



Vision  AWARE

Self-Help for Vision Loss

Diabetes and Diabetic Retinopathy

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An Introduction to Diabetes and Diabetic Retinopathy

What was the first thing you thought about when you were diagnosed with diabetes? You probably experienced a wide-ranging mix of emotions, and wondered how this news would affect the rest of your life. Your family might have had similar feelings. These are familiar reactions that millions of people around the world have experienced. Diabetes is a complex condition that warrants serious attention. Talk about your concerns and feelings with your doctor, your family and friends—and then, together, learn the facts. Don't assume all is doom-and-gloom, because it's not!

While there is no cure for diabetes, its potential day-to-day impact can be dramatically reduced by learning how to manage your medical situation, understanding what will and will not improve your condition, and doing as much as you can to help yourself. Self-help is key!

We hope you'll find the following information to be of broad and immediate use and that as a result, you'll be able to enjoy a long and healthy life. We encourage you to share this information with your family and friends, and those who are eager to learn more about diabetes and diabetic retinopathy.



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What Is Diabetes?

[Diabetes Mellitus](#) has several definitions:

1. A metabolic disorder
2. A chronic, progressive disease
3. A growing public health concern.

Diabetes is characterized by a high level of glucose in the bloodstream, also known as [hyperglycemia](#). Glucose is the principal circulating sugar in the blood and provides energy to all cells in the body. These cells cannot use glucose, however, without the help of [insulin](#). Insulin is a hormone produced by the [pancreas](#) that converts sugar and starch from food into the energy needed to fuel everyday activities. Diabetes occurs when (1) the pancreas does not make or release enough insulin, (2) the body's cells are resistant to insulin, or (3) both conditions are present.

1. A Metabolic Disorder

Metabolism is a term that describes the processes through which food is converted into energy for your body to use immediately or store for later use.

In normal food metabolism:

- The food you eat is broken down into glucose and other simple sugars and enters your bloodstream;
- Your body senses the rise in blood glucose and signals your pancreas to release insulin into your bloodstream;
- The released insulin acts as a "key" that unlocks your cells and allows glucose to enter;
- Your cells absorb glucose to provide energy for physical activity.

The foods you eat that break down into glucose are called [carbohydrates](#), which:

- Are one of the three main nutrients in food, in addition to proteins and fats;
- Include sugars and starches contained in fruit; breads and cereals; milk and dairy; starchy vegetables such as corn, potatoes, and peas; cake and ice cream;
- Cause blood glucose levels to rise about one to two hours after a meal;
- Determine how high or low blood your glucose levels will go, according to the type and amount of carbohydrate-containing foods you eat.

When this process occurs as it should, the glucose level in your bloodstream remains within a normal range of 90 to 100 milligrams per deciliter ([mg/dL](#)). In [type 1](#) and [type 2](#) diabetes, however, this process does not occur properly, which results in a serious, lifelong [metabolic disorder](#).

[Type 1](#) diabetes (formerly called juvenile-onset, Type I, or insulin dependent) has the following characteristics

- It usually occurs before age 30 and affects 5–10% of individuals with diabetes.
- It occurs when the body produces little to no insulin (insulin deficiency).
- Glucose continues to rise in the bloodstream because it cannot enter the body's cells
- The body's immune system destroys its own insulin-producing cells in the pancreas, for reasons that are not yet

clear to researchers. Possible reasons include genetic factors, viruses, or a defect in the body's autoimmune system.

- Insulin shots are required to sustain life.

Type 2 diabetes (formerly called adult-onset, Type II, or non-insulin dependent) has the following characteristics:

- It usually occurs after age 30 and affects 90-95% of individuals with diabetes.
- It occurs if (1) the pancreas does not produce enough insulin (insulin deficiency), (2) the body's cells are not able to use insulin correctly and efficiently (insulin resistance), or (3) both conditions are present.
- Glucose continues to rise in the bloodstream because sufficient levels of insulin are not available to open the cells and allow glucose to enter.
- It can be managed initially with weight loss, physical activity, and effective meal planning and for some individuals this suffices for a period of time; when the disease progresses, however, oral medication or insulin may also be required.
- Primary risk factors include increasing age (45+); ethnic background (African-American, Latino, Native American, Asian); family history; and obesity.

2. A Chronic, Progressive Disease

- Diabetes is a condition that is treatable but not curable.
- There is no such condition as "having a little bit of sugar" or "a touch of sugar." An individual either has diabetes or does not.
- There is, however, a condition called pre-diabetes in which blood glucose levels are higher than normal, but are not yet high enough to be diagnosed as diabetes.
- Individuals with pre-diabetes have a significant risk for progressing to diabetes, and an elevated risk for heart disease and stroke.
- Several tests can diagnose both diabetes and pre-diabetes: (a) the Fasting Plasma Glucose Test (FPG) and (b) the 2-Hour Oral Glucose Tolerance Test (OGTT).
- The FPG is used more frequently. When your doctor prescribes blood work and tells you not to eat the night before, he or she is probably checking for diabetes or pre-diabetes by using the FPG test.
- An FPG test that reports blood glucose levels between 100 mg/dL and 125 mg/dL indicates pre-diabetes. Diabetes is present when the result is 126 mg/dL or greater. A repeat test will confirm the results.
- You can learn more about each test at the [National Diabetes Education Program web site](#).

3. A Growing Public Health Concern

- In 2005, the American Diabetes Association reported that 20.8 million children and adults in the United States have diabetes, or about 7% of the population.
 - The fastest-growing segment of the population diagnosed with type 2 diabetes is individuals aged 65 and older.
 - Type 2 diabetes is becoming more prevalent in children, due to poor eating habits and lack of exercise.
 - The [Centers for Disease Control and Prevention](#) (CDC) estimates that approximately 41 million Americans have pre-diabetes.
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How Do Blood Glucose Levels Relate to Diabetes?

Research has shown that maintaining blood glucose levels within an acceptable range can lower and delay your risk for complications. You and your physician must decide together what blood glucose levels are achievable for you, based upon your age, abilities, medical status, personal needs, and any other special circumstances.

The current acceptable blood glucose target ranges set by the [American Diabetes Association](#) (ADA) are as follows:

- Fasting/pre-meal: between 90 and 130 mg/dL
- One to two hours after meal: below 180 mg/dL

It is important to remember that the purpose of your blood glucose readings is to let you know how close you are to your target range. Try not to label your readings as either "bad" or "good"; instead, think of them as indicators that describe (a) which aspects of your treatment are working for you and (b) which aspects need to be changed.

Two major studies that support the importance of blood glucose control are [The Diabetes Control and Complications Trial](#) for type 1 diabetes and the [United Kingdom Prospective Diabetes Study](#) for type 2 diabetes.

What Is the Difference Between Hyperglycemia and Hypoglycemia?

Hyperglycemia

Hyperglycemia refers to chronically high blood glucose levels. Most medical professionals define hyperglycemia by using the **blood glucose goals** that you and your physician have established and combining those goals with the blood glucose target ranges (listed previously) set by the American Diabetes Association.

It's important to understand that you'll probably experience high blood glucose levels from time to time, despite your best efforts at control. As with any chronic disease, talk with your physician and diabetes care team if the pattern of your blood glucose readings is consistently higher or lower than your blood glucose goals.

Persistent hyperglycemia can cause a wide range of chronic complications that affect almost every system in your body. When large blood vessels are affected, it can lead to:

- [Stroke](#) (cerebral vascular disease)
- [Heart attack or Congestive Heart Failure](#) (coronary heart disease)
- [Circulation disorders](#) and possible amputation (peripheral vascular disease)

When smaller blood vessels are affected, it can lead to:

- [Kidney disease](#) (nephropathy)
- [Nerve damage](#) (neuropathy)
- [Eye disease](#) (retinopathy)

Very high blood glucose levels can also lead to the following acute, life-threatening conditions, both of which require immediate medical attention:

[Diabetic Ketoacidosis](#) (or DKA) occurs most frequently in persons with type 1 diabetes. Physical signs and symptoms of DKA include:

- Hyperglycemia (greater than 250 mg/dL)
- Dry, parched mouth
- Extreme thirst
- Frequent urination
- General weakness
- Loss of appetite
- Fruity breath
- Nausea and vomiting
- Abdominal pain
- Deep, rapid breathing

[Hyperosmolar Hyperglycemic Nonketotic Syndrome](#) (or HHNS) occurs most frequently in elderly persons with type 2 diabetes, especially residents of long-term care facilities. Physical signs and symptoms of HHNS include:

- Severe hyperglycemia (greater than 600 mg/dL)

- Dry, parched mouth
- Extreme thirst (which may gradually disappear)
- Warm, dry skin that does not sweat
- High fever (greater than 101 degrees F)
- Sleepiness or confusion
- Hallucinations
- Weakness on one side of the body

You can reduce your risk factors for these potential complications by doing the following:

- Maintaining your blood glucose levels within a normal range
- Keeping your blood pressure under control
- Controlling your blood fats (cholesterol and triglycerides)
- Avoiding/stopping smoking
- Increasing your physical activity
- Avoiding excess alcohol consumption
- Developing healthy eating habits and losing weight if necessary

Hypoglycemia

Hypoglycemia refers to dangerously low blood glucose levels that drop below 70 mg/dL. It is an acute complication of diabetes and occurs in individuals who use insulin or specific kinds of oral diabetes medication. If you use oral diabetes medications, ask your physician or diabetes educator whether hypoglycemia should be a concern. Symptoms of hypoglycemia include the following:

- Sweating
- Rapid pulse
- Shakiness, dizziness, weakness
- Decreased coordination
- Difficulty concentrating
- Blurred vision
- Headache
- Trouble performing routine tasks
- **Note:** Symptoms can vary from person to person and episode to episode.

To treat hypoglycemia, you must immediately:

- Check your blood glucose level to determine the amount of carbohydrate that is needed to raise your blood glucose to a safe level.
- Use the [15/15 Rule](#): Consume 15 grams of carbohydrate (4 ounces of regular juice or soda, 1 tablespoon honey, 2 tablespoons raisins, 7 Life Savers™, 9 Sweet Tarts™, or 3-4 glucose tablets) and retest your blood glucose in 15 minutes. If it is still below 70 mg/dL, you should consume an additional 15 grams of carbohydrate. Following the 15/15 Rule can help avoid over treatment and resulting hyperglycemia.

If you are not planning to have a meal within one to two hours after treating a hypoglycemic reaction, eat a snack containing 15-30 grams of carbohydrate to prevent another episode of hypoglycemia.

If hypoglycemia is not treated immediately, it can result in:

- Severe confusion and disorientation
- Unconsciousness
- Seizures
- Coma
- Death

Other tips for managing hypoglycemia include:

- Keep glucose-containing products close by at all times.
 - Clearly label sugar-free products, in a format of your choosing, to distinguish them from regular products.
 - Make sure you can test your own blood glucose, measure insulin accurately, and determine recommended food portions to help prevent and properly treat low blood glucose.
 - Be sure to wear diabetes identification at all times.
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How Does Diabetes Affect the Eyes and Vision?

Although individuals with diabetes are more likely to develop [cataracts](#) at a younger age and are [twice as likely](#) to develop [glaucoma](#) as are non-diabetics, the primary vision problem caused by diabetes is [diabetic retinopathy](#), the leading cause of new cases of blindness and low vision in adults aged 20-65:

- "Retinopathy" is a general term that describes damage to the retina.
- The retina is a thin, light-sensitive tissue that lines the inside surface of the eye. Nerve cells in the retina convert incoming light into electrical impulses. These electrical impulses are carried by the optic nerve to the brain, which interprets them as visual images.
- Diabetic retinopathy occurs when there is damage to the small blood vessels that nourish tissue and nerve cells in the retina.
- "Proliferative" is a general term that means to grow or increase at a rapid rate by producing new tissue or cells. When the term "proliferative" is used in relation to diabetic retinopathy, it describes the growth, or proliferation, of abnormal new blood vessels in the retina. "Non-proliferative" indicates that this process is not yet occurring.
- Proliferative diabetic retinopathy affects approximately 1 in 20 individuals with the disease.

According to the National Eye Institute, diabetic retinopathy has four stages:

- **Mild non-proliferative retinopathy:** At this early stage, small areas of balloon-like swelling occur in the retina's tiny blood vessels.
- **Moderate non-proliferative retinopathy:** As the disease progresses, some blood vessels that nourish the retina become blocked.
- **Severe non-proliferative retinopathy:** Many more blood vessels become blocked, which disrupts the blood supply that nourishes the retina. The damaged retina then signals the body to produce new blood vessels.
- **Proliferative retinopathy:** At this advanced stage, signals sent by the retina trigger the development of new blood vessels that grow (or proliferate) in the retina and the vitreous, which is a transparent gel that fills the interior of the eye. Because these new blood vessels are abnormal, they can rupture and bleed, causing hemorrhages in the retina or vitreous. Scar tissue can develop and can tug at the retina, causing further damage or even retinal detachment.

In addition, fluid can leak into the macula, the small sensitive area in the center of the retina that *provides detailed vision*. This fluid can cause [macular edema](#) (or swelling), which can occur at any stage of diabetic retinopathy, although it is more likely to occur as the disease progresses.

Symptoms of diabetic retinopathy can include:

- Blurred or double vision
- Flashing lights, which can indicate a retinal detachment
- A veil, cloud, or streaks of red in the field of vision, or dark or floating spots in one or both eyes, which can indicate bleeding
- Blind or blank spots in the field of vision

Ocular and functional effects of diabetic retinopathy can include any or all of the following:

- Fluctuating vision in response to changing blood glucose levels; vision can change from day-to-day, or from morning to evening
 - Blurred central vision from macular edema can interfere with reading
 - Decreased visual acuity can interfere with seeing the markings on an insulin syringe or the display on a standard blood glucose monitor
 - Irregular patches of vision loss or "blind spots" can make it difficult to judge the size of food portions on a plate.
 - Decreased depth perception, in combination with decreased visual acuity, can make it difficult to see curbs and steps, or walk to the diabetes clinic.
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How Can I Detect Diabetic Eye Disease?

Diabetic retinopathy usually has no early warning symptoms. It can be detected only through a comprehensive eye examination that looks for early signs of the disease, including:

- Leaking blood vessels
- Macular edema (swelling)
- Pale, fatty deposits on the retina
- Damaged nerve tissue
- Any changes to the retinal blood vessels

To effectively diagnose diabetic eye disease, eye care specialists recommend a comprehensive diabetic eye examination that includes the following procedures:

- Distance and near vision [acuity tests](#)
- A [dilated eye \(or fundus\) examination](#), which includes the use of an ophthalmoscope. In a dilated eye examination, it is the pupil that is dilated – not the entire eye. This allows the examiner to see through the pupil to the retina. Acuity tests alone may not be sufficient to detect diabetic retinopathy in its early stages.
- A [tonometry test](#) to measure fluid pressure inside the eye.
- A [fluorescein angiography](#) test, if more serious retinal changes, such as macular edema, are suspected.
- A newer technique called [optical coherence tomography](#) (OCT) may be used to gain a clearer picture of the retina and its supporting layers.
- Also, an [Amsler Grid](#) test can detect early and sometimes subtle visual changes in a variety of macular diseases, including diabetic macular edema. An online Amsler Grid test is available from the [Diabetes Mall](#).

The [American Association of Diabetes Educators](#) provides the following eye examination guidelines for individuals with diabetes: At minimum, individuals with type 1 and type 2 diabetes should schedule an annual diabetic eye exam.

- Individuals with mild non-proliferative retinopathy should schedule an annual diabetic eye exam.
 - Individuals with moderate to severe non-proliferative retinopathy should schedule a diabetic eye exam every 6 to 12 months.
 - Individuals with macular edema or proliferative retinopathy should schedule a diabetic eye exam as frequently as every 4 months, if indicated.
 - Individuals with proliferative retinopathy and high-risk complications, such as the growth of new blood vessels in the optic disc area or recent bleeding in the retina or vitreous, should schedule diabetic eye exams as frequently as needed.
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What Treatments Are Available for Diabetic Eye Disease?

The first step in any treatment for diabetic eye disease is to maintain blood glucose, blood pressure, and blood cholesterol levels as close to normal as possible. Other options for treatment are the following:

Laser treatment

This technique is used by retinal surgeons to treat a number of eye conditions, one of which is diabetic eye disease. A beam of high-intensity light is directed into the eye to seal off leaking blood vessels and prevent additional blood and fluid from leaking into the vitreous. The doctor administers eye drops to dilate the pupil and numb the eye before treatment begins. Since lasers cannot restore lost vision, it is critical to maintain regular eye examinations so that treatment can be initiated as soon as diabetic eye changes are detected. There are two types of laser treatments for diabetic eye disease:

- Scatter laser treatment for proliferative retinopathy.
- Focal laser treatment for macular edema.
- [Diabetes Life](#) explains more about scatter and focal laser treatments.

Vitrectomy

This surgical procedure removes blood and fluids that have accumulated in the vitreous as a result of retinal bleeding, and is performed under local or general anesthesia. During a vitrectomy, the doctor makes an incision in the eye and uses a small instrument to remove the vitreous gel that is clouded with blood. The gel is then replaced with a saline (or salt) solution. [EyeMDLink](#) explains more about vitrectomy surgery.

How Can I Manage My Diabetes?

Diabetes is a disease that requires 24-hour, 7-day-a-week self-management. It is you who lives with your diabetes and it is you who will make health care decisions when your doctor or other members of your health care team are not available. Blindness or low vision may present challenges, but aren't necessarily barriers to effective and successful self-management of diabetes.

Certified diabetes educators (usually nurses and dieticians), in consultation with primary care physicians and [endocrinologists](#) (physicians who specialize in the diagnosis and treatment of conditions affecting the glands and hormones), can help you learn more about this type of diabetes management, called diabetes self-management education (DSME) or diabetes self-management training (DSMT):

- The [American Association of Diabetes Educators](#) (AADE) is the national organization of diabetes educators. AADE provides the [Find A Diabetes Educator](#) search function to help you find a diabetes educator in your home area. Members of the Disability Specialty Practice group are experienced in dealing with blindness, low vision, and other disabilities.
- [Diabetes Self-Management](#) provides self-management information from health care professionals and people with diabetes and publishes [The Diabetes Self-Management Blog](#), an [e-mail newsletter](#), and [Diabetes Self-Management](#) magazine, also available via the [NFB-NEWSLINE®](#) service.

Visit your primary care physician when:

- You have an episode of very low blood glucose, several days of low blood glucose, or if you can't determine when your blood glucose is becoming low.
- You want to discuss a change or modification in your diabetes treatment plan.

Visit an endocrinologist when:

- Your blood glucose levels are consistently higher than you want them to be.
- You have one or more diabetes complications or medical conditions that makes managing your diabetes difficult.
- You'd like to change the way you manage your diabetes.

Visit a nurse diabetes educator when:

- You want to better understand how diabetes affects your entire body.
- You want basic training to manage your diabetes.
- You're having difficulty with at least one diabetes-related task, such as monitoring your blood glucose.
- You're having problems coping with the emotional aspects of your diabetes.
- You want to start an exercise program or find physical activities to help you keep your diabetes in better control.

Visit a dietician when:

- You don't understand what or how much to eat.
- You haven't visited a dietician in several years
- You don't have a food plan or your current plan is more than two years old.

The most effective diabetes self-management treatment includes a combination of all of the following therapies:

- Blood glucose monitoring
- Medication (oral and/or insulin) and insulin measurement
- Healthy eating
- Physical activity/exercise
- Proper foot care
- Overall health management

1. Blood Glucose Monitoring

Blood glucose monitoring allows you to evaluate the effectiveness of your diabetes treatment plan in maintaining your blood glucose levels within a normal range (as described previously). Monitoring will also help you determine if your blood glucose level is low and, if so, what quantity of glucose-containing products or foods you must eat to raise your blood glucose levels into a safe range.

In order to perform effective and consistent blood glucose monitoring, you must be able to access the numerical readout on your monitor. Here are some suggestions for individuals who have low vision and use a blood glucose monitor with a standard visual display:

- Use [magnifier](#) or a [closed circuit television \(CCTV\)/electronic video magnifier](#) with your current monitor.
- Use a [flexible-arm task lamp](#) and position it near your better-seeing eye.
- Place your monitoring equipment on a contrasting surface; for example, place dark equipment on a light-colored tray.
- Obtain a monitor that has a larger-print display, such as the [ACCU-CHEK® Aviva](#), the [TrueTrack Smart System®](#), or the [Precision Xtra™ Blood Glucose and Ketone Monitoring System](#).
- Obtain a monitor that has a larger-print display and backlighting, such as the [One Touch® Ultra®2](#)

If you've been certified as [legally blind](#), it's likely you'll meet the requirements of most insurers to obtain a blood glucose monitor with speech capability, also called a talking blood glucose monitor:

- The [Lifescan One Touch® Basic®](#) with speech attachment
- The [Prodigy® Autocode](#) and [Prodigy® Voice](#) (coming soon)
- The Advocate Talking Blood Glucose Monitor, available from [MaxiAids](#) and [Independent Living Aids, Inc.](#)
- The [SensoCard Plus](#) (pending FDA approval)



Lamp and tray for contrast



One Touch Ultra



**ACCU-CHEK
Aviva**

Even if your monitor has a large print display and/or speech capability, you may still want to use additional low vision, tactile, and/or auditory techniques to help with accurate and effective blood glucose monitoring:

- Explore your test strips either (a) visually to identify color differences or (b) tactilely to identify textural features. This will help you position the strip in the proper direction before inserting it into the monitor.
- Try this technique: (1) Use your left index finger as a "marker" and place it parallel with the slot that holds the test strip; (2) Hold the test strip in your right hand so that it is parallel with, and touching, the left, or "marker" finger; (3) Using the "marker" finger as a guide, insert the test strip into the monitor. Reverse these instructions if you are left-handed.
- If you have low vision and find it difficult to locate the blood droplet/sample after lancing your finger, (a) bring your finger closer to your eye; (b) use additional lighting; or (c) hold your finger with the droplet against a white or other contrasting background.
- Determine the number of strokes that are required to "milk" your finger and produce a large enough blood sample. Meters are now available that require very small amounts of blood if producing a sufficient blood sample is a problem.
- Create a mental map of where you lance your finger in relation to your fingernail to help you locate the blood droplet/sample.
- Use a monitor with a "beep" feature that indicates (a) when you have completed a step and (b) when to proceed to the next step.

2. Insulin and Insulin Measurement

Insulin is the medication most often associated with diabetes. Insulin therapy is used when other forms of therapy (diet, exercise, and oral medications) are no longer effective in controlling blood glucose levels. Although insulin is usually injected, it's now available in an inhaled form called [Exubera](#). Research is also in progress to develop insulin in pill, patch, and nasal spray forms.

Here are some important facts about insulin:

- Insulin must be timed to coincide with your food and activity levels. For example, if you take your usual dose of insulin in the morning and then decide to eat a lighter lunch than you originally planned, your blood glucose levels could become very low. Be sure to discuss insulin problem-solving strategies with your diabetes health care team.
- Insulin in a vial – like any other medication – has an expiration date. Talk with your physician if you use your insulin for more than 30 days or keep it beyond its expiration date.

Note: Always consult with your diabetes health care team before purchasing and using any adaptive insulin measurement device.

There are several adaptive devices currently available that can help with insulin measurement if you are blind or have low vision:

For low vision insulin measurement:

- A [syringe magnifier](#) can be used in combination with a [flexible-arm task lamp](#) and a contrasting background. Syringe magnifiers offer minimal magnification, however.

For non-visual insulin measurement:

Fixed dose insulin measurement devices are appropriate for individuals whose insulin dosage remains consistent from day to day:

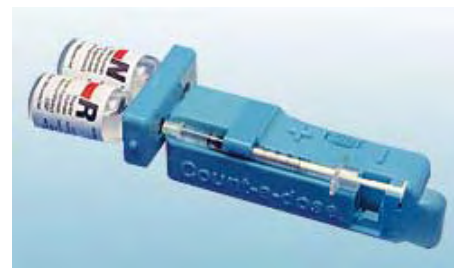
- The [Safe Shot Syringe Loader](#) has one pre-set dosage step and is available in three colors (yellow, blue, and red).
- The [Unit Calibration Aid](#) has two pre-set dosage steps; its larger size makes it easier to grasp.

Flexible dose insulin measurement devices are appropriate for individuals who need to vary their daily insulin dosage, due to changing blood glucose levels and/or carbohydrate intake:

- The [Syringe Support](#) accommodates a large dose (up to 100 units). One full turn of the calibrated screw is equal to two units of insulin. It requires a B-D 100 unit or 1cc syringe.
- The [Count-A-Dose ½ cc](#) accommodates a smaller dose (up to 50 units). It holds one or two vials of insulin and makes a distinctive click that can be heard and felt with each unit increment. It requires a B-D 50 unit or ½ cc syringe.

Insulin pens provide another measurement option. Some are disposable and pre-filled with insulin, while others are refillable. All pens make a distinctive click that can be heard and felt with each unit or ½ unit increment.

Although most insulin pens come with a disclaimer stating that individuals who are blind or have low vision cannot use them independently, many diabetes educators disagree with this assessment and continue to recommend them. Always consult with your diabetes health care team before purchasing and using any adaptive insulin measurement device, including insulin pens.



Count-A-Dose insulin measuring device

Several brands of insulin pens are currently available, including but not limited to:

- The [NovoLog® FlexPen®](#)
- The [Novolin® InnoLet®](#)
- The [Sanofi-aventis® SoloSTAR®](#) (recently approved by the FDA)
- The Eli Lilly [HumaPen® MEMOIR™](#) and [HumaPen® LUXURA™ HD](#)

The insulin pump for continuous (24/7) insulin delivery

An insulin pump is a computerized device – approximately the size of a pager or iPod Mini – that administers insulin, via flexible plastic tubing, to a small needle inserted just beneath the skin. It is programmed to closely mimic the body's normal release of insulin from the pancreas.

Some models have tactile controls and audio features and have been used successfully by individuals who are blind or have low vision, such as the [Animas® 2020 Insulin Pump](#) with an illuminated, high-contrast display screen.

You can learn more about these devices, including a [comparison of current insulin pumps](#), at [Diabetes Mall](#). Your diabetes health care team can provide more information about these devices,

including eligibility requirements, insurance coverage, accessibility features, and appropriate training.

3. Healthy Eating

There are many adaptations that can help you follow a [nutrition management plan](#), an important component of diabetes self-management treatment. Note: Always consult with your diabetes health care team to select and follow a nutrition management plan that's right for you.

Portion control can be achieved by using any of the following methods and adaptations:

- Nested, large print, color contrasting, or color-coded measuring cups and spoons, such as [Adjust-A Measure Spoons and Scoops](#), [Color-Coded Measuring Cups](#), and [Pop-Out Measuring Cups](#) from [Independent Living Aids](#).
- Portion-controlled serving utensils, such as the [Vollrath Grip 'N Serv Spoodle](#).
- A talking food scale, such as the [VOX 3000 Talking Kitchen Scale](#) from Dynamic Living, the [Talking Tel-Weight Scale](#) from MaxiAids, or the [Talking Kitchen Scale](#) from Independent Living Aids.
- You can also place tactile markings on your own food scale, by using [Hi-Marks 3-D Marker](#), [Orange Tactile Paint](#), [Spot 'n Line Pen](#), fabric/craft paint, or [a number of other labeling options](#).
- Use dishes that control your food portions: a 4-ounce juice cup, a 9-inch plate, or a 1½-cup cereal bowl.
- Use a plate with built-in portions, such as the [EZ Weight Plate](#).
- You can test your knowledge of portion sizes and portion control with [Test Your Portion Size IQ](#) from WebMD and the [Portion Control Quiz](#) from About.com.



Adjust-A-Measure spoons



Spoodle serving utensil



Plate with tactile portion templates

Accessing printed information on food labels is also necessary for healthy eating, especially when counting carbohydrates. It's possible to obtain nutrition information by using any of the following methods and adaptations:

- A [magnifier](#) or a [closed circuit television \(CCTV\)/electronic video magnifier](#)
- A talking bar code reader, such as the [i.d.mate OMNI](#) from [En-Vision America](#)
- The [CalorieKing-Joslin Food Awareness Toolbar](#) from the Joslin Diabetes Center
- Enlisting assistance from family and friends

Record nutrition information and save it for future reference by using any of the following methods and adaptations:

- [Braille](#) note cards
- Large print made with a wide-tip marker, laundry marker, or felt-tip pen
- Audio methods, such as cassette tape, [Talking Labels](#), the [VOXCOM III magnetic card reader](#), or the [Sherlock Talking Labeling System](#).

There are a number of online resources and publications that specifically address nutrition, meal planning, and recipe information for individuals with diabetes:

- The [Recipe Corner](#) and [Exchange Lists for Meal Planning](#) from [Voice of the Diabetic](#), published quarterly by the [National Federation of the Blind](#)
- A selection of [diabetes-friendly recipes](#) from [Diabetes Self-Management Magazine](#)
- [Magic Foods for Better Blood Sugar](#) and [Stopping Diabetes in Its Tracks](#) from [Reader's Digest](#)
- The [Nutrition & Recipes](#) and [Cookbook](#) sections of the [American Diabetes Association](#) web site

4. Physical Activity and Exercise

Physical activity includes formal exercise as well as sports, leisure or recreational activities, and even household chores. You can accumulate a minimum of 30 minutes of activity throughout the day by making simple changes in your level of physical activity, such as taking the steps instead of the elevator and walking to the store instead of taking the bus or driving.

Physical activity is an important component of diabetes self-management treatment, and some of its many benefits include the following:

- Maintaining and improving overall health
- Increasing strength and endurance
- Improving blood glucose control
- Controlling blood pressure
- Increasing beneficial [HDL cholesterol](#) and decreasing unhealthy [LDL cholesterol](#)
- Reducing stress, which can increase blood glucose levels
- Helping with weight loss

Note: Always consult with your diabetes health care team to select and follow an individualized exercise program that includes general exercise guidelines, physical and ocular precautions and restrictions, blood glucose monitoring, and management of hypoglycemia.

Here are some helpful hints and adaptations for exercise:

- A treadmill can supplement your walking program.
- A tandem or stationary bicycle is helpful for cycling.
- A rowing machine or cross-country ski trainer can provide aerobic exercise.
- An arm cycle can provide low impact aerobic exercise.
- Swimming is a good form of exercise if you have physical limitations or difficulty walking or running.

Stand near a wall or chair to better orient yourself during aerobic exercise.

- Use an exercise program designed for individuals who are blind or have low vision, such as the [Aerobic Exercise Tape](#) from Independent Living Aids.
- Use a talking pedometer, such as the [VoiceZone Talking Pedometer with Panic Alarm](#) from MaxiAids.
- Create braille or large print exercise records to track and record your progress.
- Wear a medical alert tag or bracelet.
- Test your blood glucose before, after, and during your exercise session if you feel symptoms of hypoglycemia.
- Keep a fast-acting carbohydrate snack nearby.
- Wear proper socks and shoes.
- Perform a foot examination (see the following section) before and after exercise.
- Check the floor space to avoid hazards and obstacles.



Tabletop arm bike

Several online resources and publications specifically address physical activity and exercise for individuals who are blind or have low vision:

- [Get Moving: Exercising with Complications](#) from [Voice of the Diabetic](#), published quarterly by the National Federation of the Blind
- [I Hate to Exercise](#) from the American Diabetes Association
- [Sports groups and associations](#) from VisionAWARE

5. Proper Foot Care

Proper foot care is a crucial component of diabetes self-management treatment, since several complications related to diabetes can cause serious foot problems:

- Decreased sensation can lead to foot injuries.
- Impaired temperature regulation can cause dry and cracked skin, which can lead to bacterial infections.
- Impaired circulation can lead to impaired healing ability and, in serious cases, amputation.

Develop a reliable foot inspection routine:

- Establish a consistent time to check your feet every day, such as after bathing or before bedtime.
- Pay special attention to previous or existing foot problems.
- Wash your feet daily and dry them carefully, especially between your toes. Apply lotion to your feet, but not between your toes.
- Ask your physician to perform a foot inspection during every visit; in fact, it's perfectly all right to take your shoes off during your appointment to make sure your physician checks your feet.
- Make an appointment with a podiatrist at least once a year. Be sure to tell your podiatrist that you have diabetes.
- Contact your physician if a cut, blister, or sore does not begin to heal after one day; contact your physician immediately if your foot is painful or swollen.
- **Note:** Medicare Part B and Medicaid recently approved coverage for biannual foot exams for people with decreased sensation in their feet due to diabetes.

Here are some helpful hints for performing a foot inspection:

- You can effectively perform a tactile foot inspection only if sensation is

intact in your hands and fingertips.

- Use your fingertips to search for skin and/or foot irregularities, such as cuts, breaks in the skin, blisters, new calluses, swollen areas, bumps, embedded objects, and changes in foot texture and/or shape.
- Feel the entire top and bottom surfaces of each foot, using overlapping strokes in an organized pattern. Be sure to check the nail beds, all pressure points, and the areas between your toes.
- Run the back of your hand over the top and bottom surfaces of each foot, feeling for excessively cool (impaired circulation) or warm (possibly infected) areas. Compare these areas to other parts of your foot or to your other foot.
- Feel for changes in the skin texture or shape of your feet.
- Note any changes in foot odor when removing your socks and shoes.
- Check for wet, moist, or crusty areas on your socks, which can indicate blood or discharge.
- If you have low vision, try using one the following adaptations: a [task lamp with a flexible arm](#), a [hand-held magnifier](#), a [magnifying or lighted mirror](#), or place a dark towel underneath your feet for better contrast.



**Foot with
pressure points**

Here are some tips to help [care for your feet](#) and prevent diabetic foot problems:

- Do not smoke. If you do smoke, try to stop. The [American Diabetes Association](#) explains the effects of smoking on diabetes and offers advice and tips to help you stop.
- Notify your physician or podiatrist immediately if you detect any problems.
- Avoid temperature extremes when washing your feet.
- If you feel cold at night, wear cotton socks. Do not use hot water bottles or heating pads.
- Do not soak your feet for a prolonged period of time, unless your physician or podiatrist prescribes it. Taking a bath or shower is fine, however.
- Your toenails should be cut or filed straight across (not cut into the corners), ideally by a podiatrist. File your nails with an emery board between cuttings, if necessary.
- Inspect the insides of your shoes every day for torn linings, nail points, and other objects that can damage your feet.
- Do not walk barefoot or in your stocking feet.
- Wear socks or stockings that fit properly, keep your feet dry, and do not have raised seams. Be sure to change your socks every day.
- Do not remove corns or calluses on your own, and do not use commercial corn and callus removal products. Visit your podiatrist for any of these procedures.

In addition, there are a number of online resources and publications that specifically address foot care for individuals with diabetes:

- [The Lower Extremity Amputation Prevention \(L.E.A.P.\) Program](#), which also provides [footwear](#) and [shoe modification](#) guidelines
- [Guidelines for Diabetic Foot Care](#) from eMedicineHealth
- [Diabetes Foot Care](#) from ePodiatry.com
- The [foot care section](#) from [Voice of the Diabetic](#), published quarterly by the [National Federation of the Blind](#)

6. Overall Health Management

There are a number of adaptations that can help with maintaining your health or managing illness:

- Visit an ophthalmologist at least once a year.
 - A large display or talking blood pressure monitor, such as the [Life Source™ Talking Blood Pressure Monitor](#) from Dynamic-Living.com and the [Talking Wrist-Mounted Blood Pressure Monitor](#) from MaxiAids
 - A large display or talking scale, such as the [Phoenix Talking Bathroom Scale](#) from Dynamic-Living.com and the [Superior Talking Scale](#) from Independent Living Aids, Inc.
 - A large display or talking thermometer, such as the [Tel-Temp Talking Thermometer](#) and the [Jumbo Display Digital Thermometer](#) from MaxiAids
 - Ask your physician or diabetes educator to create a [sick-day plan](#) in braille, large print, cassette tape, or another accessible format.
 - Label your carbohydrate-containing and calorie-free liquids in braille, large print, cassette tape, or another accessible format.
-

Are There Other Vision-Related Rehabilitation Services for Adults with Diabetic Retinopathy?

Although there is not – as of yet – a cure for diabetes and diabetic retinopathy, vision-related rehabilitation services and assistive devices can help individuals with diabetic retinopathy to use their remaining vision safely and effectively. Visit the following links from VisionAWARE to learn more about eye conditions, vision-related rehabilitation services and professionals, low vision and low vision eye examinations, optical and non-optical low vision devices, and payment options for vision-related rehabilitation:

General Information and Resources

- [An overview of eye conditions and vision-related rehabilitation services and professionals](#)
- [Resources for vision-related rehabilitation products and services](#)

Eye Care and Low Vision Services

- [Finding the type of eye care professional who is right for you](#)
- [What is a low vision examination?](#)
- [How does diabetic retinopathy affect everyday activities?](#)
- [What are low vision optical devices?](#)
- [What are low vision non-optical devices?](#)

Vision-Related Rehabilitation Services and Resources

- [An explanation of vision-related rehabilitation and services](#)
- [The types of professionals who provide vision-related rehabilitation services](#)
- [How do I pay for vision-related rehabilitation services?](#)
- [Self-help and support groups for adults who are blind or have low vision](#)

Also, be sure to visit [VisionAWARE's](#) Question & Answer links for more information on [Personal Self-Care](#), [Home Management](#), and [Home Modifications](#).

Additional Publications, Organizations, and Support Services for Adults with Diabetes and Diabetic Retinopathy

[The American Diabetes Association](#)

Provides information and updates on diabetes research, and conducts programs in all 50 states and the District of Columbia. Publishes [Diabetes Forecast](#), [Diabetes eNewsletters](#), and maintains an [online diabetes bookstore](#), including the [American Diabetes Association Complete Guide to Diabetes, 4th Edition](#) and [Diabetes Burnout: What to Do When You Can't Take it Anymore](#), also available in [audiocassette format](#).

[The American Dietetic Association](#)

The nation's largest organization of food and nutrition professionals. Provides [Nutrition Fact Sheets](#), a [Diabetes Reading List](#), and [Nutrition Information](#).

[Children with Diabetes \(CWD\) Online Community](#)

Developed by the father of a child with diabetes. Provides chat rooms, forums, information on upcoming CWD conferences, as well as the latest developments and information about diabetes for children and adults.

[Diabetes Action Network](#)

A division of the [National Federation of the Blind](#) that provides a support and information network for all diabetics, especially those who are blind or losing vision. Publishes the quarterly [Voice of the Diabetic](#) in standard print, 4-track audiocassette, and large print (in the near future), and sponsors the [Diabetes-Talk Listserv](#).

[Diabetic Gourmet](#)

Promotes healthy living and diabetic dining and provides information on a variety of diabetes-related topics, including [In the News](#), [Food and Dining](#), [Healthy Living](#), and [Forums & Chat](#).

[Diabetic Lifestyle](#)

Provides recipes and practical information for managing diabetes. Has a [diabetic supply center](#), [diabetic bookstore](#), and provides [guidelines for diabetic meal planning](#).

[Diabetes Association of Greater Cleveland](#)

Publishes two audio books specifically for diabetics who are blind or have low vision: [Diabetes: the Basics and Living with Diabetes and Visual Impairment](#).

[Diabetes.com](#)

Provides information on [understanding](#), [treating](#), and [managing](#) type 2 diabetes.

[The Diabetes Mall: Health Through Information](#)

Provides information on a variety of diabetes-related topics, including [Carb Counting](#), [Complications](#), [Cookbooks](#), [Diabetes Types](#), [Exercise](#), [Meal Planning](#), [Pump Use](#), and [Weight Loss](#).

[Go Insulin](#)

Provides testimonials from real people about diabetes and insulin, as well as suggestions about what to ask your doctor and information on treatment guidelines, types of insulin, and blood glucose testing, including the A1C test.

[Hadley School for the Blind](#)

Offers more than 100 distance education courses free of charge to those who are blind, their families, or blindness professionals. Online course offerings include [Diabetes: Toward Self-Management](#).

[The Joslin Diabetes Center](#)

An affiliate of Harvard Medical School that provides online [diabetes articles and information](#), including [Joslin's Library](#), [Diabetes Words and Phrases](#), and [The Joslin Guide to Diabetes – Revised Edition](#).

[Juvenile Diabetes Research Foundation International](#)

Provides information on research, publications, advocacy related to type 1 diabetes. Has an [online diabetes support team](#), [diabetes questions and answers](#), [Life with Diabetes E-Newsletter](#), and a [listing of clinical trials](#).

[National Diabetes Information Clearinghouse \(NDIC\)](#)

Provides educational materials to increase knowledge and understanding about diabetes among patients, health care professionals, and the general public. Publishes the [A-Z List of Topics and Titles](#) and [Easy-to-Read Publications](#) in English and Spanish.

[Shadows of Perfection](#)

A blog, or web log, " ...about the intersection of living with both type 1 diabetes and legal blindness, and the emotions, issues, and everyday struggles and triumphs that go along with each." The author is 25 years old, has been legally blind since birth, and has had type 1 diabetes for 16 years.

[The World Health Organization](#)

Publishes a range of international position and policy papers on diabetes, including [Prevention of Blindness from Diabetes Mellitus](#).

About VisionAWARE

AWARE is a 501 (c)(3) non-profit social service organization. AWARE's primary focus is [VisionAWARE](#), a "Self-Help for Vision Loss" web site that includes Questions & Answers on a wide range of topics, including eye diseases and disorders, home management, home modification, reading and writing, personal care and grooming, recreational activities, crafts, braille, computers and technology, and helpful services and resources.

For more information, e-mail Maureen A. Duffy, AWARE's Editorial Director, at maureen.duffy@visionaware.org

[Your donation](#) can help us continue to promote self-help vision rehabilitation hints, provide step-by-step adaptive techniques, and disseminate information on services and independent living resources to adults with vision loss, their families and friends, caregivers, and related professionals.

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