice and public health policy. Such translation requires the balancing of efficacy, feasibility, and safety issues. The challenge to healthcare providers and policymakers is determining how best to promote appropriate levels of regular physical activity to their patients and to the general public, respectively. We believe that the public health message should remain "30 minutes per day is good, and more is better, to a reasonable extent." As the eminent British epidemiologist Geoffrey Rose stated in his classic text *The Strategy of Preventive Medicine*, the overall burden of disease in a given population is likely to undergo a more dramatic reduction when a large segment of that population adopts modest improvements in health behaviors than when a modest segment of that population adopts large improvements.

Note: References are included in the electronic version found at www.fitness.gov.

“Epidemiologic studies suggest that 30 minutes per day of brisk walking can reduce the occurrence of cardiovascular disease in women and men. In a sedentary society such as ours, public health initiatives that promote moderate increases in physical activity may represent the optimal balance between efficacy, feasibility, and safety to achieve the desired cardiovascular benefit.”

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