



Understanding diabetes

Oxford | Self-help guide

Living with diabetes

If you have been recently diagnosed with diabetes, you are not alone. Over 14.6 million people in the United States have been diagnosed with the disease, and this number continues to grow.

Properly managing diabetes will most likely require some changes in your lifestyle. But with the help of modern treatments and careful monitoring, many people with diabetes are able to enjoy the same activities that they did before the diagnosis.

In fact, you may have heard of a few of the people that have been able to continue to excel at the things they love, even after being diagnosed with diabetes – actress Halle Berry, jazz great Miles Davis, even baseball legend Jackie Robinson. Throughout this book, you'll learn how to keep your diabetes under control so that you too can continue to lead a healthy and fulfilling life.

Diabetes can be different for everyone who has it and not everyone follows the same course of treatment. With time, and with the help of your doctor, you will learn what methods work best to help keep your blood sugar levels under control.

Bring this book along to your next doctor visit and review the questions on page 32 together. Before long, you can be on the road to successfully managing your diabetes.





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1. What is diabetes?

Diabetes, also referred to as diabetes mellitus, is a disease in which the body is unable to properly produce or use insulin, which is needed to process glucose. Glucose is a simple sugar that gives the body's cells the energy they need to do their work. It is released from many of the foods we eat during the process of digestion.

Good health depends on the cells' ability to do their work. How well the cells perform depends on the answers to the following questions:

- Is there a normal level of glucose in the bloodstream?
- Are the cells able to draw in (absorb) glucose so it can be used as a source of energy?

In diabetes, the answer to one or both questions is "No."

- Approximately one million new cases of diabetes are diagnosed each year in the United States
- There are three major types of diabetes: type 1, type 2 and gestational
- People are more likely to develop diabetes after age 40
- Those who develop diabetes during middle age are often overweight

The pancreas is in charge

The pancreas is the gland responsible for manufacturing and releasing chemicals, or hormones, that control the level of glucose in the blood. The pancreas lies behind the stomach and is shaped like a lamb chop. It contains many types of cells. Two of these cell types make protein hormones that help control blood sugar.

- Beta cells produce the hormone **insulin**, which lowers the blood glucose level
- Alpha cells produce the hormone **glucagon**, which raises the blood glucose level

Insulin is the key

Insulin normally balances the cells' need for glucose by regulating the glucose level in the bloodstream. The carbohydrates we eat are the body's main source of glucose. After the carbohydrates are digested, they are stored by various organs, mainly the liver. Insulin helps determine how much glucose is sent to the bloodstream from the liver and how much is sent to the liver and muscles for storage.

Even when there is a normal glucose level in the bloodstream, the cells cannot absorb it without the help of insulin. Insulin attaches to the surface of the cells, and just as a key unlocks a door, insulin "unlocks" the cells' surface, allowing glucose to enter.

In people who have diabetes, either the pancreas stops producing insulin or the insulin that is produced is less effective than normal. Each of these problems is linked to a specific type of diabetes.

Types of diabetes

Pre-diabetes is a condition that is marked by blood glucose levels that are higher than normal, but not high enough for a diagnosis of diabetes. Over 41 million Americans have pre-diabetes, a number which continues to increase as a result of rising obesity. Being overweight increases the risk of both pre-diabetes and diabetes. Patients with pre-diabetes that do not improve their diet and exercise levels are more likely to develop diabetes. Patients who take steps to improve their risk factors may be able to prevent pre-diabetes from developing into diabetes.

In type 1 diabetes, which effects five to 10 percent of all Americans, the beta cells stop producing insulin. In the past, this was also referred to as **insulin-dependent diabetes mellitus**, or **IDDM**. About 15,000 to 20,000 new cases of type 1 diabetes are diagnosed each year in the United States. Type 1 diabetes is about 1.5 to 2.0 times more common among Caucasians than African Americans.

In type 2 diabetes, the beta cells produce insulin, but the insulin is at a lower level or is less effective than normal. As a result, the blood glucose level is frequently above normal range. In the past, this was referred to as

Types of diabetes

Type	Key points
Type 1	▪ Usually diagnosed in children or young adults
	▪ Symptoms may include unusual thirst, big appetite, frequent urination, blurred vision, tiredness, weight loss, non-healing infection
	▪ Diagnosis frequently based on high blood glucose and presenting symptoms
Type 2	▪ Must be treated with insulin
	▪ Usually diagnosed in people over age 40; increasingly found in teens and youth
	▪ Often associated with overweight and sedentary lifestyle
	▪ May cause no symptoms at all or milder forms of the symptoms seen in individuals with type 1 diabetes
Gestational	▪ May be suspected when a routine blood test shows a high glucose level
	▪ Diagnosis often based on blood glucose test or an oral glucose tolerance test
	▪ Treatment includes diet, exercise, oral medication, and/or insulin
Gestational	▪ Occurs during pregnancy, usually during the 24th to 28th weeks
	▪ Often causes no symptoms or just tiredness
	▪ Diagnosis usually based on an oral glucose tolerance test
Gestational	▪ The diabetes disappears after the pregnancy is completed
	▪ Signals a risk for developing type 2 diabetes within 10 years

noninsulin-dependent diabetes mellitus, or NIDDM.

The incidence of new cases of type 2 diabetes each year in the United States is 500,000. Type 2 diabetes is thought to affect more than 18 percent of the elderly population. At all ages, the incidence is higher in African Americans, Hispanics, Asians, and Native Americans than in other groups.

Gestational diabetes occurs during pregnancy, often during the 24th to 28th weeks. Unlike type 1 and type 2 diabetes, gestational diabetes is a temporary condition. It only lasts until the pregnancy is completed. However, women who have gestational diabetes are more likely than others to develop type 2 diabetes within the following 10 years. Roughly 135,000 pregnant women in the United States have gestational diabetes each year.



Symptoms and diagnosis

What are the key symptoms of the most common types of diabetes?

Pre-diabetes is a diagnosis for people who have been tested and found to have elevated blood glucose levels. Although the elevated levels are not high enough to be classified as diabetes, individuals are at increased risk for developing the condition in the future and are at increased risk of certain blood vessel damage such as heart disease. To prevent this progression, it is important to reach and/or maintain an ideal body weight, develop an exercise program and healthy eating habits and follow recommendations from your doctor.

Type 1 diabetes tends to cause symptoms rather suddenly, and it most often affects children or young adults. Unusual thirst, increased appetite, frequent urination, blurred vision, and tiredness are all common signs of type 1 diabetes.

Type 2 diabetes usually evolves more slowly than type 1 – over months or sometimes years; it tends to be more common among overweight people over the age of 40. Some people with type 2 diabetes have milder forms of the symptoms described for type 1 diabetes, but many have no symptoms at all. Instead, their disease is discovered during a routine blood test or medical evaluation.

Gestational diabetes is only rarely accompanied by symptoms. Therefore, periodic blood glucose testing is very important during the 24th to 28th weeks of pregnancy.

How is the diagnosis made?

Type 1 diabetes is diagnosed by measuring your blood glucose level; a high blood glucose reading, combined with the expected symptoms, is usually all that is needed to be sure of the diagnosis.

Type 2 diabetes may not be suspected until a routine blood test finds an unusually high glucose level. If type 2 diabetes seems like a possibility, a “fasting” blood glucose test is usually done. The word “fasting” is used because the blood sample is taken first thing in the morning or at least 10 hours after the person being tested has eaten. An oral glucose tolerance test is another choice; for this test, the person is given a drink that contains sugar and his or her blood glucose level is measured after 30 minutes, 60 minutes and 120 minutes to see how well the body handles sugar.

Gestational diabetes is usually identified with oral glucose tolerance testing. The test is done during pregnancy. (This brochure does not provide further details about gestational diabetes. If you need additional information, please contact your doctor or log on to the American Diabetes Association web site at www.diabetes.org.)



2. Managing your diabetes

While there is no cure for diabetes, a great deal is now known about how to keep it under control. Maintaining good control allows the body to use glucose efficiently. It also helps prevent the development of serious disease-related complications.

Monitoring your blood glucose, establishing a proper diet and exercise routine, and making other lifestyle commitments can help keep your diabetes under control and reduce the risk of complications. You are the manager of your disease. The first step is to always wear identification that states that you have diabetes. This may be on a chain you wear around your neck under your clothing, or on a bracelet. If something happens to you, even if it is unrelated to your disease, it is extremely important that those who are providing care are aware that you have diabetes.

Over time, you and your healthcare team will get to know your body's responses to various dietary changes, exercise, other illnesses, and, if necessary, medication. You will also learn which periodic examinations are important to schedule to help you manage your disease.

- Keeping the blood glucose level in control is the best way to avoid diabetes-related complications
- What you eat, when you eat, your level of physical activity, and stress all influence your blood glucose level
- Even moderately strenuous exercise, when done regularly, reduces the risk of heart disease, lowers blood pressure and helps maintain good body weight

Blood glucose testing

When you have diabetes, frequent blood testing is extremely important. There are several test kits and devices available for getting reliable readings, and they are easy to use. You and your doctor can decide which one is best for you.

Changes in blood glucose readings

One of the reasons for frequent blood glucose testing is that test results are influenced by many things. An answer of "Yes" to any of the following questions may account for unexpected test results:

- Did you eat within the last 90 minutes, or has it been several hours since you've eaten? If you have eaten recently, what did you eat?
- Has your eating been "off schedule" in the last 24 hours?
- Have you exercised today?
- Have you been under stress?
- Has your blood glucose been somewhat unstable?
- Other than your diabetes, are you ill?
- Do you have symptoms of possible hypoglycemia, hyperglycemia or ketoacidosis?
- Are you taking medication for your diabetes? If you are taking insulin, what type are you taking, when was your last dose and what injection site did you use? If you are taking an oral hypoglycemic agent, which one is it, what is the dose and when did you take it last?

If you have questions about your blood glucose, call your doctor.

Monitoring your blood glucose

Checking your blood glucose level regularly and recording the readings is the best way to know whether your diabetes is well controlled. The finger-stick devices that are now readily available allow you to obtain a small blood sample relatively painlessly. The tiny needle on the end is easily removed so that a fresh needle tip can be inserted for each test. Depending on the testing system being used, you simply place the blood sample directly onto a test strip, a meter test pad, or a sensor that analyzes the blood for glucose.

How often do I have to self-monitor my blood glucose?

The frequency of daily blood glucose testing varies. There may be periods of time, such as when you are first diagnosed or if your blood glucose control worsens, when you will benefit from testing three or more times per day. You may also need to test more frequently if you:

- Take insulin or are starting a new medication
- Have problems with low blood glucose
- Have problems with high blood glucose

- Are sick
- Are unable to eat as usual
- Are pregnant
- Use an insulin pump

If your diabetes is well-controlled, you may test less frequently. Be sure to ask your diabetes care team to work with you to determine the right amount of testing for you.

Importance of blood glucose control

Studies show that controlling your blood glucose helps prevent long-term complications affecting your eyes, kidneys, nerves, and heart. That's why keeping your blood glucose in the proper range is so important.

Once diabetes develops, your blood glucose will rise and will attach to the hemoglobin found in your red blood cells. Monitoring will help you control your blood glucose and should be performed by your doctor and yourself.

Self-monitoring

Self-monitoring, using a blood glucose meter, is performed several times a day or as directed by your doctor. You will be testing the amount of glucose in milligrams per deciliter (mg/dL) found in your blood. Your daily goal will be to keep your blood glucose below 160 mg/dL within two hours after eating and between 80-120 mg/dL after fasting.

Physician monitoring

Your doctor will perform an HbA_{1c} test every three months in order to achieve an ongoing average of your blood glucose levels. This test gives your doctor an extremely accurate indication of how your diabetes is being controlled over time. The HbA_{1c} test measures the percentage of hemoglobin with attached glucose in your blood. For people who don't have diabetes, levels fall between five to six percent. As an individual with diabetes, your goal will be to achieve an HbA_{1c} of seven percent or at the level recommended by your physician.

Short-term complications of diabetes

Ketoacidosis and its prevention

Ketoacidosis occurs when the insulin level is so low that the body's cells are unable to absorb glucose from the bloodstream. The cells then use body fat as their major source of energy. When fat is used consistently for this purpose, by-product chemicals called **ketones** are produced. If the build-up of ketones in the blood goes unrecognized, ketoacidosis results.

Ketoacidosis is a very serious complication because if it is left untreated, it can cause coma – even death. Some of the common signs of the condition include unusual thirst, nausea, vomiting, excessive urination, rapid breathing, abdominal pain, and a fruity smelling breath. The risk of ketoacidosis increases if you stop following your usual meal plan for any reason, but particularly if you are ill or under stress. The best way to prevent ketoacidosis is to follow your basic daily plan for blood glucose testing, diet and exercise. If ketoacidosis is suspected, call for emergency help. An ambulance will bring you directly to the emergency room of your nearest hospital for treatment.

Since the kidneys attempt to remove excess ketones from the blood, urine can be tested for ketones. You'll want to keep ketone test strips available so you can check for ketones any time your blood glucose reading is over 240 mg/dL. (Make sure that you replace the test strips within six months of opening a new package or when the expiration date has passed.) A ketone test strip is placed into a urine sample, and color changes shown on the directions of the test kit will tell you whether ketones are present. A positive test means that your diabetes is not well controlled, and you should report these findings by telephone to your doctor, especially if the result is moderate or severe. Blood ketone testing kits are also available for use at home.

Hypoglycemia and hyperglycemia and their prevention

Hypoglycemia is the term used to describe a blood glucose level under 50 mg/dL. The symptoms are anxiety, sweating, hunger, and a sense of shakiness or lightheadedness. If you have some of these symptoms, test your blood level. If it is below 50 mg/dL, eat or drink something sweet immediately to give your blood glucose a “quick” boost.

Be sure to carry a source of “quick” sugar with you at all times. In addition to glucose tablets prescribed by your doctor, other choices include the following:

- Four or five sugar cubes
- A small box of raisins or five or six pieces of dried fruit

- A piece of fresh fruit
- A half-cup of fruit juice
- A half-cup of sugared soda
- Six small hard candies
- Half tube of decorative frosting

If you still have symptoms after 15 minutes, check your blood glucose level again. If it is still low, eat or drink another selection from the list. If this process doesn't ease your symptoms, call your doctor. If you seem to be having hypoglycemic periods more frequently than you did before, call your doctor, even if the episodes are brought under control fairly easily. You may need an adjustment in diet, exercise or medication.

Hyperglycemia is the term used to describe a blood glucose level that is too high – at least 250 mg/dL. Symptoms include increased thirst, frequent urination, blurred vision, fatigue, and headaches.

When the blood glucose remains high, your diabetes is not adequately controlled. An immediate serious risk is ketoacidosis, which was described earlier in this section. Again, if your blood glucose level is too high, it is very important to call your doctor and work out a more effective diabetes management program.

Maintaining a normal blood glucose level is the best insurance against developing these complications. People with diabetes can develop wide-ranging changes in their blood glucose because so many factors can affect it. Diet, exercise, drug therapy, other illnesses, and emotional stress are among the many influences that make it important to check your blood glucose level according to the schedule recommended by your doctor. Regular testing leads to better blood glucose balance.

Diet and meal planning

Consistent eating habits

Establishing consistent eating habits is extremely important when you have diabetes. As you plan meals and snacks, you'll find a wide variety of choices. You'll be able to select foods you already like and try new items as well.



Consistency is the key to maintaining a normal blood glucose level throughout the day. You are in control. Your doctor may recommend that you meet with a registered dietitian to organize your diet and to see what adjustments need to be made in the first few weeks. You'll also learn how to read the labeling on prepared foods and which questions to ask when dining out.

Matching weight, calories and exercise

Food preferences, your daily meal and snack schedule, exercise level, weight, and age all help determine your daily caloric and nutrient needs. Since maintaining weight within normal range is very helpful for diabetes control, weight loss is a common objective for people with type 2 diabetes. If you want to lose weight, your healthcare team will help you start a sensible program.

You will also learn how your food choices affect your blood glucose levels. For instance, some people achieve better blood glucose control and feel better with a meal plan that provides six small meals during the day rather than the traditional small breakfast, medium-sized lunch and larger dinner.

Your diet doesn't have to be boring

There are numerous cookbooks for people with diabetes. You can check your local library and bookstores to see what's available.

Reading food labels to determine the protein, fat and carbohydrate (sugars and starches) content will also help you make good selections among the prepared foods you buy. Many food markets and restaurants have healthy selections, and as part of their commitment to please customers who have healthy lifestyles, their employees are happy to answer questions.

Feeling good: exercise for fun and fitness



Diabetes raises the risk of heart and circulatory disease. In addition, normal blood pressure helps lower the risk of some of the long-term complications of diabetes, particularly complications involving the kidneys and eyes. Regular exercise that requires even moderate levels of exertion is known to reduce the risk of heart disease, lower blood pressure and help with proper weight maintenance. No matter what type of diabetes you have, a thorough physical examination is recommended before you start an exercise program.

Exercise affects your blood glucose level

The benefits of exercise far outweigh the risks, but keep in mind that hypoglycemia can occur as a consequence of working out. Your health-care team can provide specific guidelines for exercising safely. For people with type 1 diabetes, regular exercise seems to lower the insulin requirement. However, regulating your use of insulin when exercise is a normal part of your lifestyle may take some practice and experience. Measuring your blood glucose level is essential to make sure that the effects of exercise on the blood glucose are in balance with your food intake and insulin regimen. Some overall guidelines may be helpful:

- If your blood glucose is under 100 mg/dL before exercise, you may need a snack before you start to work out; appropriate choices include a piece of fruit, a slice of bread, a small box of raisins, or a half-cup of juice
- When checking your blood glucose after exercise, your doctor may recommend that you have a snack if the reading is below a certain level; in general, a snack is advised if the blood glucose is under 100 mg/dL
- Exercise should be avoided if fasting glucose is over 250 mg/dL and ketosis is present; or use caution if glucose is over 300 mg/dL
- If possible, do not inject a part of the body that will be exercised; this can affect the insulin absorption and make its action unpredictable

For weight loss: exercise burns calories

The number of calories burned during exercise depends on which exercise you choose and your current weight. In the chart below, 250 calories is used as the example. The columns show how many minutes of each exercise would be needed to burn 250 calories if you weigh 129 lbs., 150 lbs. or 220 lbs.

Minutes needed to burn 250 calories if you weigh:

Type of exercise	129 lb.	150 lb.	220 lb.
Aerobic dancing	27 min.	22 min.	15 min.
Bicycling (6 mph)	71	57	43
Bicycling (12 mph)	27	22	16
Bowling	100	83	71
Calisthenics	69	56	42
Golf (walking with bag)	54	43	32
Running or jogging (12-min. mile)	34	27	20
Running or jogging (8-min. mile)	24	19	14
Running or jogging (6-min. mile)	18	15	11
Skiing (cross-country)	38	31	23
Racquetball	42	34	25
Swimming (fast, freestyle)	36	29	22
Tennis (singles)	42	34	25
Tennis (doubles)	71	57	43
Walking (3 mph)	74	58	44
Walking (4 mph)	49	39	29
Walking (up stairs)	32	26	19

Source: Franz MJ, Etwiler DD, Joynes JO, et al: International Diabetes Center: *Learning to Live Well with Diabetes*. Minneapolis, MN:DCI Publishing, a division of ChroniMed, Inc.; 1996.

Getting started

You'll probably find that regular exercise gives you increased energy. In fact, most experts recommend exercise as an energy booster on "tired" days. Here are some tips for getting started:

Choose a type of exercise you know you enjoy or think would be fun. Discuss the options with your doctor to make sure that your initial plan matches your state of fitness. You'll probably want to increase the difficulty and/or add minutes to your routine over time.

You may vary your choice of activities or prefer to do one type of exercise for a period of time. Think about whether you would be more committed if you were to exercise with a companion or in a class, or whether you'd rather exercise on your own. If extra weight or a sedentary lifestyle makes you self-conscious, exercising at home may be more comfortable at first; perhaps walking on a treadmill or exercising to a video program would be a good choice.

If you haven't been exercising regularly, start slowly – perhaps exercising for 10 minutes three times a week. You can increase the amount of time by 5-minute increments every 10 to 14 days until you are exercising for 30-minute periods; then you can slowly increase your level of exertion. Set regular exercise times that suit your lifestyle.

The goal is to exercise at moderate intensity for a minimum of 30 minutes at least three or four times a week. (When you're exercising at moderate intensity, you are just below the point at which you must breathe too hard to carry on a conversation.)

Stop smoking

Smoking is a major health hazard for everyone. It is particularly dangerous for people with diabetes because it heightens your risk for heart and circulatory diseases. The link between smoking and these diseases has been established by many major studies. If you are a smoker, ask your doctor about local programs that can help you quit.

Take good care of your feet

People with diabetes can develop serious foot problems due to circulatory and nerve changes in the feet and legs. The best way to guard against developing serious foot infections that can lead to permanent foot damage is to examine your feet closely every day. Here are additional steps to take:

- Wash your feet every day as you shower or bathe
- After you dry your feet carefully, look at them and note anything unusual – a corn, flaking between the toes, a blister, a rough nail, swelling, discolored areas, dry skin, cracks in the skin; if you need help with these problems, call a podiatrist or speak to your primary care physician
- Keep your toenails clipped straight across; if you need help with this, consult your podiatrist or your doctor regularly
- Use a mild lotion on your feet to counteract and prevent excessive dryness
- Do not go barefoot – ever – except when you're in the bathtub
- Do not wear tight stockings, socks or shoes; they can cause sores and inhibit the circulation to your feet
- Keep your feet comfortably warm, particularly in cold weather
- Wear clean stockings or socks every day
- Have your feet examined every time you go to your doctor
- Report any changes in how your feet feel to your doctor – for example, if you have tingling sensations, numbness, excessive coldness, or pain
- Do not use your feet to test the temperature of bath water – use a bathing thermometer or hands
- Do not use a heating pad on your feet

Gum care

People with diabetes are at risk for developing gum disease. Careful brushing and flossing in the morning and before going to bed at night are essential aspects of self-care. Having a dental check-up every six months is very important. Call your dentist if you develop mouth, gum, or jaw soreness, bleeding or swollen gums, or a toothache.



Periodic exams to schedule

Testing your blood glucose as directed by your doctor and keeping your blood glucose level within an acceptable range are the best ways to avoid disease complications. You can take several other steps to prevent complications:

Maintain consistent daily behavior. Maintain a good diet, exercise regularly, do not smoke, keep your body weight in check, test your blood glucose according to plan, and if applicable, take your medications as prescribed.

Check your HbA_{1c} level every three months. In addition to your daily blood glucose testing, the HbA_{1c} test, performed by your doctor is a very accurate way to assess your blood glucose level over time.

Have your blood pressure and weight checked every three or four months. High blood pressure and excessive weight increase the risk of heart and blood vessel disease. Your doctor will help you get these problems under control.

Diabetes evaluation checklist

There are several routine tests and exams you should receive from your doctor to help you keep your diabetes under control. Below is a recommended schedule:

Once a year

- **Thorough physical exam by your primary care physician, including:**
 - Blood cholesterol and lipid level screening (target: LDL <100 or <70 if high risk; HDL >40; Triglycerides <150)
 - Urine test to assess kidney function (microalbuminuria)
 - Cardiovascular exam
 - Blood pressure (target: <130/80)
 - Weight
 - Foot exam (with monofilament if indicated)
 - Diabetes self-management education
 - Smoking cessation counseling (if appropriate)
 - Dilated eye exam by an ophthalmologist or optometrist
 - Flu vaccine

Every six months

- **Dental Exam**

Every three or four months

- **Periodic checkup by your primary care physician, including:**
 - HbA_{1c} test (target: <7%) – 2-3 times per year depending on level of glucose control
 - Urine test for ketones if you have type 1 diabetes
 - Blood pressure (target: <130/80)
 - Weight
 - Foot exam
 - Diabetes self-management education
 - Smoking cessation counseling (if appropriate)

As needed

- **Pneumonia vaccine**
- **Prepregnancy planning**

Also ask your doctor about aspirin therapy; it is recommended for all adults with diabetes and cardiovascular disease and people over age 40 with diabetes who are at risk for cardiovascular disease.

Schedule a dental exam every six months. Make sure your dentist knows you have diabetes, and that you have a routine dental exam every six months. If you develop gum soreness, bleeding or swelling — or a toothache or pain in your jaw — call your dentist and schedule a check-up immediately.

Have your urine tested once a year. Your doctor will want to analyze your urine once a year for the presence of protein (proteinuria), which is a sign of improper kidney function.

Schedule an eye exam once a year. A thorough exam by an ophthalmologist or optometrist is very important to have once a year. The exam is painless. The ophthalmologist dilates your pupils with eye drops and then is able to examine the structures within your eyes and note any signs of damage. Since damage may not cause symptoms, an eye exam is the only means of detection.

Check your blood cholesterol and lipids once a year. Having your blood cholesterol and lipid levels checked during your yearly exam is a precaution against high levels going unnoticed. People with diabetes are at risk for heart and blood vessel disease, and high blood cholesterol and lipids increase that risk even further. If necessary, your doctor will help you get these elevations under control. Know your numbers — request a copy of your laboratory work.

Tips for changes in your daily routine

Unexpected meal-time changes

Issue: Even when you know how important consistent meal times are, you are not always in control of a day's events.

Solution: If you are taking insulin and your normal meal time will be delayed up to an hour, you can postpone your insulin injection for an hour. If the delay is more than an hour, you can have a snack at the usual meal time, take your insulin injection according to your normal schedule and eat your meal later.

Issue: You don't want to ignore your diabetes during holidays and on special occasions, but you do want to enjoy yourself.

Solution: Careful planning will help. It is best to divide your meal and snack amounts according to the holiday or special-occasion eating schedule while keeping the total day's food consumption — total calories and total carbohydrates — close to normal.

Things to remember

- Plan your meals and snacks very carefully
- Maintain consistent eating times day-to-day
- Test your blood glucose level on schedule
- Exercise regularly
- If you are a smoker, start a quit-smoking program

When you are sick

Issue: Any infection or illness, even a minor one, can cause blood glucose to elevate.

Solution: To avoid this, you need to take illness seriously and carefully follow these guidelines:

- Speak with your doctor about how to take your medication if you are unable to eat
- Increase your blood glucose monitoring to every three to four hours, or at least four times a day; check for ketones if blood glucose is greater than 240 mg/dL; keep a careful record so you can report back to your doctor and care team
- Drink plenty of fluids to prevent dehydration, about six to eight ounces every hour while you are awake
- If you are able to eat, drink sugar-free fluids such as water, broth or diet soda with your meals
- If you are unable to eat or keep food down, alternate drinking sugar-free liquids with drinks such as soda, apple juice or Jell-O® per hour
- If you are unable to eat, contact your doctor for medication instruction and “sick day” rules
- Rest and take your temperature; contact your doctor if your temperature exceeds 102° – or it lasts longer than two to three days

When you are under stress

Both emotional and physical stress have an impact on your blood glucose level, but stress cannot always be avoided. The first step is to learn to recognize, and when possible, anticipate stress. If you can't schedule a 20-minute block of time for extra exercise or quiet relaxation, close your eyes and breathe deeply for five-minute periods several times during the day, and think of a place that calms you or play music for the five-minute periods. If you feel you are almost always under stress, you may want to talk about it with a professional counselor.

Planning for travel

Advanced planning is the key to safe travel:

- Discuss with your doctor any questions you might have several weeks in advance of the departure date
- Pack all the medications you know you'll need and some precautionary ones as well — perhaps for headache, nausea, and diarrhea; add enough for a few extra days, just to protect against a change in plans
- Pack snack foods and/or glucose tablets that will last for a few days beyond the duration of the trip, particularly if you are going to an unfamiliar area
- Include enough glucose and ketone testing equipment for several extra days
- Be sure to wear a diabetes identification tag on a chain around your neck or on a bracelet
- Bring a letter from your doctor verifying that you have diabetes
- Write down what you need to know about adjusting your medication times if you are going to another time zone
- If you're traveling by plane, train or bus, take all of the items listed with you in a carry-on bag; do not check them for shipping in a baggage compartment
- Call your transportation carrier to inquire about their policy about diabetic supplies (sharp objects)
- Carry new written prescriptions





3. Medication

When to call your doctor

Ask your doctor for recommendations on when you should call him or her, or follow the guidelines below, calling your provider if:

- There are many types of oral medications available for type 2 diabetes
 - Insulin was first used for diabetes treatment in 1922
 - The rate of insulin absorption into the bloodstream depends on where it is injected
 - Since prescription and non-prescription drugs often interact with diabetes medications, discuss all drugs you are taking with your doctor
- Your blood glucose test results are 240 mg/dL or more for two consecutive tests
 - A urine test reveals the presence of moderate to large ketones
 - You became hypoglycemic, have consumed a “quick” source of glucose, waited 10 minutes to recover, and did not feel better; after repeating the process, you still have symptoms
 - You are too nauseated to eat or drink, or you have abdominal pain or persistent bloating
 - You seem to be losing weight and are just not feeling “right”
 - You have vomited more than once or had repeat episodes of diarrhea for several hours
 - You are experiencing mental confusion or dizziness, have double vision or are breathing rapidly

- You want to make a major change in your level of physical activity
- You are persistently depressed, worried or angry about having diabetes

Although proper diet, regular exercise and quitting smoking are very helpful for keeping your diabetes under control, medication is sometimes needed as well. Type 1 diabetes always requires taking insulin because it is no longer produced by the pancreas. Insulin is a protein, which means it would be broken down in the digestive tract if taken in pill form. Therefore, it has to be injected. Type 2 diabetes can often be controlled without drug therapy, but it, too, may require the assistance of medication. Oral antidiabetic agents, the medication most often used for type 2 diabetes, are swallowed in pill form. In some cases, insulin may be prescribed for patients who have type 2 diabetes.

Oral medication

Oral antidiabetic medications are used to control blood glucose levels when type 2 diabetes cannot be well controlled with diet and exercise alone. There are several different types of oral agents available, which work in different ways. For example, some work to boost the production of insulin by stimulating the beta cells of the pancreas, while others help the body's cells take up glucose more easily. The following includes brief descriptions of oral antidiabetic medications that are available:

Insulin secretagogues are the most common group of oral hypoglycemic medications. They work by stimulating the pancreas, specifically the pancreatic beta cells, to produce more insulin. Examples of this type of medication are glipizide and glyburide. Newer agents in this class include repaglinide and nateglinide.

Biguanides are a newer group of oral agents. These drugs aid the body's management of glucose. They may also improve the blood lipid (fat) level in individuals with high glucose readings and help stabilize weight. An example of this type of medication is metformin. This product is now available in liquid and extended-release tablet form.

Thiazolidinediones are a new group as well. They seem to make the body cells more responsive to insulin. Examples of this type of medication are rosiglitazone and pioglitazone.

Alpha-glucosidase inhibitors are one of the newer groups of oral agents. They delay the digestion of carbohydrates (starches and sugars). As a result, the blood glucose level doesn't rise as high after meals as it would without the drug's inhibiting effect. An example of this type of drug is acarbose.

If your doctor recommends an oral antidiabetic medication, he or she will want to discuss other drugs you might be taking, including drugs that do not require a prescription. **If you will be using an oral antidiabetic agent, take the medication exactly as prescribed.**

Types of insulin

Most insulin used in the United States is manufactured in a laboratory and mimics human insulin. The insulins can be categorized according to their action times, and each has its advantages. Your doctor will work with you to determine the best insulin or combination of insulins for your medical condition and lifestyle. It's important to refer to package instructions for proper storage of insulin, and it must be thrown away after its expiration date. It is common for insulin that is stored at room temperature to be disposed of 30 days after opening.

Injecting insulin

Insulin is injected into the fatty tissue just beneath the skin. Rotating the site of injection and establishing a regular pattern of rotation of sites is helpful. Absorption is quickest when the room temperature insulin is injected into the abdominal area, followed in order by the back of the arms, the top and outside of the thighs, and the buttocks.

You and your doctor will discuss your injection schedule. You will be taught how to draw the insulin into a syringe, how to inject it and the best way to dispose of used syringes. You'll need to maintain an adequate supply of syringes and medication.

Insulin pump therapies

While most individuals will use syringes for injection, there are times when a doctor will recommend that a patient use an insulin pump. This device allows for continual delivery of insulin into the body and requires a high level of monitoring. Because only certain people will benefit from insulin pump therapy, you should discuss this option with your doctor to see if it is appropriate for you.

Complementary therapies

In addition to diet, exercise and lifestyle choices, there is published and ongoing research on the helpfulness of vitamins, minerals, herbs, and trace metals for maintaining control of blood glucose and increasing insulin sensitivity. Many naturopathic physicians use magnesium, chromium, B-complex vitamins, vitamin C, guar gum, psyllium seeds, evening primrose oil, and bioflavonoids to aid in the treatment of their diabetic patients.

If you are using oral antidiabetic agents or insulin, it is important to check with your doctor or a doctor trained in nutritional and botanical medicines, such as a naturopathic physician, before taking more than three times the recommended daily allowance (RDA) of any vitamin, one times the RDA of any mineral, or any herbal supplements. You and your doctor can discuss whether these supplements would be helpful to you and how frequently you should measure your blood glucose level if you start using them.

Insulins commonly used in the United States

Generic name	Brand name	Form	Onset	Time to peak of action (h)	Duration of action
Rapid-acting*					
insulin glulisine	Apidra®*	analog	<15 minutes	1–2 hours	3–4 hours
insulin lispro	Humalog®*	analog	<15 minutes	1–2 hours	3–4 hours
insulin aspart	NovoLog®*	analog	<15 minutes	1–2 hours	3–4 hours
Regular					
regular	Humulin® R	human	0.5–1 hour	2–3 hours	3–6 hours
regular	Novolin® R*, ReliOn® (Wal-Mart)	human	0.5–1 hour	2–3 hours	3–6 hours
Intermediate-acting					
NPH	Humulin® N*	human	2–4 hours	4–10 hours	10–16 hours
NPH	Novolin® N*, ReliOn® (Wal-Mart)	human	2–4 hours	4–10 hours	10–16 hours
Long-acting					
insulin detemir	Levemir®*	analog	0.8–2 hours	relatively flat	up to 24 hours
insulin glargine	Lantus®*	analog	2–4 hours	peakless	20–24 hours
Mixtures					
50% lispro protamine, 50% insulin lispro	Humalog® Mix 50/50™*	analog			
70% NPH/30% regular	Humulin® 70/30*	human			
70% NPH/30% regular	Novolin® 70/30*†, ReliOn® (Wal-Mart)	human			
75% lispro protamine/ (NPL) 25% lispro	Humalog® Mix 75/25™*	analog			
70% aspart protamine/ 30% aspart	NovoLog® Mix 70/30*†	analog			
				The time of action for these mixtures is a combination of the intermediate and short- or rapid-acting components, with one peak of action. Please ask your doctor for the specific time of action for your medication.	

* Available in prefilled, disposable pens or cartridges for reusable pens. Apidra® is available in pens, pumps or infusion sets. (Insulin pens are listed on pages RG28 and RG29.)

† Note difference between Novolin® 70/30 (70% NPH/30% regular) and NovoLog® Mix 70/30 (70% aspart-protamine/30% aspart).



4. Preventing long-term complications

- Circulatory problems increase your risk of developing heart and blood vessel disease, diabetic retinopathy and diabetic nephropathy
- Having an annual eye exam is the best way to guard against developing serious visual disturbances, such as blurriness or loss of vision
- The risk of diabetic nephropathy may be higher when there is a family history of hypertension

The key to preventing the long-term complications of diabetes is maintaining stable blood glucose within the acceptable range. How well your diabetes is controlled depends on establishing consistent habits and finding a good balance between diet, exercise and, if necessary, drug therapy. Tests can be done periodically to recognize these complications in their early stages — before they cause symptoms in some cases. These conditions are most easily managed when they are identified early.

Eye problems: diabetic retinopathy

The eye is a complex organ that serves as our window to the world. Each part of the eye has a special function. Our ability to see is based on the coordination of these functions, much as the parts of a camera work together to take good quality pictures.

The eye is serviced by a rich network of small blood vessels called the **capillaries**. The **retina**, which is most directly responsible for vision, and the capillaries of the eye can develop abnormalities and weak spots that disrupt eyesight.

These changes, which can cause visual disturbance or loss, are known as **diabetic retinopathy**. Blurry or cloudy vision may be symptoms of this condition, but having clear vision does not necessarily mean that retinopathy is absent. That is why a careful yearly examination of the deeper structures of the eyes is essential.

Pregnancy increases the risk of retinopathy. If you have diabetes and become pregnant, an eye exam is recommended during the first trimester, with follow-up exams every three months until the delivery, and then six weeks after the delivery.

Eye care specialists are well trained to perform this simple, painless procedure that allows them to look at the deeper structures of the eye and find any abnormality that might be an early sign of retinopathy. If early signs are noted, your doctor will review your blood glucose readings and your usual habits to decide whether some modifications would be wise.

Kidney problems: diabetic nephropathy

The kidneys' main task is to filter out, or remove, waste products from the blood. If the small blood vessels become weak or damaged, wastes accumulate in the body. That is what happens in **diabetic nephropathy**.

Diabetic nephropathy usually does not begin to develop, if it is going to develop at all, until 15 or 20 years have passed after the diagnosis of diabetes is made. The best way to prevent this complication is to maintain consistent control of your blood glucose level and blood pressure. Controlling your weight and exercising regularly are two proven ways to keep your blood pressure regulated. If your blood glucose or blood pressure is high, your doctor may prescribe medication.

Your doctor may also test the level of a protein called **albumin** in your urine from time to time. It is now known that a finding of small amounts of albumin in the urine is an indication of early-stage nephropathy. If early-stage nephropathy is suspected, there are steps you can take to prevent it from worsening:

- Maintain proper weight or lose weight if needed to reach a healthier range for your age and height

Things to remember

- A thorough dilated eye exam should be completed every year; detecting diabetic retinopathy early may prevent serious damage
- Keeping your blood pressure in normal range is a good way to prevent the kidney damage that can occur in connection with diabetes
- A simple test for the presence of protein in your urine should be done each year to identify early-stage kidney damage
- If tingling, burning, numbness, or pain in the legs and feet gives you reason to suspect nerve damage related to your diabetes, call your doctor
- An annual cardiovascular exam will help detect and prevent serious heart, blood vessel or blood pressure disturbances
- The American Diabetes Association recommends aspirin therapy as a preventive agent against heart attack and stroke; be sure to discuss with your physician if you are considering this therapy

- Stay on your program of regular exercise
- Monitor your blood glucose levels as advised by your doctor
- Keep your blood pressure within normal range, with medication if necessary
- Restrict daily salt, fluid and protein in your diet as your doctor advises

Nerve problems: diabetic neuropathy

The nervous system is the main messenger for sending information from one part of the body to another. It coordinates the body's various tasks and alerts us to conditions outside the body. For example, the nervous

system sends a signal to speed up our heartbeat and breathe faster when we exercise, to put on warmer clothing when we feel cold, or to let us know that something is painful.

The damage to the nervous system that can occur in diabetes is called **diabetic neuropathy**. Symptoms include double vision, nausea, a sense of stomach fullness, and tingling, burning, or numbness of the feet. The diminished feeling in your feet and legs can reduce your sensitivity to cold or heat, and this can result in injury.

Prevention is best achieved by maintaining good blood glucose control. Your doctor will ask you questions periodically to identify signs of neuropathy. If you develop any symptoms that do not go away, call your doctor.

Heart problems: cardiovascular disease

People with diabetes are at increased risk for diseases of the heart and blood vessels. This is especially true of those with type 2 diabetes. If you have developed diabetic nephropathy, you will have an increased risk of **cardiovascular disease**.

To prevent cardiovascular disease, keep blood glucose levels regulated, maintain good weight control, follow a low-fat diet, and exercise regularly. If you smoke, this is the time to quit. You'll also want to have your blood pressure checked every three or four months and your blood cholesterol and lipids measured once a year.

Depression and diabetes

Studies show that diabetes may also increase the risk for depression. It is not clear what exactly causes this connection, but it is important that you notify your primary care physician (PCP) if you:

- Feel sad, guilty or hopeless
- Have trouble sleeping, or sleep too much
- Experience major weight change
- Have problems concentrating or making decisions

Depression can make it harder to manage your diabetes, and can even have an effect on blood sugar levels. If your physician determines that you suffer from depression, there are treatments available to you.





5. Taking care of your child with diabetes

Establishing a partnership with your child that encourages open communication is a top priority. You can look together for ways to build habits that will keep the diabetes in control – habits that do not prevent your child from participating in normal activities. Over time, you'll learn what your child wants to do independently and when he or she prefers your help.

There are a number of books available for children with diabetes. Your library, local bookstores and care team can help you find information (targeted by age group) for children with diabetes.

- You can share food responsibility with your child: make sure healthy food choices are available, and let your child decide how much to eat
- As you and your child think of questions about diabetes, keep a written list, and plan on going through them together at your child's next doctor visit – or earlier, if necessary
- Ask for a meeting with staff members who interact with your child at school to discuss your child's special needs in relation to diabetes
- Make a healthy lifestyle a family affair

Questions children often ask

The following is a brief list of common questions your child might ask and the answers you can offer. You can find additional information on talking with your child about diabetes in books, other brochures and on the Internet. You can also refer to page 34 for additional resources.

Q Did I do something that gave me diabetes?

A No, diabetes just happens. It is not something you can bring on yourself, and you can't catch it from someone else.

Q What is diabetes?

A When you have diabetes, your pancreas, which sits behind your stomach, stops making insulin. Insulin is needed for your body to be able to burn glucose for energy. Your body needs energy for everyday activities. When insulin is not being made, you can feel tired. You can also be unusually thirsty and need to go to the bathroom a lot.

Q How do doctors cure diabetes?

A There are many ways to control diabetes, but there is no cure for it. We're going to learn how to control your diabetes.

Q What does "controlling diabetes" mean?

A First, it means that we're going to learn how to inject insulin to replace the insulin your body has stopped making. Second, we're going to find out when to inject insulin to make sure your body has what it needs throughout the day. Third, we're going to talk about what you eat to see whether you need to make some changes. We're also going to learn how to test your blood glucose level to make sure all the other things we're doing are working.

Q What happens when diabetes gets out of control?

A You might start to sweat even though you're not exercising, or feel faint, shaky, or a little dizzy. You might get tired or irritable. These are signs of low blood glucose. Usually eating something that provides quick energy makes you feel better in just a few minutes. Some choices might be a cup of juice or a small box of raisins. We'll make sure that you always have something like this with you.

Q I'm afraid. Am I going to be sick a lot? Will I have to stop playing with my friends?

A I can understand that you're afraid. This is all new for you and for me. But we'll work it out together. You may even get angry about having diabetes. That's okay, too. I hope you'll be able to let me know if you have any questions or want to talk about what's on your mind and how you are feeling. You're not going to be sick a lot. You'll be able to play with your friends as you always have.

Informing school personnel

Meeting with school officials

Your child's teachers, principal, school nurse, coach, head of cafeteria services, and bus driver all need to know that your child has diabetes. Ask for a meeting to discuss the following:

- Your child's usual routine for taking insulin and testing blood glucose
- The importance of keeping insulin and testing materials available at the nurse's office
- Your child's need for snacks to maintain a stable blood glucose level
- Whether the cafeteria food choices are appropriate for a child with diabetes
- The symptoms of trouble
- Where to reach you
- The doctor's phone number

"Checking in" with the principal and your child's teachers at least once a quarter keeps the lines of communication open. How your child is doing at school can be a good indicator of his or her emotional and physical well-being.

Reminders

Maintain regular meal times, but don't expect your child to eat as planned. Your child's appetite may vary according to growth spurts and physical activity. Regular meal times are important, but your child may "rebel" against feeling regimented. If a gentle reminder doesn't work, he or she may have to learn by experience that there are consequences of ignoring meal schedules.

Know that your child may occasionally go off his or her meal plan, and not tell you. Your child is going to eat something extra at times, skip a needed snack occasionally, or even take an insulin shot a bit off schedule now and then. This behavior is common. It is a serious concern only if it becomes frequent, and therefore endangering.

If your child asks about them, discuss the possible complications of diabetes in a positive way.

Reassure your child that regular checks of blood glucose are the best way to keep blood glucose in an acceptable range, and that maintaining the right range is the best way to avoid complications.





6. Questions for your doctor

Hopefully, this book has answered many of your questions about diabetes. But, because diabetes affects each person differently, successful management of the disease requires treatment and lifestyle choices that are unique to you or your child. It is important to speak with your healthcare team if you have any questions about this disease and its management. Some suggested questions are listed here, but you may want to write down a list of any other questions you have before your next appointment.

Suggested questions for you next doctor visit

Diet and exercise

- How can I learn more about healthy eating?
- How limited will my selection of foods be? How rigid will my eating schedule be?
- Can I drink alcoholic beverages? If so, what are the limits?
- What happens if I change my regular eating schedule?
- What are some tips for making reasonable food choices when dining out or at someone's home?
- How should I get started on a good exercise regimen?

Medication

- Do I have to take insulin? If so, how will I learn to inject myself?
- Will I need other medication(s) for my diabetes? If so, what will I be taking?
- How does diabetes or medication for diabetes affect other medications I am taking?
- Do I have to stop some of the other medications? Do I have to be careful about starting other medications?

Follow-up

- How frequently will I see you for check-ups?
- Who should I call to arrange for other periodic tests?
- Who is the best person in your office to call if I have questions?

Other concerns

- How will we know whether my diabetes is being adequately controlled? What are the little signs of being out of control?
- Do I need special information for times when I'm ill with something like the flu or an upset stomach?
- Is traveling safe? What precautions should I take?
- Does hot or cold weather influence my condition?
- Are there support groups for people with diabetes in this area?



7. Getting additional help

Want more information? There are many people, organizations and resources available to help you manage your diabetes. Here are a few suggestions.

Medical Professionals

Your primary care physician

If you have questions about diabetes, diabetes medications or follow-up, contact your primary care physician (PCP) first. Most doctors are well-prepared to assist you in this area.

Specialists

If you are having difficulty controlling your diabetes, or if your diabetes is severe, your PCP may recommend that you see a specialist, such as an endocrinologist or a nutritionist. These healthcare professionals can help you to better manage your diabetes.

Pharmacists

Your local pharmacist can provide you with valuable information about the medications your doctor has prescribed. He or she can help you avoid other medications that might interfere with successful treatment of your diabetes, as well as help you get the greatest benefit from your medications.

Organizations

The following organizations provide information and support services for people with diabetes. While this list is a great starting point, there are many other resources available. Contact your doctor for more information.

American Association of Diabetes Educators

100 West Monroe Street
Chicago, IL 60603
312-644-2233
1-800-338-3633
1-800-832-6874 (To find diabetes educators in your area)
www.aadenet.org

American Diabetes Association

Attn: National Call Center
1701 North Beauregard Street
Alexandria, VA 22314
1-800-342-2383
www.diabetes.org

American Dietetic Association

120 South Riverside Plaza, Suite 2000
Chicago, IL 60606-6995
312-899-0040
1-800-877-1600
www.eatright.org

American Heart Association

7272 Greenville Avenue
Dallas, TX 75231
214-373-6300
1-800-242-8721
www.americanheart.org

Diabetes Exercise and Sports Association

8001 Moncastle Dr.
Nashville, TN 37221
602-433-2113
1-800-898-4322
www.diabetes-exercise.org

Juvenile Diabetes Research Foundation International

120 Wall Street
New York, NY 10005-4001
212-785-9500
1-800-533-2873
www.jdf.com

National Diabetes Information Clearinghouse

One Information Way
Bethesda, MD 20892-3560
1-800-860-8747
www.diabetes.niddk.nih.gov

National Federation of the Blind

1800 Johnson Street
Baltimore, MD 21230
410-659-9314
www.nfb.org

National Kidney Foundation

30 East 33rd Street, Suite 1100
New York, NY 10016
1-800-622-9010
www.kidney.org



8. Glossary

The words and phrases listed are commonly used in relation to diabetes:

Albumin A protein that can be measured in urine that signals kidney malfunction. This protein can also be detected in microscopic amounts by a special urine test that your doctor can request called a microalbuminemia test. This allows your doctor to detect, treat and further prevent diabetic kidney damage at a very early stage.

Beta cells Beta cells are responsible for manufacturing insulin. The beta cells are found in the pancreas.

Blood cholesterol and lipids When the blood lipids are measured, the level of several types of cholesterol and the triglycerides are identified. High levels of some of these substances raise the risk of cardiovascular disease.

Blood glucose testing Regular, frequent testing of the blood glucose level is the best way to monitor how well diabetes is being controlled. Sometimes blood glucose is measured in the fasting state, which means that the person whose blood is being tested hasn't eaten in the last eight hours. At other times, blood glucose is tested in the post-prandial state, which is about 90 minutes after a meal has been eaten. Your doctor will tell you when to test your blood glucose level.

Cardiovascular disease These are disorders of the heart and/or blood vessels, and people with diabetes are at risk for developing these conditions. In addition, blood vessel changes and high blood pressure contribute to other long-term complications of diabetes.

Diabetes Also referred to as diabetes mellitus, this disease indicates that your cells are not able to make normal use of glucose as a source of energy. This inability is due either to the absence of insulin or to the presence of insufficient or ineffective insulin. In **type 1 diabetes**, the beta cells of the pancreas stop making insulin completely. In **type 2 diabetes**, insulin is produced, but the insulin is at a lower level or is less effective than normal. A third type of diabetes occurs during pregnancy and stops after the pregnancy is completed. It is called **gestational diabetes** and is considered a sign of the potential development of type 2 diabetes in the future.

Diabetic nephropathy Kidney malfunction (nephropathy) can be a long-term consequence of diabetes. Annual urine tests to search for the presence of protein are advised as a means of identifying nephropathy. Keeping blood pressure within normal range, with the use of medications if necessary, is a precautionary step that helps prevent nephropathy.

Diabetic neuropathy Nerve malfunction (neuropathy) can be a long-term complication of diabetes. Numbness, pain and tingling of the feet, stomach upsets and fullness and blurry or double vision may be signs of neuropathy.

Diabetic retinopathy Visual impairment, even blindness, can be a long-term effect of diabetes. The smallest blood vessels in the eyes – the capillaries – become malformed. The retina, which is most directly responsible for vision, can develop tears and distortions as well, and vision is disturbed or lost. Annual thorough eye exams identify early signs of retinopathy, and this early stage is the most treatable one.

Glucagon This is a hormone produced by the pancreas that stimulates an increased level of glucose in the blood.

Glycosylated hemoglobin test This is another term for the HbA_{1c} test, which is considered a very accurate measure of the control of blood glucose levels over time and has been proven to be correlated with rates of diabetes complications. It is generally advised that the test be done by your doctor every three months.

Hormone Any chemical substance produced by the body whose purpose is to assist in the regulation of specific functions.

Hyperglycemia In this condition, the blood glucose level exceeds 250 mg/dL.

Hypoglycemia In this condition, the blood glucose level falls below 50 mg/dL. Associated symptoms include shaking, sweating, fainting, hunger, and irritability.

Insulin This hormone is produced by the beta cells of the pancreas and has responsibility for the glucose level of the blood and the body cells' ability to absorb glucose and use it as a major source of energy.

Ketoacidosis This complication occurs when your body is unable to use your blood sugar for fuel and is a sign that your diabetes may be dangerously out of control. If it is not brought quickly under control, coma and death can result. A finding of ketones in the urine is a warning sign that must be reported right away to your doctor.

Ketones These chemical compounds can be found in the urine and are a sign of uncontrolled diabetes. They are much more commonly found in people who have type 1 than type 2 diabetes and are a warning of possible ketoacidosis.

Microalbumin See Albumin.

Oral antidiabetic agents These are the drugs most commonly given for type 2 diabetes that does not respond adequately to a controlled diet and exercise plan. The different types are the secretagogues, biguanides, thiazolidinedione, and alpha-glucosidase inhibitors.

Pancreas This flat organ lies behind the stomach and has many functions. The hormones, insulin and glucagon are produced in the pancreas and function to regulate the level of glucose in the blood and to enable the body's cells to absorb glucose.

Proteinuria This is the term used to describe a finding of protein in the urine. It is an indication of kidney malfunction.

