Physical Activity Has Many Health Benefits

All Americans should be regularly physically active to improve overall health and fitness and to prevent many adverse health outcomes. The benefits of physical activity occur in generally healthy people, in people at risk of developing chronic diseases, and in people with current chronic conditions or disabilities. This chapter gives an overview of research findings on physical activity and health. The box on page 8 provides a summary of these benefits.

Physical activity affects many health conditions, and the specific amounts and types of activity that benefit each condition vary. In developing public health guidelines, the challenge is to integrate scientific information across all health benefits and identify a critical range of physical activity that appears to have an effect across the health benefits. One consistent finding from research studies is that once the health benefits from physical activity begin to accrue, additional amounts of activity provide additional benefits.

Although some health benefits seem to begin with as little as 60 minutes (1 hour) a week, research shows that a total amount of 150 minutes (2 hours and 30 minutes) a week of moderate-intensity aerobic activity, such as brisk walking, consistently reduces the risk of many chronic diseases and other adverse health outcomes.

Examining the Relationship Between Physical Activity and Health

In many studies covering a wide range of issues, researchers have focused on exercise, as well as on the more broadly defined concept of physical activity. Exercise is a form of physical activity that is planned, structured, repetitive, and performed with the goal of improving health or fitness. So, although all exercise is physical activity, not all physical activity is exercise.

Studies have examined the role of physical activity in many groups—men and women, children, teens, adults, older adults, people with disabilities, and women during pregnancy and the postpartum period. These studies have focused on the role that physical activity plays in many health outcomes, including:

- Premature (early) death;
- Diseases such as coronary heart disease, stroke, some cancers, type 2 diabetes, osteoporosis, and depression;

The Health Benefits of Physical Activity—Major Research Findings

- Regular physical activity reduces the risk of many adverse health outcomes.
- Some physical activity is better than none.
- For most health outcomes, additional benefits occur as the amount of physical activity increases through higher intensity, greater frequency, and/or longer duration.
- Most health benefits occur with at least 150 minutes a week of moderate-intensity physical activity, such as brisk walking. Additional benefits occur with more physical activity.
- Both aerobic (endurance) and muscle-strengthening (resistance) physical activity are beneficial.
- Health benefits occur for children and adolescents, young and middle-aged adults, older adults, and those in every studied racial and ethnic group.
- The health benefits of physical activity occur for people with disabilities.
- The benefits of physical activity far outweigh the possibility of adverse outcomes.

- Risk factors for disease, such as high blood pressure and high blood cholesterol;
- Physical fitness, such as aerobic capacity, and muscle strength and endurance;
- Functional capacity (the ability to engage in activities needed for daily living);
- Mental health, such as depression and cognitive function; and
- Injuries or sudden heart attacks.

These studies have also prompted questions as to what type and how much physical activity is needed for various health benefits. To answer this question, investigators have studied three main kinds of physical activity: aerobic, muscle-strengthening, and bone-strengthening. Investigators have also studied balance and flexibility activities. These latter two activities are addressed in Chapters 4, 5, and 6.

Aerobic Activity

In this kind of physical activity (also called an endurance activity or cardio activity), the body's large muscles move in a rhythmic manner for a sustained period of time. Brisk walking, running, bicycling, jumping rope, and swimming are all examples.

Aerobic activity causes a person's heart to beat faster than usual.

Aerobic physical activity has three components:

- **Intensity,** or how hard a person works to do the activity. The intensities most often examined are moderate intensity (equivalent in effort to brisk walking) and vigorous intensity (equivalent in effort to running or jogging);
- **Frequency,** or how often a person does aerobic activity; and
- **Duration,** or how long a person does an activity in any one session.

Although these components make up a physical activity profile, research has shown that the total amount of physical activity (minutes of moderate-intensity physical activity, for example) is more important for achieving health benefits than is any one component (frequency, intensity, or duration).

Muscle-Strengthening Activity

This kind of activity, which includes resistance training and lifting weights, causes the body's muscles to work or hold against an applied force or weight. These

activities often involve relatively heavy objects, such as weights, which are lifted multiple times to train various muscle groups. Muscle-strengthening activity can also be done by using elastic bands or body weight for resistance (climbing a tree or doing push-ups, for example).

Muscle-strengthening activity also has three components:

- **Intensity,** or how much weight or force is used relative to how much a person is able to lift;
- **Frequency,** or how often a person does muscle-strengthening activity; and
- **Repetitions,** or how many times a person lifts a weight (analogous to duration for aerobic activity).

The effects of muscle-strengthening activity are limited to the muscles doing the work. It's important to work all the major muscle groups of the body: the legs, hips, back, abdomen, chest, shoulders, and arms.

Bone-Strengthening Activity

This kind of activity (sometimes called weight-bearing or weight-loading activity) produces a force on the bones that promotes bone growth and strength. This force is commonly produced by impact with the ground. Examples of bone-strengthening activity include jumping jacks, running, brisk walking, and weight-lifting exercises. As these examples illustrate, bone-strengthening activities can also be aerobic and muscle strengthening.

The Health Benefits of Physical Activity

Studies clearly demonstrate that participating in regular physical activity provides many health benefits. These benefits are summarized in the accompanying table. Many conditions affected by physical activity occur with increasing age, such as heart disease and cancer. Reducing risk of these conditions may require years of participation in regular physical activity. However, other benefits, such as increased cardiorespiratory fitness, increased muscular strength, and decreased depressive symptoms and blood pressure, require only a few weeks or months of participation in physical activity.

Health Benefits Associated With Regular Physical Activity

Children and Adolescents

Strong evidence

- Improved cardiorespiratory and muscular fitness
- Improved bone health
- Improved cardiovascular and metabolic health biomarkers
- Favorable body composition

Moderate evidence

- Reduced symptoms of depression

Adults and Older Adults

Strong evidence

- Lower risk of early death
- Lower risk of coronary heart disease
- Lower risk of stroke
- Lower risk of high blood pressure
- Lower risk of adverse blood lipid profile
- Lower risk of type 2 diabetes
- Lower risk of metabolic syndrome
- Lower risk of colon cancer
- Lower risk of breast cancer
- Prevention of weight gain
- Weight loss, particularly when combined with reduced calorie intake
- Improved cardiorespiratory and muscular fitness
- Prevention of falls
- Reduced depression
- Better cognitive function (for older adults)

Moderate to strong evidence

- Better functional health (for older adults)
- Reduced abdominal obesity

Moderate evidence

- Lower risk of hip fracture
- Lower risk of lung cancer
- Lower risk of endometrial cancer
- Weight maintenance after weight loss
- Increased bone density
- Improved sleep quality

Note: The Advisory Committee rated the evidence of health benefits of physical activity as strong, moderate, or weak. To do so, the Committee considered the type, number, and quality of studies available, as well as consistency of findings across studies that addressed each outcome. The Committee also considered evidence for causality and dose response in assigning the strength-of-evidence rating.

The Beneficial Effects of Increasing Physical Activity: It's About Overload, Progression, and Specificity

Overload is the physical stress placed on the body when physical activity is greater in amount or intensity than usual. The body's structures and functions respond and adapt to these stresses. For example, aerobic physical activity places a stress on the cardiorespiratory system and muscles, requiring the lungs to move more air and the heart to pump more blood and deliver it to the working muscles. This increase in demand increases the efficiency and capacity of the lungs, heart, circulatory system, and exercising muscles. In the same way, muscle-strengthening and bone-strengthening activities overload muscles and bones, making them stronger.

Progression is closely tied to overload. Once a person reaches a certain fitness level, he or she progresses to higher levels of physical activity by continued overload and adaptation. Small, progressive changes in overload help the body adapt to the additional stresses while minimizing the risk of injury.

Specificity means that the benefits of physical activity are specific to the body systems that are doing the work. For example, aerobic physical activity largely benefits the body's cardiovascular system.

The health benefits of physical activity are seen in children and adolescents, young and middle-aged adults, older adults, women and men, people of different races and ethnicities, and people with disabilities and chronic conditions. The health benefits of physical activity are generally independent of body weight. Adults of all sizes and shapes gain health and fitness benefits by being habitually physically active. The benefits of physical activity also outweigh the risk of injury and sudden heart attacks, two concerns that prevent many people from becoming physically active.

The following sections provide more detail on what is known from research studies about the specific health benefits of physical activity and how much physical activity is needed to get the health benefits.

Premature Death

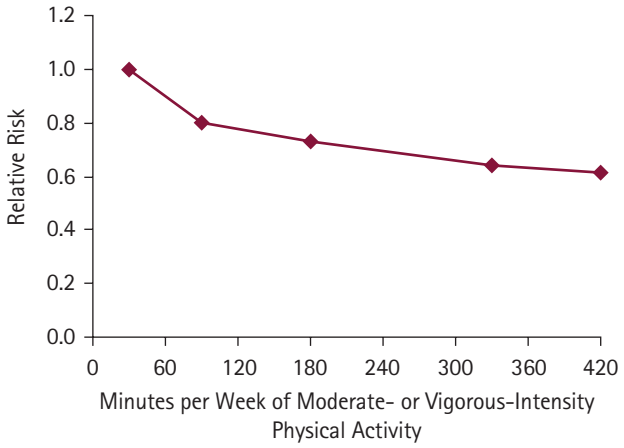
Strong scientific evidence shows that physical activity reduces the risk of premature death (dying earlier than the average age of death for a specific population group) from the leading causes of death, such as heart disease and some cancers, as well as from other causes of death. This effect is remarkable in two ways:

- First, only a few lifestyle choices have as large an effect on mortality as physical activity. It has been estimated that people who are physically active for approximately 7 hours a week have a 40 percent lower risk of dying early than those who are active for less than 30 minutes a week.
- Second, it is not necessary to do high amounts of activity or vigorous-intensity activity to reduce the risk of premature death. Studies show substantially lower risk when people do 150 minutes of at least moderate-intensity aerobic physical activity a week.

Research clearly demonstrates the importance of avoiding inactivity. Even low amounts of physical activity reduce the risk of dying prematurely. As the figure on page 11 shows, the most dramatic difference in risk is seen between those who are inactive (30 minutes a week) and those with low levels of activity (90 minutes or 1 hour and 30 minutes a week). The relative risk of dying prematurely continues to be lower with higher levels of reported moderate- or vigorous-intensity leisure-time physical activity.

All adults can gain this health benefit of physical activity. Age, race, and ethnicity do not matter. Men and women younger than 65 years as well as older adults have lower rates of early death when they are physically active than when they are inactive. Physically active people of all body weights (normal weight, overweight, obese) also have lower rates of early death than do inactive people.

The Risk of Dying Prematurely Declines as People Become Physically Active



Cardiorespiratory Health

The benefits of physical activity on cardiorespiratory health are some of the most extensively documented of all the health benefits. Cardiorespiratory health involves the health of the heart, lungs, and blood vessels.

Heart diseases and stroke are two of the leading causes of death in the United States. Risk factors that increase the likelihood of cardiovascular diseases include smoking, high blood pressure (called hypertension), type 2 diabetes, and high levels of certain blood lipids (such as low-density lipoprotein, or LDL, cholesterol). Low cardiorespiratory fitness also is a risk factor for heart disease.

People who do moderate- or vigorous-intensity aerobic physical activity have a significantly lower risk of cardiovascular disease than do inactive people. Regularly active adults have lower rates of heart disease and stroke, and have lower blood pressure, better blood lipid profiles, and fitness. Significant reductions in risk of cardiovascular disease occur at activity levels equivalent to 150 minutes a week of moderate-intensity physical activity. Even greater benefits are seen with 200 minutes (3 hours and 20 minutes) a week. The evidence is strong that greater amounts of physical activity result in even further reductions in the risk of cardiovascular disease.

Everyone can gain the cardiovascular health benefits of physical activity. The amount of physical activity that provides favorable cardiorespiratory health and fitness outcomes is similar for adults of various ages, including older people, as well as for adults of various races and ethnicities. Aerobic exercise also improves cardiorespiratory fitness in individuals with some disabilities, including people who have lost the use of one or both legs and those with multiple sclerosis, stroke, spinal cord injury, and cognitive disabilities.

Moderate-intensity physical activity is safe for generally healthy women during pregnancy. It increases cardiorespiratory fitness without increasing the risk of early pregnancy loss, preterm delivery, or low birth weight. Physical activity during the postpartum period also improves cardiorespiratory fitness.

Metabolic Health

Regular physical activity strongly reduces the risk of developing type 2 diabetes as well as the metabolic syndrome. The metabolic syndrome is defined as a condition in which people have some combination of high blood pressure, a large waistline (abdominal obesity), an adverse blood lipid profile (low levels of high-density lipoprotein [HDL] cholesterol, raised triglycerides), and impaired glucose tolerance.

People who regularly engage in at least moderate-intensity aerobic activity have a significantly lower risk of developing type 2 diabetes than do inactive people. Although some experts debate the usefulness of defining the metabolic syndrome, good evidence exists that physical activity reduces the risk of having this condition, as defined in various ways. Lower rates of these conditions are seen with 120 to 150 minutes (2 hours to 2 hours and 30 minutes) a week of at least moderate-intensity aerobic activity. As with cardiovascular health, additional levels of physical activity seem to lower risk even further. In addition, physical activity helps control blood glucose levels in persons who already have type 2 diabetes.

Physical activity also improves metabolic health in youth. Studies find this effect when young people participate in at least 3 days of vigorous aerobic activity a week. More physical activity is associated with improved metabolic health, but research has yet to determine the exact amount of improvement.

Obesity and Energy Balance

Overweight and obesity occur when fewer calories are expended, including calories burned through physical activity, than are taken in through food and beverages. Physical activity and caloric intake both must be considered when trying to control body weight. Because of this role in energy balance, physical activity is a critical factor in determining whether a person can maintain a healthy body weight, lose excess body weight, or maintain successful weight loss. People vary a great deal in how much physical activity they need to achieve and maintain a healthy weight. Some need more physical activity than others to maintain a healthy body weight, to lose weight, or to keep weight off once it has been lost.

Strong scientific evidence shows that physical activity helps people maintain a stable weight over time. However, the optimal amount of physical activity needed to maintain weight is unclear. People vary greatly in how much physical activity results in weight stability. Many people need more than the equivalent of 150 minutes of moderate-intensity activity a week to maintain their weight.

Over short periods of time, such as a year, research shows that it is possible to achieve weight stability by doing the equivalent of 150 to 300 minutes (5 hours) a week of moderate-intensity walking at about a 4 mile-an-hour pace. Muscle-strengthening activities may help promote weight maintenance, although not to the same degree as aerobic activity.

People who want to lose a substantial (more than 5 percent of body weight) amount of weight and people who are trying to keep a significant amount of weight off once it has been lost need a high amount of physical activity unless they also reduce their caloric intake. Many people need to do more than 300 minutes of moderate-intensity activity a week to meet weight-control goals.

Regular physical activity also helps control the percentage of body fat in children and adolescents. Exercise training studies with overweight and obese youth have shown that they can reduce their body fatness by participating in physical activity that is at least moderate intensity on 3 to 5 days a week, for 30 to 60 minutes each time.

Musculoskeletal Health

Bones, muscles, and joints support the body and help it move. Healthy bones, joints, and muscles are critical to the ability to do daily activities without physical limitations.

Preserving bone, joint, and muscle health is essential with increasing age. Studies show that the frequent decline in bone density that happens during aging can be slowed with regular physical activity. These effects are seen in people who participate in aerobic, muscle-strengthening, and bone-strengthening physical activity programs of moderate or vigorous intensity. The range of total physical activity for these benefits varies widely. Important changes seem to begin at 90 minutes a week and continue up to 300 minutes a week.

Hip fracture is a serious health condition that can have life-changing negative effects for many older people. Physically active people, especially women, appear to have a lower risk of hip fracture than do inactive people. Research studies on physical activity to prevent hip fracture show that participating in 120 to 300 minutes a week of physical activity that is of at least moderate intensity is associated with a reduced risk. It is unclear, however, whether activity also lowers risk of fractures of the spine or other important areas of the skeleton.

The bottom line

is that the health benefits of physical activity far outweigh the risks of adverse events for almost everyone.

Building strong, healthy bones is also important for children and adolescents. Along with having a healthy diet that includes adequate calcium and vitamin D, physical activity is critical for bone development in children and adolescents. Bone-strengthening physical activity done 3 or more days a week increases bone-mineral content and bone density in youth.

Regular physical activity also helps people with arthritis or other rheumatic conditions affecting the joints. Participation in 130 to 150 minutes (2 hours and 10 minutes to 2 hours and 30 minutes) a week of moderate-intensity, low-impact physical activity improves pain management, function, and quality of life. Researchers don't yet know whether participation in physical activity, particularly at low to moderate intensity, reduces the risk of osteoarthritis. Very high levels of physical activity, however, may have extra risks. People who participate in very high levels of physical activity, such as elite or professional athletes, have a higher risk of hip and knee osteoarthritis, mostly due to the risk of injury involved in competing in some sports.

Progressive muscle-strengthening activities increase or preserve muscle mass, strength, and power. Higher amounts (through greater frequency or higher weights) improve muscle function to a greater degree. Improvements occur in younger and older adults. Resistance exercises also improve muscular strength in persons with such conditions as stroke, multiple sclerosis, cerebral palsy, spinal cord injury, and cognitive disability. Though it doesn't increase muscle mass in the same way that muscle-strengthening activities do, aerobic activity may also help slow the loss of muscle with aging.

Functional Ability and Fall Prevention

Functional ability is the capacity of a person to perform tasks or behaviors that enable him or her to carry out everyday activities, such as climbing stairs or walking on a sidewalk. Functional ability is key to a person's ability to fulfill basic life roles, such as personal care, grocery shopping, or playing with the grandchildren. Loss of functional ability is referred to as functional limitation.

Middle-aged and older adults who are physically active have lower risk of functional limitations than do inactive adults. It appears that greater physical activity levels can further reduce risk of functional limitations.

Older adults who already have functional limitations also benefit from regular physical activity. Typically, studies of physical activity in adults with functional limitations tested a combination of aerobic and muscle-strengthening activities, making it difficult to assess the relative importance of each type of activity. However, both types of activity appear to provide benefit.

In older adults at risk of falls, strong evidence shows that regular physical activity is safe and reduces this risk. Reduction in falls is seen for participants in programs that include balance and moderate-intensity muscle-strengthening activities for 90 minutes a week plus moderate-intensity walking for about an hour a week. It's not known whether different combinations of type, amount, or frequency of activity can reduce falls to a greater degree. Tai chi exercises also may help prevent falls.

Cancer

Physically active people have a significantly lower risk of colon cancer than do inactive people, and physically active women have a significantly lower risk of breast cancer. Research shows that a wide range of moderate-intensity physical activity—between 210 and 420 minutes a week (3 hours and 30 minutes to 7 hours)—is needed to significantly reduce the risk of colon and breast cancer; currently, 150 minutes a

week does not appear to provide a major benefit. It also appears that greater amounts of physical activity lower risks of these cancers even further, although exactly how much lower is not clear.

Although not definitive, some research suggests that the risk of endometrial cancer in women and lung cancers in men and women also may be lower among those who are regularly active compared to those who are inactive.

Finally, cancer survivors have a better quality of life and improved physical fitness if they are physically active, compared to survivors who are inactive.

Mental Health

Physically active adults have lower risk of depression and cognitive decline (declines with aging in thinking, learning, and judgment skills). Physical activity also may improve the quality of sleep. Whether physical activity reduces distress or anxiety is currently unclear.

Mental health benefits have been found in people who do aerobic or a combination of aerobic and muscle-strengthening activities 3 to 5 days a week for 30 to 60 minutes at a time. Some research has shown that even lower levels of physical activity also may provide some benefits.

Regular physical activity appears to reduce symptoms of anxiety and depression for children and adolescents. Whether physical activity improves self-esteem is not clear.

Adverse Events

Some people hesitate to become active or increase their level of physical activity because they fear getting injured or having a heart attack. Studies of generally healthy people clearly show that moderate-intensity physical activity, such as brisk walking, has a low risk of such adverse events.

The risk of musculoskeletal injury increases with the total amount of physical activity. For example, a person who regularly runs 40 miles a week has a higher risk of injury than a person who runs 10 miles each week. However, people who are physically active may have fewer injuries from other causes, such as motor vehicle collisions or work-related injuries. Depending on the type and amount of activity that physically active people do, their overall injury rate may be lower than the overall injury rate for inactive people.

Participation in contact or collision sports, such as soccer or football, has a higher risk of injury than participation in non-contact physical activity, such as swimming or walking. However, when performing the same activity, people who are less fit are more likely to be injured than people who are fitter.

Cardiac events, such as a heart attack or sudden death during physical activity, are rare. However, the risk of such cardiac events does increase when a person suddenly becomes much more active than usual. The greatest risk occurs when an adult who is usually inactive engages in vigorous-intensity activity (such as shoveling snow). People who are regularly physically active have the lowest risk of cardiac events both while being active and overall.

The bottom line is that the health benefits of physical activity far outweigh the risks of adverse events for almost everyone.