

# CHAPTER 7

The background of the cover features a green gradient. On the left, a person in a wheelchair is shown in silhouette, holding a basketball above their head. To the right, another person in a wheelchair is shown in silhouette, riding a bicycle. A bright sun or light source is visible in the upper right quadrant of the background.

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## PHYSICAL ACTIVITY FOR THE PHYSICALLY CHALLENGED

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# Physical Activity for the Physically Challenged

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*Everyone needs physical activity. While disability complicates matters, physically challenged individuals can still obtain the important benefits of participation in a regular program of physical activity. However, physical activity does increase the risks of worsening complications, or causing musculoskeletal injuries. There are precautions that doctor and patient can take to overcome many limitations and develop an effective physical activity program.*

Topics covered in this chapter are:

- Diabetes and Disability
- Physical Activity is Good for Mind and Body
- How Much Is Enough?
- Types of Physical Activity
- Intensity of Physical Activity
- Measuring Intensity
- Physical Activity and Depression
  - Activities for Diabetes-Related Disabilities
  - Diabetic Retinopathy
  - Renal Disease
  - Peripheral Vascular Disease (PVD) and Peripheral
- Neuropathy (PN)
- Limb Differences
- Mental Impairment or Dementia
- Arthritis of the Hips
- Arthritis of the Knees
- Rx for Activity
- Further Reading

## **Diabetes and Disability**

Several impairments and chronic conditions that are important causes of disabilities are more prevalent in diabetes. Obesity, visual impairment, cardiovascular diseases, and other complications are common in diabetes and increase the burden of physical disability in these individuals. People with diabetes are more likely to have difficulty walking or climbing stairs than people without diabetes. People with diabetes also have poor balance, and a greater difficulty with activities of daily living.<sup>1</sup> In a large Third National Health and Nutrition Examination Survey (NHANES III), men and women aged 60 or older with diagnosed diabetes were two to three times more likely to be unable to walk one-fourth of a mile, climb stairs, or do housework than similar-aged adults without diabetes.

In particular, women with diabetes had a much slower walking speed, worse balance, and a higher likelihood of falling than women without diabetes. It is estimated that, of the over five million older Americans with diabetes, 1.2 million are unable to do major physical tasks.<sup>2</sup> This indicates that older patients with diabetes may greatly benefit from physical activity programs that target basic impairments such as strength and balance, which are major factors in the disablement process.

### **Physical Activity is Good for Mind and Body**

Physical activity provides many benefits to the body and the mind. Individuals obviously benefit in strength, endurance, balance, and cardiovascular fitness. Earlier chapters in this book describe the manner in which physical activity also improves insulin sensitivity. In addition, physical activity provides a sense of mastery and accomplishment, increases self-esteem, energizes the individual, improves sleep, and helps individuals conquer fear of injury from activity. These psychological benefits are particularly important in individuals with physical challenges, who often have difficulties with self-image. Importantly, physical activity can also improve depression, which is not only common in diabetes, but accounts for much of the excess risk of disability seen in these individuals.<sup>1</sup>

### **How Much Is Enough?**

Aerobic, anaerobic, high-impact, and low-impact activities are described earlier in this book. The Institute of Medicine which is part of the National Academy of Sciences, now recommends at least one hour of moderately intense physical activity each day to maintain cardiovascular health at a maximal level. This recommendation is double the daily minimum goal set by the 1996 Surgeon General's report.<sup>3</sup> Weight loss requires more prolonged activity. The American College of Sports Medicine (ACSM) points out that some post-exercise tissue discomfort is natural. However, they caution people to avoid all activity that causes joint pain lasting longer than seven hours.<sup>4</sup> Most people can tolerate low-intensity aerobic exercises. These can be started in 10- to 15-minute sessions, three to five times a week, and increased slowly to the recommended one hour each day. People should stop their activity if they feel fatigue.

### **Types of Physical Activity**

There are several types of physical programs in common use. They focus on achieving cardiovascular fitness, building strength, or increasing flexibility/functionality. Here are some general suggestions for each type of activity.

### *Cardiovascular Fitness:*

- Vary your workout each session.
- Be creative! Increase activity by walking throughout the day, during lunch breaks, coffee breaks, or around the house during TV commercials.
- Choose a pace that feels good to you. Use the “Conversation Rule:” you should be able to converse while exercising.<sup>5</sup>
- Take slow, deep breaths and “think tall” to maintain good posture.
- Types of cardiovascular training include walking (outside or treadmill), cycling (outside or stationary bicycle), and swimming.

### *Building Strength:*

- Perform each movement through a complete range of motion.
- Do not hold your breath while strength training. Instead, exhale or breathe out while pushing the weight up or out, and inhale or breathe in while letting the weight down or in. Again, “think tall” to maintain good posture.
- To increase endurance, use lighter weights and do eight to twelve repetitions.
- To increase strength, use heavier weights and do five to eight repetitions.
- Types of strength training include weight machines, free weights, plastic tubing, “toys” (such as medicine balls), and circuit training.

### *Increasing Flexibility/Functionality:*

- Flexibility/functionality activities improve range of motion, balance, coordination, and the ability to carry out the regular activities of daily living.
- Practice flexibility training (stretching) before and after every cardiovascular or strength workout.
- Hold stretches and progress slowly.
- Thoroughly stretch every muscle group used in a workout. Spend more time on tight muscle groups.
- Stretching should not be painful.
- Types of flexibility training include stretching, yoga, and Pilates.

### **Intensity of Physical Activity**

The time required to achieve benefit from any physical activity depends on the intensity of that activity. Higher intensity activities require less time spent to achieve the same benefit. Lower intensity activities require more time.

*Light-intensity activities:* walking slowly, golf (with a powered cart), swimming, gardening, bicycling, very light effort (such as dusting or vacuuming), conditioning exercises, light stretching or warm-up.

*Moderate-intensity activities:* walking briskly, golf (no cart), swimming (casual), lawn mowing (power mower),

tennis (doubles), bicycling (five to nine mph, level terrain), scrubbing floors, washing windows, weight lifting, nautilus machines, free weights.

*High-intensity (vigorous) activities:* jogging or running, swimming (laps), mowing lawn (hand mower), tennis (singles), bicycling (more than 10 mph, or on hills), moving furniture.<sup>6</sup>

### Measuring Intensity

There are several ways to measure the intensity of exercise. These include the talk test, the pulse rate, the perceived exertion scale, and metabolic equivalent (MET) measurement. The first three are simple.

*Talk test:* The talk test measurement is simple. At a *light* intensity level, a person should be able to sing during the activity. At a *moderate* intensity level, a person should be able to carry on a conversation comfortably during the activity. At a *vigorous* intensity level, a person is winded or too out of breath to carry on a conversation.<sup>7</sup>

*Pulse rate:* A person's maximum heart rate is based on their age. An estimate of a person's maximum age-related heart rate can be obtained by subtracting their age from 220. For moderate-intensity physical activity, a person's target heart

rate should be 50% to 70% of their maximum heart rate. For vigorous-intensity physical activity, a person's target heart rate should be 70% to 85% of their maximum heart rate.<sup>7</sup>

*Perceived exertion scale:* This measure reflects how strenuous physical activity feels to the individual, combining all sensations and feelings of physical stress, effort, and fatigue. While engaging in an activity, a person chooses a number from six (no exertion at all) to 20 (maximal exertion) that best describes their level of exertion.

- 6: No exertion at all
- 7: Extremely light
- 8–9: Very light
- 10–11: Light
- 12–13: Somewhat hard
- 14–15: Hard (heavy)
- 16–17: Very hard
- 18–19: Extremely hard
- 20: Maximal exertion

On the scale, 9 is very light exercise. For a healthy person, it is like walking slowly at a normal pace. On the scale, 13 is somewhat hard exercise, but still feels comfortable. On the scale, 17 is very strenuous activity. A healthy person can still go on, but has to push to go further. On the scale, 19 is extremely strenuous exercise. This

is the most strenuous exercise many people have ever experienced.

People can use this measure to gauge the intensity level of their activity. They can then use this information to adjust the intensity of the activity by speeding up or slowing down their movements.<sup>7</sup>

**MET measurement:** Another way of measuring physical activity intensity is by the metabolic equivalent (MET) level. Activities can be classified as light, moderate, or vigorous based on how hard a person has to work to do the activity, that is, by the amount of oxygen used by the body during the activity.<sup>7</sup> A table of physical activities at different levels of effort based on METs is available online at: [http://www.cdc.gov/nccdphp/dnpa/physical/pdf/PA\\_Intensity\\_table\\_2\\_1.pdf](http://www.cdc.gov/nccdphp/dnpa/physical/pdf/PA_Intensity_table_2_1.pdf).

### **Physical Activity and Depression**

Depression is a barrier to maintaining a program of physical activity. Depression is more common among people with diabetes than people without it, and may be the link between diabetes and mental or physical decline. Depression can also limit a person's ability to manage their own diabetes, and thus increase the risk for diabetes-related complications and death. Treating depression might

improve a person's ability to participate in regular physical activity. Medication may be needed. Exercise in general improves depression, and yoga breathing exercises and meditation may help.

### **Activity in Diabetes-Related Disability**

Many physically challenged people watch a lot of TV. These people can increase muscular endurance by doing 8 to 12 repetitions with light weights, using the full range of motion for arm muscles, during each commercial break. Individuals with diabetes-related disabilities should do low-intensity activities for 10 minutes, 3 or 4 times a day, with adequate rest periods.

### **Diabetic Retinopathy**

Annual eye examinations can detect retinopathy. Regular exams are important because retinopathy is often silent and can cause blindness. Exercise does not improve retinopathy, but may help prevent it.

Aerobic activities are better than anaerobic activities for the individual with mild diabetic retinopathy. Individuals should coordinate breathing with the activities. Helpful activities include endurance exercises, bicycling, low-intensity machine rowing, swimming,

and walking. Patients with active proliferative diabetic retinopathy, retinal detachment, or vitreous hemorrhage should only engage in mildly intense activities, because increases in blood pressure during exercise could increase bleeding. People with diabetic retinopathy should not engage in any activities involving breath holding, weight lifting, boxing, trumpet playing, lowering the head below the heart, or lifting the arms.

### **Renal Disease**

Microalbuminuria is present in normal individuals after exercise. This is harmless. In mild renal disease there is microalbuminuria at rest, or a slight increase in urine albumin. Albumin increases with the increasing blood pressure seen with exercise. This is also harmless. Exercise capacity is reduced in renal disease, and these people should take part in only light- to moderate-intensity physical activity.

People with moderate renal disease should generally not perform strenuous activities. In patients on dialysis, exercise testing before physical activity is not very productive. The exercise capacity and function capacity is limited due to anemia, reduced cardiac output, and blunted heart rate increase. It is generally safe simply to monitor the blood pressure during physical activity and stop activity if the blood pressure

goes too high. These patients should schedule their physical activity on non-dialysis days or at least 2 hours before dialysis, in 10-minute sessions. This may improve kidney function in some patients. Low-resistance, high-repetition exercises are particularly good, and may help improve activities of daily living. Endurance exercises are helpful because muscular power is reduced in these patients. Continuous activity for 30 minutes is a realistic, achievable goal. There is evidence that bicycling may be good for patients on dialysis.<sup>8</sup>

### **Peripheral Vascular Disease (PVD) and Peripheral Neuropathy (PN)**

Symptoms and signs of peripheral vascular disease (PVD) are described on the AACE website at: <http://www.aace.com/>. Pain at rest limits the ability to walk and may indicate a need for further investigation and treatment before taking part in physical activity. PVD may be silent, and can be discovered by regular pulse examination of the feet and yearly Ankle Brachial Index (ABI) testing. Supervised walking may open collateral circulation. AACE recommends non-weight-bearing and arm exercises for these patients.

### **Neuropathy**

People with *autonomic neuropathy (AN)* do not increase the heart rate by exercising compared to those without.

Measurement of increase in heart rate in these patients will not serve as a useful guide for the target heart rate level of exercise. Individuals should use the perceived exertion scale instead of, or in addition to, the heart rate. These patients should have blood glucose monitored before, during, and after physical activity because of the possibility of hypoglycemia seen with AN. Preferred exercises are non-weight-bearing exercises. The low-intensity exercises and activity are better. Exercise should be stopped if the patient cannot talk while exercising. Intensive exercise may lead to fainting, dizziness, silent heart attacks, and sudden death. The rate of perceived exertion is better than heart rate for deciding a target level of exercise. The water temperature should be below 85° F to avoid fainting and collapse.

*Peripheral neuropathy (PN)* causes the loss of protective sensation, such as touch, from the feet. High-impact activity can then easily damage the feet. PN also leads to a loss of the fat pad in the feet. This can destroy the arch of the uncushioned foot, and derange the foot joints. Patients with PN need special shoes to prevent foot ulcers, and must avoid all weight-bearing activity. Repetitive weight-bearing exercises such as extended

walking or jogging can damage the feet, cause blisters and ulcers, and may lead to loss of limb.


The physical activity program for these patients should be designed to improve the tone of lower extremity muscles and improve balance. Such a program could alternate weight-bearing aerobic activity with non-weight-bearing activities, especially if neuropathy or PVD is present. Non-weight-bearing activities or aquatic therapy is safer if PN has reduced sensations. Supervised chair exercises, light weight lifting while sitting, swimming, bicycling, arm exercises, or rowing would be effective. Yoga, preferably under guidance from a certified instructor, can improve stretching and endurance.


### **Limb Differences**


Any disability makes a person less likely to engage in regular physical activity. Still, even individuals who have experienced amputation or were born with limb differences can benefit from moderately intense activities (such as 30–40 minutes of using a wheelchair) or shorter sessions of more intense activity (such as 20 minutes of wheelchair basketball). Out-of-shape patients may need initial resistance training prior to aerobic activities.


Or, they may take part in non-weight-bearing activities involving the upper body, such as lifting small weights or modified row boating.

Adaptive floor hockey, canoeing, rafting, and hand cycling are all excellent physical activities for individuals with limb differences.

 **Adaptive floor hockey** can be a productive and enjoyable activity for people with any of a range of disabilities. This game is not limited to players in wheelchairs. Instead of playing on ice, the teams play indoors on a wooden floor.

 **Canoeing** is a great way to experience the outdoors. A custom-made seat with padding to protect the buttocks and legs is an example of an adaptation made to accommodate an individual with a disability.

 **Rafting** is another paddle sport that is easily adaptable to the needs of people with disabilities.

 **Hand cycling** is growing rapidly as a sport for people with limited use of their legs. Hand cycles have three wheels and allow the rider to pedal and steer using only his or her upper body. Recumbent and upright hand cycles

are available. On a recumbent hand cycle, a person's torso reclines and the legs stretch out in front. On an upright hand cycle, a person sits upright, just as in a wheelchair. One advantage of the upright model is that it is easier to transfer to and from a wheelchair, compared with a recumbent bike. In addition, the higher profile makes the upright model more visible (and thus safer) in traffic.

### **Mental Impairment or Dementia**

Diabetes that remains uncontrolled for many years can impair cognition by a number of mechanisms. Factors associated with cognitive decline include depression, hypertension, and cardio- and cerebrovascular diseases, all of which occur to varying degrees in individuals with diabetes.<sup>9</sup> These people can take part in supervised activity in groups at day camps.

### **Hip Arthritis**

Because it is painful to walk with arthritis of the hips, many of these people avoid physical activity and gain weight. These people can easily engage in upper extremity activities such as light weight lifting, stationary cycling, hand cycling, yoga, and aquatic activities.

### **Arthritis of the Knees**

Jogging with healthy knees will not

cause arthritis unless the jogging surface is uneven. An earlier injury to the knees can also result in arthritis. Swimming is excellent exercise and is easy on the knees (except for the dolphin kick of the butterfly stroke). Walking is also a low-impact activity, and suitable for people with arthritis of the knees. Most of these people should be able to jog as well if they have not had an injury. Cycling is another low-impact option.

Activities that involve flexing, especially weight-bearing (such as a full squat) can be difficult for people with arthritis of the knees. Plyometrics are exercises that involve a jumping movement, such as skipping, bounding, jumping rope, hopping, lunges, jump squats, and clap push-ups are all examples of plyometric exercises. Some plyometrics can be very hard on the knees. People with arthritis of the knees should consult their doctor before even considering these or other activities involving twisting and landing motions such as basketball, tennis, and soccer.

### **Aquatic Activities**

Aquatic activities are excellent exercise that anyone can tolerate. They are appropriate for many physically challenged individuals who might have difficulty taking part in other activities. Aquatic activities are ideal for individuals with sensory disorders, a limited range of motion, weakness, poor motor coordination, pain, spasticity, perceptual/

spatial problems, balance deficits, respiratory problems, circulatory problems, depression, poor self-esteem, cardiac diseases, joint replacement, orthopedic injuries or trauma, obesity, neurologic disorders (such as multiple sclerosis), osteoporosis, arthritis, or fibromyalgia. They are also safe and beneficial in pregnancy.

### **Rx for Activity**

Proper clinical evaluation and exercise testing will precede the development of any physical activity program for physically challenged individuals. Patients with diabetes will have blood glucose checked before, during, and after exercise, with adjustment of insulin dose, or snacks before or during exercise as necessary.

An appropriate physical activity program for physically challenged individuals will have the following components:

1. Type of activity (such as walking, swimming, or cycling).
2. Specific workloads (such as walking speed).
3. Duration of activity session.
4. Intensity guidelines—target heart rate (THR) range and estimated rate of perceived exertion (RPE).
5. Precautions regarding certain orthopedic or other concerns or related comments.

By thoughtfully choosing these components, people with disabilities and their doctors can develop a productive, sustainable program of physical activity that can maintain an individual in the best possible health.

### **Further Reading**

*Handbook of Exercise in Diabetes* / Edited by Neil Ruderman, with the assistance of John T. Devlin, Andrea Kriska and Stephen H. Schneider, MD. Alexandria, VA: American Diabetes Association, 2002. This resource contains data on the effects of exercise on blood glucose and metabolism, prevention of type 2 diabetes, treatment plans, and medication adjustment, as well as exercise's effects on conditions such as retinopathy, nephropathy, and neuropathy.

*Home Exercise Guide for Lower Extremity Amputees* / Ann M. Gailey, Robert S. Gailey and Sandra J. Sendelbach, with illustrations by Frank Angulo. Miami, FL: Advanced Rehabilitation Therapy, 1995. This book presents all the information patients will need to perform over 100 exercises safely and independently.

*Physical Fitness: A Guide for Individuals with Lower Limb Loss: A Clinical Guide* / Ernest M. Burgess and Albert Rappoport. Baltimore, MD: Department of Veterans Affairs, Veterans Health

Administration, Rehabilitation Research and Development Service, Scientific and Technical Publications Section, 1991. This book presents a guide for helping people who have had a lower-limb amputation realize their full physical potential.

NCPAD: National Center on Physical Activity and Disability. Chicago, IL: The University of Illinois at Chicago, 2000. The National Center on Physical Activity and Disability is dedicated to helping persons with disabilities participate in regular physical activity, to develop healthy lifestyles and prevent the development of secondary conditions. <http://www.ncpad.org>.

Physical Activity for Everyone: Measuring Physical Activity Intensity: Center for Disease Control and Prevention and Control. Atlanta, GA. 2005. Available online at: <http://www.cdc.gov/nccdphp/dnpa/physical/index.htm>. Accessed December 1, 2005.

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