

Living with Diabetes

Key facts about type 1 and type 2 diabetes, recognizing symptoms, and recognizing the risks. This is a special **FREE** report compiled by The Corner 4 Women from the Harvard Health Special Health Reports.

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Good News for Managing Diabetes

The odds are that you or someone you know has diabetes already or is at risk of developing this disease. The number of Americans with diabetes currently tops 18 million, or roughly 1 out of every 15 people, and many more are at risk.

Of course, if you or someone you love has diabetes, the disorder is about much more than a statistic. It means a new way of life. Eating a meal, planning a vacation, or going for a run requires forethought and planning. From testing your blood sugar, to planning your meals, to injecting yourself with insulin, managing your diabetes takes effort and discipline.

What's more, you not only have to think about keeping your blood sugar levels as normal as possible from day to day, you also have to worry about finding ways to avoid long-term complications that may develop as a result of having diabetes. People with diabetes face an increased risk of such complications as blindness, kidney failure, amputation, and heart attacks and stroke.

Small wonder, then, that a diagnosis of diabetes may seem overwhelming. Both people with diabetes and their families may find themselves struggling with negative emotions -- fear, frustration, anger -- as they learn more about the disease and the lifestyle changes it requires. However, there's plenty of good news emerging about diabetes. Research now shows that keeping your blood sugar levels as close to normal as possible is worth the time and effort. Rigorous blood sugar control can enable you to delay or even prevent the progression of diabetes and its debilitating long-term complications. Such tight control is now possible thanks to recent innovations such as high-tech monitoring devices, improved medications, and nearly painless insulin injectors.

This report will help you better understand and manage your diabetes. It covers the two main forms of diabetes, type 1 and type 2, as well as other variations of this disease. Among other things, you'll learn the basics of how your body metabolizes sugar, the tools of diabetes control, and the fundamentals of nutrition and exercise. You'll also get up-to-date information on new products, medications, and techniques that may further revolutionize diabetes care. Perhaps most important, you'll see that it's not just possible to live with diabetes; it's possible to live well.

What Is Diabetes?

Diabetes (medically known as diabetes mellitus) is a chronic metabolic disorder characterized by elevated levels of blood glucose, or sugar. It occurs when your body produces little or no insulin or when your cells don't respond appropriately to the insulin that is produced. Diabetes usually can't be cured; left untreated -- or poorly managed -- it can lead to serious long-term complications, including kidney failure, amputation, and blindness. Moreover, having diabetes increases your risk for cardiovascular disease, including heart attack and stroke.

Key Players to Metabolize Sugar

Many of the cells in your body need sugar as a source of energy. When you eat carbohydrates, such as a bowl of pasta or some vegetables, your digestive system breaks the carbohydrates down into simple sugars (generally glucose), which are ferried into and through your bloodstream to nourish and energize cells.

A key player in the metabolism of sugar is the pancreas, an elongated gland behind your stomach and liver. The pancreas fills two roles. First, it produces enzymes that flow into the small intestine to help your body digest proteins, carbohydrates, and fats. Second, it makes hormones that regulate the disposal of nutrients, including sugars. The islets of Langerhans, tiny clusters of cells found throughout the pancreas, are responsible for producing these hormones. They are composed of alpha cells, which produce the hormone glucagon, and beta cells, which secrete insulin. These hormones generally have opposite actions, but both are important in regulating your body's use of sugar, fat, and protein.

Much like traffic cops dispatched at rush hour to ease congestion, insulin is released by beta cells in response to the rise in blood sugar levels after you've eaten. By directing sugar into liver and muscle cells, it promotes the storage of nutrients and prevents blood sugar levels from rising excessively. It also increases the uptake of amino acids (the building blocks of proteins) and fatty acids (the building blocks of fats) into protein and fat stores, respectively. Insulin thus serves as one of the principal gatekeepers of metabolism, promoting energy storage and growth.

The Blood Glucose Balance

The liver converts glucose that is not needed immediately for energy into glycogen. When blood glucose levels drop too low, your pancreas releases the hormone glucagon, which prompts your liver to reconvert stored glycogen into glucose and

release it into the bloodstream. Usually insulin and glucagon levels fluctuate in a coordinated fashion to keep your blood glucose levels within a rather narrow range. This is important because certain organs, such as the brain and kidneys, depend on a consistent, steady supply of glucose. A normally functioning pancreas assures your body of a stable supply of nutrients.

In healthy people, insulin prevents a large rise in blood sugar after eating. The normal blood sugar level before breakfast usually hovers between 70 and 110 milligrams per deciliter (mg/dL). Normal levels of sugar in the blood rarely exceed 180 mg/dL, even after a meal.

The Diabetes Epidemic in a Nutshell

The prevalence of diabetes has increased so quickly, in such a short amount of time, that many refer to it as an "epidemic" -- a term once reserved only for infectious diseases. Although the exact cause of diabetes is unclear, one thing is certain: Excess body fat is the leading controllable risk factor for the most common form of this disease, type 2 diabetes. And it's not just Americans who are getting fatter. Diets high in saturated fat and refined carbohydrates coupled with the modern sedentary lifestyle have been instrumental in the alarming rise in obesity and diabetes around the world. Here's how all those burgers and shakes add up:

About 64 percent of U.S. adults (180 million people) are overweight or obese; 30 percent (85 million) of them are obese.

Worldwide, 1 billion adults are overweight or obese, with 300 million being obese. Rates vary widely among countries; fewer than 5 percent of people in China are obese, compared with more than 75 percent of those in urban Samoa.

There are 1.3 million new cases of diabetes per year in the United States -- about twice the 1992 number. The disease is expected to grow another 165 percent in this country by the year 2050.

In 1985, about 30 million people in the world had diabetes. By 2025, 10 times as many -- an estimated 300 million people worldwide -- are expected to have this disease.

Diabetes is the sixth leading cause of death in the United States. Worldwide, the disease contributes to nearly 1 out of 10 deaths.

Calculate Your Risk for Diabetes

Your body mass index -- a scale measuring your height against your ideal healthy weight -- can indicate your risk for developing diabetes. To stay healthy, try to keep your BMI within a normal range for your height

Does a high BMI score put you at risk?

Calculate your BMI NOW >>

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Type 1 Diabetes

Fast Fact: Between 5 percent and 10 percent of people with diabetes have type 1. This kind of diabetes affects roughly 1 million people in the United States.

The two main types of diabetes mellitus are designated type 1 and type 2. While the mechanisms that cause them differ, they're both characterized by high blood glucose levels and, if left untreated, have similar long-term consequences. Gestational diabetes, which occurs during pregnancy, resembles type 2 diabetes. However, it usually disappears after the baby is delivered.

Type 1 diabetes, also known as insulin-dependent diabetes mellitus (IDDM), is an autoimmune disease. That means the body's immune system turns inexplicably against its own cells, destroying them as if they were foreign invaders.

Body Symptoms, Chemical Changes

The destruction of the insulin-producing beta cells begins when the T-lymphocytes of the immune system fail to recognize the beta cells as friendly and turn against them. Other immune system cells, the B-lymphocytes, are recruited and the destruction proceeds. One by-product of this destruction is the formation of autoantibodies, which are directed against specific components of the pancreatic beta cells. Autoantibodies that are frequently found in people with type 1 diabetes variously target the islet cells, insulin, and other beta cell proteins such as glutamic acid decarboxylase (GAD) and tyrosine phosphatase. The presence of these antibodies signals the ongoing destruction of the beta cells; they usually appear years before you notice any symptoms or are diagnosed with diabetes.

Eventually, total destruction of the beta cells leaves the body unable to produce insulin and metabolize nutrients properly. As a result, blood sugar levels rise and cells starve, even though they are bathed by glucose-rich blood. A person with type 1 diabetes must have daily insulin injections to survive.

Who's at Risk for Type 1?

Type 1 diabetes is sometimes referred to as juvenile diabetes because it usually develops in children and adolescents, most often around puberty. It's the most common serious chronic disorder in children and adolescents. Type 1 can also develop in adulthood, although this is uncommon.

Type 1 diabetes is an inherited disease, so people with a family history of it are at greatest risk. For instance, if you have an identical twin with type 1, you have a 50 percent chance of getting it as well. If you have a sibling with the disorder, your risk of developing it is 5 percent to 10 percent; that's 10 times the rate of someone without a diabetic sibling. White people of northern European heritage are more prone to type 1 than members of other racial and ethnic groups.

Causes of Type 1 Diabetes

Scientists don't know what triggers the autoimmune response, but they've uncovered several factors that appear to be involved.

Genes

People with type 1 diabetes and their nondiabetic family members are more likely to develop other autoimmune diseases such as thyroiditis, Addison's disease (adrenal failure), and lupus. The primary gene associated with type 1 is found on chromosome 6 and involves human leukocyte antigens (HLAs). HLAs are proteins on cell surfaces that enable the body to distinguish its own cells from foreign intruders; in effect, they instruct the immune system not to attack the body's own cells. In type 1 diabetes, an unknown abnormality associated with the HLAs may lead the immune system to mistakenly identify the beta cells as alien. As a result, the immune system attacks and obliterates these cells.

Everyone inherits HLA genes. Among people with type 1 diabetes, 95 percent have HLA-DR3, HLA-DR4, and a specific HLA-DQ-Beta. However, nearly half of all Americans without diabetes also carry HLA-DR3 and HLA-DR4 genes, so having them doesn't necessarily mean you'll have the condition. Studies have shown that the siblings of a person with type 1 who share two of the same HLA variants have a 15 percent chance of getting the disease, but when only one HLA variant is identical, the risk drops to 5 percent. Although testing for HLA type can indicate a higher risk for developing diabetes, it's not conclusive and isn't used in clinical practice.

Additional genes linked to diabetes susceptibility are located on chromosome 11, near genes coding for insulin and insulin-like growth factor. Genetics doesn't tell the entire story, though. Other factors probably trigger the disease in people who are genetically vulnerable to developing type 1 diabetes.

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The Viral Connection

Some scientists believe that certain viruses, such as the coxsackievirus or those that cause mumps and German measles, may activate type 1 diabetes. According to this theory, the viruses may resemble some component of the beta cell, leading the immune system, in resisting the viral invaders, to destroy beta cells as well. Others postulate that a viral infection may somehow alter the islet cells, leaving them vulnerable to autoimmune attack. Yet another opinion is that a slow-acting virus causes the disease.

Foods

Some studies have shown an association between drinking cow's milk and eating wheat products early in life and the development of type 1 diabetes, because some children with type 1 diabetes have antibodies to a protein in cow's milk or to gluten, a protein component of grains. But this needs further study. It's still not clear whether children who have a higher risk of developing type 1 diabetes (because they have a diabetic sibling, for example) should avoid cow's milk.

Type 2 Diabetes

Fast Fact: Of the more than 18 million people with diabetes in the United States, 90 to 95 percent have type 2 diabetes. What's more, the number of adults diagnosed with this disease has increased dramatically -- by 65 percent in a little more than a decade.

A combination of abnormalities is responsible for type 2 diabetes. The first is probably insulin resistance, a condition in which body cells become less responsive to insulin. Therefore, the body must secrete more insulin to maintain normal metabolism. Insulin resistance, which is very common, doesn't cause type 2 diabetes by itself. The pancreas usually rallies to compensate for the resistance by pumping out more insulin. For most people with insulin resistance, blood sugar levels stay within a normal range. But for some, the insulin-producing cells eventually fail to keep up with the increased demand. Blood sugar levels rise, resulting in type 2 diabetes.

Essentially, type 2 diabetes is a problem of supply and demand. The pancreas supplies too little insulin to keep up with the increased demand that occurs with insulin resistance. For this reason, people with type 2 diabetes can be treated with therapies that decrease insulin demand, including diet, exercise, and drugs; with medications that increase insulin supply, such as sulfonylureas or meglitinides; or with insulin itself.

Who's at Risk for Type 2?

While genes, aging, and medications can all cause insulin resistance, being overweight and failing to get enough exercise are major culprits. Of the approximately 1.3 million Americans who will develop type 2 diabetes this year, about 90 percent are overweight or obese. (People who are overweight have a body mass index, or BMI, of 25 or more; those who are obese have a BMI of 30 and above. See chart.) Exactly how weight contributes to insulin resistance is a puzzle waiting to be solved. Recent studies have suggested that fat cells are not merely passive storage sites. Fat cells produce fatty acids and secrete proteins such as leptin, resistin, and adiponectin, which interfere with the secretion and action of insulin in the body.

In addition to people who are overweight or sedentary, people over age 65 or who have a family history of type 2 diabetes are at particularly high risk. Recently, a growing number of children and adolescents have been diagnosed with it. Typically, such children are obese and have a family history of the disease. Women who develop

diabetes during pregnancy also have a high risk. Gestational diabetes usually disappears after delivery, but as many as 50 percent of women who have this form of diabetes go on to develop permanent type 2 diabetes, often within 10 years of their pregnancy.

Race and ethnicity also play a crucial role: The disease is far more common among African Americans, Asian Americans, Hispanics, Pacific Islanders, and Native Americans than among whites. One tribe of Native Americans living in Arizona has the highest rate of type 2 diabetes in the world, with the illness affecting about 50 percent of their adults ages 30-64.

Causes of Type 2 Diabetes

Predominantly a disease of later life, type 2 diabetes generally develops after age 40. Blood sugar levels usually rise slowly and progressively over the years before they become high enough to be considered in the diabetic range.

Pre-Diabetes Conditions

Two conditions, impaired glucose tolerance and impaired fasting glucose, often precede type 2 diabetes, and for this reason are known collectively as pre-diabetes. In both types of pre-diabetes, blood sugar levels are above normal, but not high enough to be considered clinical diabetes. A conservative estimate is that more than 20 million U.S. adults have pre-diabetes and, therefore, are much more prone to developing type 2 diabetes. Like people with type 2 diabetes, those with pre-diabetes tend to be overweight, have high blood pressure and abnormal lipid levels, and have a higher risk for cardiovascular disease.

Type 2 diabetes and its underlying causes, insulin resistance and defective insulin secretion, probably have a genetic basis. But in most cases, environmental factors also play a major role. For example, before the 20th century, diabetes was virtually unknown to Native Americans. But as hunting or farming gave way to a sedentary lifestyle, higher-fat diets, and obesity, diabetes became rampant. People from many other cultures have had similar experiences after adopting "Western" habits. Thus, in people who are genetically susceptible, the influences of older age, increasing obesity, and a sedentary lifestyle all unmask the tendency to develop diabetes.

The distribution of body fat also seems to be particularly important. People who tend to store fat in their abdominal area rather than their hips -- so-called central obesity -- are more likely to become diabetic.

Preventing Type 2

Fortunately it is possible to prevent the onset of type 2 diabetes through diet and exercise. This was shown conclusively through a landmark clinical trial, known as the Diabetes Prevention Program (DPP), which looked at 3,234 Americans who had impaired glucose tolerance and therefore were at risk for developing type 2 diabetes. The study found that people who lose 5 to 7 percent of their weight and exercise about

30 minutes a day can reduce their risk by 58%. The same study found that the oral diabetes drug metformin (Glucophage) also lower risk, but less dramatically, by 31 percent.

Smaller studies in China, Finland, Europe, and Canada have shown that diet and exercise or treatment with the drug acarbose (Precose) can delay type 2 diabetes in at-risk people. However, the DPP, conducted at 27 centers nationwide, was the first major trial to demonstrate the effectiveness of lifestyle changes or drug intervention in a diverse group of overweight, high-risk people.

A new national multicenter trial, known as Look AHEAD (Action for Health in Diabetes) is now under way to determine whether the lifestyle changes that proved so effective in the DPP study can be maintained for a longer period and prevent heart attacks, strokes, and other types of cardiovascular disease in people who already have type 2 diabetes. The Look AHEAD study has enrolled 5,000 participants who will be followed for as long as 11.5 years. Results of the study will be available in the next decade.

Other Types and Causes of Diabetes

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Gestational Diabetes

Gestational diabetes mellitus occurs in about 135,000 U.S. women each year, usually around weeks 24-28 of pregnancy. Hormones produced by the placenta that hinder the action of the mother's insulin probably trigger it. This disorder can result in babies who are larger than normal, and it puts the woman and her baby at greater risk for complications at the time of delivery. Diet, insulin therapy, or glucose-lowering medications are often needed to help control blood sugar levels.

Other Types and Causes of Diabetes

Diseases or chemicals that damage or destroy the pancreas can also cause diabetes. Examples include pancreatitis, pancreatic cancer, and hemochromatosis, a disorder in which excessive amounts of iron accumulate in the pancreas and other organs.

Surgical removal of the pancreas, which is sometimes necessary to treat chronic pancreatitis or pancreatic cancer, causes a form of type 1 (insulin-deficient) diabetes. Some medications, such as corticosteroids, diuretics, beta blockers, or a new class of drugs called "atypical" or second-generation antipsychotics, originally developed to treat schizophrenia, can increase insulin resistance or decrease insulin secretion. Such drugs may thus precipitate type 2 diabetes in people who are susceptible.

Toxic substances known to cause beta cell destruction include the rat poison pyriminil (Vacor); pentamidine (Pentam), a drug used to treat a type of pneumonia associated

with AIDS; and asparaginase (Elspar), a cancer drug. All can cause a form of insulin-deficient diabetes.

Diagnosing and Managing Diabetes

Learn to recognize the symptoms of diabetes, find the best available blood test, and get the best treatments -- from traditional to alternative -- to manage your type.

Recognizing Symptoms

While type 1 diabetes usually has obvious symptoms, such as frequent urination, increased thirst, and weight loss, type 2 often develops insidiously, showing few or no symptoms. This may explain why it often goes unnoticed at first. On average, people have type 2 diabetes for nine to 12 years before they're diagnosed. To reduce this delay, experts now recommend that people ages 45 or older be regularly tested for diabetes.

Regardless of which type of diabetes you have, the symptoms of high blood sugar, or hyperglycemia, are similar.

Hyperglycemia Symptoms:

- blurry vision
- excessive thirst
- frequent urination
- feeling very hungry or tired
- weight loss (without trying)

Type 1 Symptoms

When beta cells stop producing insulin, your body's cells take in less glucose, while your liver releases more, resulting in a dramatic rise in blood sugar levels to as much as 10 times above normal. The excess sugar "spills" into your urine, drawing water with it. This accounts for the frequent urination (polyuria) and insatiable thirst (polydipsia) that can accompany this form of diabetes. It can also lead to dehydration.

You may also notice that while your appetite has increased, you've lost weight; this occurs because your cells are literally starved from a lack of nutrients and from the loss of sugar (since each gram of sugar in the urine equals four calories). Dehydration also contributes to weight loss. You may also feel fatigued and irritable, and your vision may be blurry because high sugar levels can change the shape of the lens in your eye and impair its ability to focus.

The start of symptoms in type 1 diabetes is usually abrupt and severe, occurring within days to weeks. Extreme hyperglycemia happens rapidly and leads to dehydration. Insulin deficiency causes other metabolic problems, including the unregulated breakdown of fat stores. This releases fatty acids, which are further broken down to ketones, products of fat digestion that accumulate in the blood. If your ketone concentration gets too high, your blood becomes acidic and diabetic

ketoacidosis may occur, sending you into a coma. Fortunately, the condition can usually be averted or treated.

Type 2 Symptoms

Because blood sugar levels rise slowly in type 2 diabetes, the symptoms of this more common form of the disease may develop over years or may not occur at all. The early signs and symptoms are the same as for type 1 diabetes: repeated trips to the bathroom, thirst, and fatigue. But they may develop gradually enough to be easily overlooked. Other symptoms can include recurrent urinary infections, tingling or numbness in the hands and feet as a result of nerve damage, and recurring vaginal yeast infections.

Guidelines for Diabetes Screening

The American Diabetes Association (ADA) periodically updates its screening recommendations for diabetes. Because type 1 diabetes usually is diagnosed soon after symptoms develop, the ADA does not recommend widespread screening. The ADA does recommend screening for type 2 diabetes because this form of the disease is more common and may go unrecognized for years.

The ADA recommends that everyone age 45 or over be tested for diabetes at least once every three years to ensure earlier diagnosis and intervention before complications develop. People under age 45 should also be tested as often as yearly if they have a BMI of 25 or more and have one or more of the following additional risk factors: have a mother, father, brother, or sister with diabetes are physically inactive are African American, Asian American, Hispanic American, Native American, or of Pacific Islander descent have given birth to a baby weighing more than 9 pounds or had diabetes during pregnancy have blood pressure of 140/90 millimeters of mercury (mm Hg) or higher have abnormal blood lipid (fat) levels, such as HDL cholesterol levels below 35 mg/dL or triglyceride levels over 250 mg/dL have had impaired glucose tolerance or impaired fasting glucose when previously tested for diabetes have polycystic ovary syndrome or a history of vascular problems

Does a high BMI score put you at risk?

Calculate Your Risk for Diabetes

Your body mass index -- a scale measuring your height against your ideal healthy weight -- can indicate your risk for developing diabetes. To stay healthy, try to keep your BMI within a normal range for your height. Does a high BMI score put you at risk?

Calculate your BMI >>

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Tests for Diabetes

If you display any of these symptoms or suspect that you might have diabetes, see a doctor promptly. Your doctor will take a full medical history and will probably perform one of three simple blood tests: a random plasma glucose test, a fasting plasma glucose test, or an oral glucose tolerance test. A fourth test, the glycosylated hemoglobin test, is generally used to monitor diabetes after a diagnosis has been made. All these tests require a small blood sample that a lab will analyze for glucose content.

Random Plasma Glucose Test

The random plasma glucose test measures glucose levels in your blood. If the glucose level exceeds 200 mg/dL, you probably have diabetes, especially if you've noticed symptoms. You don't have to refrain from eating before having this test done, but the glucose content of your meals can affect the results, so it's considered less reliable than the fasting plasma glucose test.

Fasting Plasma Glucose Test

This test is the current standard for diabetes diagnosis. Like the random plasma glucose test, it measures blood glucose levels, but in this case, blood is drawn after you've refrained from eating for at least eight hours so there isn't any chance of a meal interfering with the results. Normal fasting plasma glucose levels are less than 100 mg/dL, and levels at or above 126 mg/dL indicate diabetes. However, if your first test indicates diabetes, have a second one to confirm the results.

Oral Glucose Tolerance Test

Currently, the American Diabetes Association doesn't recommend an oral glucose tolerance test for detecting diabetes. This doesn't reflect any doubts about the test's accuracy. In fact, the oral glucose tolerance test is probably more sensitive than the fasting test. Instead, it's an issue of practicality: The test is considerably more time-consuming and cumbersome than the fasting plasma glucose test.

For the oral glucose tolerance test, your glucose level is measured after you've fasted overnight. You drink a sugary solution, and then another blood sample is drawn two hours later. Glucose levels will rise and fall quickly in healthy people. But they rise above normal and decrease slowly in those with diabetes. A person whose glucose level is 200 mg/dL or higher when the second blood sample is drawn has diabetes. This test, like the fasting plasma glucose test, should be repeated on another day to confirm the diagnosis.

Glycosylated Hemoglobin Test

Another measurement widely used in diabetes management is the glycosylated hemoglobin test. This blood test reflects the average blood sugar level over the preceding two to three months and will help your doctor monitor your efforts to keep your blood sugar as close to normal as possible. Because having food or a drink before the test won't skew the results, a glycosylated hemoglobin test can be performed at any time of day, even after a meal.

Hemoglobin is the oxygen-carrying protein in red blood cells. When glucose in the blood attaches to hemoglobin, the bound product is called HbA1c. (It's also known as glycosylated hemoglobin, glycated hemoglobin, or glycohemoglobin.)

Healthy, nondiabetic people usually have an HbA1c level of about 5 percent, meaning that approximately 5 percent of their hemoglobin molecules have glucose attached to them. If your diabetes has been well controlled during the previous two to three months, the HbA1c level should be close to normal, that is, less than 7 percent. If your blood sugar has been high, the level will be elevated. Studies have shown that keeping HbA1c levels low reduces the chances of developing complications of diabetes. It is therefore wise to keep HbA1c levels as close to the nondiabetic range as is safely possible. The American Diabetes Association advises people with the disease to strive for an HbA1c level of 7 percent or less.

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Degrees of Diabetes

"Not Quite" Diabetes

Some of these tests can also uncover lesser degrees of abnormal glucose metabolism, which may eventually develop into full-blown diabetes. A fasting plasma glucose reading between 100 mg/dL and 126 mg/dL indicates impaired fasting glucose. If this is the case and an oral glucose tolerance test is performed, a two-hour glucose result between 140 mg/dL and 200 mg/dL is considered impaired glucose tolerance. Both conditions raise your risk for diabetes and cardiovascular disease. To monitor these conditions, it's best to have annual glucose tests.

Determining Your Type

If you're a slim 17-year-old with elevated blood sugar levels and ketones in your urine, it's very likely that you have type 1 diabetes. If you're an overweight 55-year-old, chances are your diabetes is type 2. But determining the type of diabetes a person has isn't always straightforward.

Thanks in part to the allure of super-sized, fat-laden fast food and the TV set, more young people than ever before are overweight. As a result, type 2 diabetes has become increasingly common in youngsters. And while type 1 diabetes is much more common in younger people, as many as 10 percent of those affected are first diagnosed when they are older than 40. Therefore, your doctor must consider numerous factors in order to classify your diabetes, including weight, family history, and laboratory results.

Dealing with Your Diagnosis

Learning that you have diabetes is traumatic, and it can set off an emotional crisis. That's understandable: Diabetes is a chronic, lifelong disease that affects nearly all aspects of your daily life, including the food you eat, the activities you pursue, and possibly even your choice of a career. Indeed, because of the amount of self-care required, diabetes places an extraordinary burden on those it affects. You must pay special attention to diet and exercise. You may need to test your blood glucose levels several times a day. In addition, you may have to take oral medication or give yourself multiple daily insulin injections. And if you have type 2 diabetes, you'll probably need to take medications for high blood pressure and cholesterol.

But ignoring diabetes or failing to treat it correctly only paves the way for dangerous episodes of hyperglycemia, ketoacidosis, and hypoglycemia (low blood sugar). It may also result in serious long-term complications, such as blindness, kidney failure, and heart disease. Those who fare best and lead the healthiest lives accept their disorder, learn as much about it as they can, and work vigilantly to control their blood glucose levels.

Managing Type 1 Diabetes

The treatment regimens needed to achieve and maintain near-normal, or "tight," blood sugar control differ for type 1 and type 2 diabetes. Type 1 treatment centers on replacing insulin to offset the body's inability to produce it. Type 2 treatment typically relies on exercise, weight loss, and one or more medications to overcome insulin resistance and compensate for the insulin shortfall. Insulin injections, though, often become necessary. Most people with type 2 diabetes also have the added burden of managing one or more other conditions, such as obesity, high blood pressure, or high cholesterol.

Your treatment goal, regardless of which type of diabetes you have, is to keep your blood sugar levels as close to normal as possible to prevent damage to your eyes, kidneys, heart, nerves, and blood vessels.

Insulin Replacement Therapy

Insulin is the foundation of therapy for people with type 1 diabetes. Insulin, at least in its present form, cannot be taken orally because digestive enzymes in the gastrointestinal tract destroy it. So it must be injected, usually several times a day. Inhaled, oral, and skin-patch delivery systems are being studied, but are not currently

approved for general use. Diet and exercise are also integral to treatment because both affect blood sugar levels and insulin requirements.

The goal of insulin replacement is to mimic the levels normally supplied by the pancreas. This means maintaining a small, stable quantity in your bloodstream between meals and taking a larger, measured dose with meals to limit the increase in blood sugar that would otherwise occur. Your doctor initially determines the insulin regimen, including the pattern of injections and the number of doses, by looking at your blood glucose, diet, and activity levels. Higher blood sugar, bigger meals, and low amounts of activity require more insulin, while lower blood sugar, smaller meals, and increased activity require less.

Monitoring Your Insulin Levels

Because food, activity, and medications all influence your blood sugar and because they affect each individual differently, it's important to perform frequent checks. By providing a snapshot of blood sugar at a given time, self-monitoring gives you the information you need to tailor your treatment plan. For example, as your blood sugar fluctuates, you can adjust the doses and timing of insulin throughout the day and better maintain your target blood sugar levels.

Managing Type 2 Diabetes

Many people with type 2 diabetes may not require frequent insulin injections or glucose monitoring. Diet, exercise, and a variety of oral drugs or insulin, either alone or in combination, are usually the backbone of treatment.

Weight Loss as Therapy

Because the vast majority of people with type 2 are overweight and extra pounds can exacerbate or even cause the disease, the first line of treatment is weight loss. For many people, dropping only a modest amount (10 pounds, for example) may be all that's needed to help reduce insulin resistance, restore insulin secretion, and keep blood sugar levels within the normal range, at least initially. A long-term plan for diet and exercise is also crucial.

Oral Medication

However, for most people, evidence suggests that over time, diet and exercise fail to do the job. When they no longer suffice, medication is added to the regimen. Several different classes of drugs are available. They help lower blood glucose levels in various ways: by stimulating the release of insulin, providing insulin, lessening insulin resistance, diminishing the rate of carbohydrate absorption from the small intestine, or decreasing glucose production in the liver.

Although insulin is often used as a last resort, after oral medications have failed, there's growing evidence that it may be advantageous to use it earlier in the course of

type 2 diabetes. About 30 percent of people with type 2 diabetes currently use insulin, and twice as many will probably eventually need it in order to maintain tight control.

The Benefits of Team Treatment

You are the most important person involved in your treatment. But the attention and advice of a skilled physician, and often a team of health professionals, is vital to helping you develop the daily practices and lifelong habits necessary for effective diabetes management.

The Best Doctors for You

In many instances, particularly for type 2 diabetes, your primary care physician may be able to provide all that's needed to ensure good care. But if extensive monitoring and adjustment of your diet, medications, and exercise regimen become necessary, you'll probably best be served by a multidisciplinary team of professionals. Ideally, such a team would include your primary care doctor or an endocrinologist who specializes in diabetes, a diabetes educator (usually a nurse or nurse practitioner), and a dietitian.

The Most Important Specialists for You

Other professionals may be called to your team from time to time. For instance, diabetes puts you at risk for eye disease and blindness, so it's important to visit an ophthalmologist regularly. Because the disease can damage the peripheral nerves that provide sensation to your feet, proper foot care is essential. Therefore, you may benefit from seeing a podiatrist periodically. If efforts to prevent the development of kidney or vascular disease fail, you may need to consult with a nephrologist (kidney specialist), cardiologist, or vascular surgeon.

Intensive Treatment Pays Off

Just a few decades ago, experts weren't certain whether strictly controlling blood sugar levels offered people with diabetes long-term health benefits. Many health professionals didn't think fluctuations in blood sugar levels were detrimental and believed the enormous effort needed to maintain strict control of glucose wasn't worthwhile. By proving those theories wrong, the Diabetes Control and Complications Trial (DCCT) has had a profound impact on diabetes treatment.

In 1983, the DCCT Research Group, sponsored by the National Institute of Diabetes and Digestive and Kidney Diseases, embarked on the largest, most comprehensive study of type 1 diabetes ever undertaken, enrolling 1,441 people at 29 medical centers in the United States and Canada. The 10-year DCCT revealed that keeping blood sugar levels as close to normal as possible significantly reduces the likelihood of complications such as eye, kidney, and nerve damage. Moreover, a follow-up investigation known as the Epidemiology of Diabetes Interventions and Complications (EDIC) study, which continues to follow DCCT participants, has so far

shown that the health benefits of tight glucose control extend for the longer term -- and may even get better with time.

How the Study Worked

To find out if strict control had any value, the DCCT compared the effects of then-current conventional diabetes treatment to more intensive therapy. Volunteers were divided into two groups. The control group was treated conventionally, receiving insulin once or twice a day and not aiming for any specific level of glucose control.

The intensive therapy group received at least three daily doses of insulin via injection or an insulin pump, with the doses selected on the basis of glucose levels tested at least four times a day. Doses were adjusted to account for fluctuations caused by eating and exercising so as to maintain blood sugar levels at 70–120 mg/dL before meals and less than 180 mg/dL after meals. The overall goal was to lower the level of glycosylated hemoglobin, or HbA1c, so it stayed within the normal range. Participants in this group also received extensive diabetes education.

Fewer Long-Term Complications

The volunteers were followed, on average, for more than six years and watched for the onset or progression of eye, kidney, or nerve disease. Compared with the control group, the people receiving intensive therapy had average blood sugar levels that were 70-80 mg/dL lower and HbA1c readings that were 2 percent lower (7 percent vs. 9 percent).

Intensive therapy reduced the risk of developing diabetic retinopathy, a degenerative condition affecting the retinas of the eyes, by 76 percent. Tight control of blood sugar also lowered the risk for kidney disease (by 35 to 56 percent) and nerve disease (by 60 percent). In addition, the progression of preexisting eye disease fell by 54 percent. And subsequent follow-up of the DCCT patients in the EDIC study suggests at least a 75 percent reduction in eye and kidney disease.

Although the overall youth of the participants (average age 27) precluded predictions about heart disease, the study did show that those undergoing intensive therapy had a 35 percent lower risk of developing high cholesterol, a major contributor to heart disease.

Although the DCCT demonstrated that tight glucose control has positive long-term effects, it also uncovered some disadvantages. Compared to conventional therapy, intensive treatment tripled the risk for hypoglycemia (low blood sugar). People who kept to the strict blood glucose regimen also gained some weight.

Benefits Outweigh Drawbacks

Still, the study's investigators concluded that for people with type 1 diabetes, the impressive long-term benefits outweighed the short-term drawbacks. Although the

DCCT/EDIC studies didn't include people with type 2 diabetes, other studies have shown that tight blood glucose control minimizes their risk for complications as well. For example, the United Kingdom Prospective Diabetes Study followed more than 4,000 people newly diagnosed with type 2 diabetes who were placed on different treatment programs for more than a decade. Those who were treated intensively with insulin or oral hypoglycemic medications (sulfonylureas or metformin) had a lower incidence of major eye disease than those treated only with diet. This evidence suggests that intensive therapy is the optimal treatment goal for people with type 2 as well as type 1 diabetes.

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Natural and Alternative Treatments

The immense growth in alternative therapies during the last 20 years has not bypassed diabetes treatment. Most people with diabetes who turn to alternative therapies do so to relieve the symptoms of complications, not to control their blood sugar levels.

For instance, acupuncture is sometimes used to control neuropathy, the painful nerve damage of diabetes. And biofeedback, which teaches people how to control some seemingly involuntary processes, is sometimes helpful for incontinence, one potential consequence of neuropathy.

While some mineral supplements have been studied to see if they can help people with diabetes control their blood sugar levels, so far not enough is known about such approaches to warrant recommending them. The most commonly studied supplements for managing diabetes are:

Chromium. Chromium is needed to make glucose tolerance factor, which aids the action of insulin. Several studies report that chromium supplementation may yield better diabetes control in people who are chromium-deficient. However, supplementation has shown no benefit for those who have adequate amounts of the mineral, and few people, including few people with diabetes, have a chromium deficiency.

Magnesium. Not having enough magnesium may increase insulin resistance. It may also impair secretion of insulin by the pancreas and contribute to certain complications of diabetes. But scientists still don't fully understand the relationship between magnesium and diabetes. As with chromium, the available evidence doesn't suggest that magnesium deficiency is a significant risk factor for diabetes, and the value of supplements remains speculative.

Vanadium. Some early studies of the compound vanadium found that it normalized blood sugar levels in rats with type 1 or type 2 diabetes. A more recent study found that when people with type 2 diabetes were given vanadium, they became slightly more sensitive to insulin and were able to lower their insulin doses. However, this effect did not extend to people with type 1 diabetes. And research on vanadium is

limited. Researchers still don't understand exactly how it works or whether it has any side effects.

A final word of warning: "Natural" and "alternative" are not synonymous with safe or effective. If you want to try an alternative therapy, talk to your doctor first. Certain supplements, for instance, may be especially dangerous for someone with kidney disease.

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Monitoring Your Blood Sugar Levels

Blood glucose levels must be measured regularly to control diabetes

Reaching Glucose Goals

Keeping diabetes under control may require measuring blood sugar levels regularly. This process traditionally involves pricking your finger to get a small blood sample, which you dab onto a strip. You then insert the strip into a monitor that reads your glucose level. While most people still use this method, some are choosing newer self-monitoring equipment that eliminates the need to prick a finger.

If you're taking insulin, monitoring your blood sugar level is crucial because it varies throughout the day and you may not always realize when it dips too low or spikes too high. Regular monitoring lets you know if your blood sugar levels are in the healthy range. Close monitoring can also help you adjust the timing and amount of insulin doses, which must be balanced with food intake and exercise.

Besides helping you reach your glucose goals, self-monitoring can help prevent and treat hypoglycemia, or low blood sugar. Even if you're not taking insulin, self-monitoring may occasionally be useful to show how you're doing. This is especially true for people taking medications that can cause hypoglycemia, such as the class of diabetes drugs known as sulfonylureas.

Frequency of testing varies. Some people may need to check their blood sugar levels only once a day or when suffering from a brief illness, such as a stomach flu; others may have to do so four or five times a day. Your doctor can help you determine how often, and when, to check your blood sugar levels.

Using Glucose Meters

Glucose meters are standard equipment for many people with diabetes. A drop of blood from a prick of a finger or forearm is all you need to use the meter. Most people get their sample using spring-loaded lancing devices that stick your finger at the push of a button. Most look like oversize pens, are generally painless, and do the job in seconds.

Measuring Procedures: You place the blood sample on a special plastic test strip that you insert into -- or is contained within -- the meter, which measures the glucose in the sample. Each batch of strips differs, and to ensure accuracy, you must recalibrate your meter every time you start a fresh batch. This procedure is simple and takes only seconds. Periodically, it's also important to use a special solution to test your meter to make certain it's giving accurate readings.

Cost: Most meters are small and portable and cost \$50-\$80. People with less manual dexterity may find a bigger style easier to handle. If you have poor eyesight, you may want one with a large-print digital display or one that "talks." Processing time differs from model to model, but most take between 5 and 30 seconds to give a reading. Certain devices require more blood than others, and some meters have memories that store the results of many tests. The most sophisticated models can save information from your glucose readings and insulin doses, and record your notes about exercise and diet.

Some health plans cover only particular models, so check with your insurer before purchasing one. Pricing test strips is also prudent because their cost is the major expense of self-monitoring, and most meters are compatible with only one type of strip.

"Prickless" Glucose Monitoring

Because traditional blood glucose monitoring requires considerable effort, many people with diabetes test themselves less frequently than recommended. But several new devices may encourage people, particularly those who dislike taking blood samples, to test themselves more often. Although FDA-approved only for certain people, these devices provide a glimpse into the future of less-invasive glucose monitoring, when testing will be effortless, automatic, and continuous. Another device, the Lasette, substitutes laser energy to pierce the skin and obtain a blood sample.

New Devices and Measuring Methods

GlucoWatch Biographer

One of the newest methods for monitoring glucose uses a gadget that James Bond would love. The GlucoWatch Biographer, available only by prescription, is a wristwatch-like device that has sensors on its underside. In 2001, the GlucoWatch Biographer became the first automatic, noninvasive blood sugar monitor approved by the FDA. In 2002, a second-generation device, the GlucoWatch G2 Biographer, was approved for use by adults and children over age 6. The device applies a very low electric current to extract fluid samples from the skin every 10 minutes for 13 hours, even during sleep. The device stores the readings and sounds an alarm if your blood sugar reaches a preset level.

Because it provides frequent readings, the GlucoWatch Biographer offers a comprehensive look at blood sugar levels over the course of the day, helping people with diabetes detect patterns and trends. For instance, someone using the device can get up to 78 readings in a 13-hour period, while he or she may take just one or two readings in the same time frame using the finger-prick method.

FDA approval of the device followed clinical trials that compared GlucoWatch Biographer readings with traditional finger-prick blood glucose tests and found the measurements fairly consistent. However, up to a quarter of the time, its results were off by more than 30 percent. It had more trouble detecting very low glucose levels than very high ones. It wasn't accurate if the patient's arm was too sweaty -- a concern because perspiration is common with hypoglycemia. Finally, it can cause some degree of skin irritation in up to half of the people who use it. Because it's sometimes inaccurate, the GlucoWatch Biographer shouldn't replace finger-prick blood tests. Instead, use a traditional glucose monitor to confirm any result that triggers an alarm and before making any treatment decisions.

MiniMed Continuous Glucose Monitoring System

This device uses a sensor implanted just under the skin in the abdomen to record glucose levels continuously for up to three days. A physician can then review the glucose profile and determine how sugar levels fluctuated in response to diet and activity levels and medications. Currently the device is available only by prescription, and a doctor needs to download and interpret the data on glucose fluctuations. As such, it is a helpful tool for a doctor to have so he or she can adjust your treatment, if necessary. Eventually, the technology may improve so that patients can print glucose readings on demand and make their own adjustments in diet or medications -- but that is not yet possible with the current device.

Lasette

The Lasette doesn't eliminate the need for a glucose meter, but it does enable you to get the blood sample without using a lancet. This device uses a tiny laser beam to perforate your finger, so drawing blood is nearly painless. Although more comfortable than traditional testing methods, it's expensive (about \$1,000). And because it

Doing Your Research

Ask your insurance company what supplies it covers. Medicare, for example, reimburses people for the cost of one meter a year and glucose testing supplies, with the number of strips determined by whether you use insulin. A good resource is the American Diabetes Association's "Annual Resource Guide for Diabetes Supplies."

No matter what equipment you choose, your medical team will explain how to use it properly and how to keep a log of blood glucose readings, insulin shots, and food intake. By keeping a daily record of your blood tests, you can tell how well you're managing your diabetes and, with the advice of your healthcare team, can make adjustments in your treatment plan.

Diet and Exercise: The Foundation of Treatment

Diet and exercise combined with a medical treatment plan is the base of living healthy with diabetes. Here, learn to make a type 1- or type 2-specific plan.

Diet Therapy for Type 1 and 2

Diet therapy is crucial to treating diabetes, but the approaches are quite different for type 1 and type 2. In type 1 diabetes, your diet must be coordinated with your insulin regimen. Because the goal is to match insulin delivery to insulin requirements, which are largely dictated by meal size and content, understanding the impact of specific foods on your blood sugar levels is key. On the other hand, type 2 diabetes is largely a consequence of overeating, so cutting calories is vital. In both forms of diabetes, it is important to consume the right mixture of carbohydrates, proteins, and fats every day to keep blood sugar levels as normal as possible throughout the day.

One Dietary Recommendation Applies Universally: Aim for a diet low in saturated fats and high in fiber, fruit, and vegetables. Why? Because both types of diabetes are associated with cardiovascular disease. The American Diabetes Association and the American Dietetic Association recommend that people with diabetes get most of their daily protein requirement from beans, grains, and vegetables, not meat. By cutting down on animal proteins, your diet will have less fat and cholesterol. And high-fiber foods may help lower both your cholesterol and blood sugar levels. A 2000 study in the *New England Journal of Medicine* found that a diet rich in fiber (about 50 grams per day) lowered blood sugar levels by 10 percent.

Diet Goals for Type 1

In the past, people with type 1 diabetes had to plan meals around a set schedule of insulin injections. Now, the emphasis is on tailoring insulin doses around your eating habits. This approach is more flexible but still requires effort.

Frequent monitoring of blood sugar levels allows you to adjust your insulin dose to match glucose levels and make "mid-course" corrections, if necessary. To keep blood glucose levels from fluctuating too much, however, it's important to maintain a consistent eating pattern. Erratic habits make tight control particularly difficult. You may also find that it's important to have a snack just before bedtime to prevent a hypoglycemic reaction during the night.

Diet Goals for Type 2

Because most cases of type 2 are caused in part by obesity, a reduced-calorie, low-saturated-fat diet is often warranted. In addition, many people with type 2 diabetes have high blood pressure and may need to reduce their salt intake. While losing weight and keeping it off is a constant challenge, it can have enormous rewards. Even

a modest weight loss of 5 to 10 pounds can lower blood sugar levels enough to permit cutting back on glucose-lowering medications or dispensing with them altogether.

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Planning Your Diet

No matter which type of diabetes you have, the foods emphasized in your eating plan are good for everyone in your family. A diet low in saturated fats, cholesterol, and sweets, but high in fiber, fruits, vegetables, and whole grains can help you sidestep many common ailments, such as heart disease and high blood pressure, and can go a long way in helping you live a longer, healthier life.

Important Allies: Dietitians and Nutritionists

A dietitian or nutritionist can provide invaluable help as you develop a personalized eating plan. After all, you're not making temporary adjustments; this is a lifelong commitment. Using food to prevent hypoglycemia, or to treat it if it occurs, is also a critical safety issue.

People who've been recently diagnosed are usually asked to keep a food diary to track their calories, carbohydrates, and fats. A dietitian can instruct you on how to meet your caloric and blood glucose needs by counting fat and carbohydrate grams, measuring portions, and adjusting your food intake to the amount of exercise you get. If you prefer, more structured menus have been developed specifically for people with diabetes. Check your library or bookstore, or contact the American Diabetes Association.

Even once you've learned to manage your diabetes, you may find that a change in schedule, a trip, or a move to another part of the country necessitates some adjustments in your meal plan. On such occasions, consult your dietitian.

Monitoring Carbohydrates

People with diabetes should try to get about 45 to 55 percent of their daily calories from complex carbohydrates -- that is, from vegetables, whole-grain breads and cereals, and simple sugars that exist naturally in fruit and low-fat milk.

Watching your carbohydrate intake is particularly important because most of the glucose flooding your bloodstream after you eat comes from the breakdown of carbohydrates. But not all carbohydrates are equal. The amount of glucose and the speed with which it's released into your bloodstream varies, depending on the food's manner of preparation, its fiber content, and other foods it's combined with. For example, raw vegetables are digested more slowly than cooked ones; eating fats with carbohydrates retards digestion; and drinking a glass of apple juice raises blood sugar more rapidly than eating an apple.

Targeting Fats

Recently there has been a keen interest in high-fat, high-protein, low-carbohydrate diets as a means to lose weight. Although short-term studies have shown that these eating plans can be an effective way to drop pounds, no long-term studies have verified that they are more effective than other low-calorie diets. In addition, some of these diets fail to distinguish between unhealthy saturated and trans fats (which increase the risk of heart attacks, strokes, and other forms of cardiovascular disease) and healthier unsaturated fats (which may lower cardiovascular risk when consumed in moderation). As a result, experts question the safety of the high-fat, low-carbohydrate diets in the long run, especially in regard to cardiovascular risk. That's why no more than 20 to 35 percent of your total daily calories should come from fat, and less than 7 percent from saturated fat.

Saturated Fat: Saturated fat is notorious for raising unhealthy LDL cholesterol levels. And it speeds the artery-clogging process called atherosclerosis, raising your risk for heart disease. It's found in meat, dairy products, and certain vegetable oils, such as palm oil and coconut oil, and it's generally solid at room temperature.

Trans Fats: Trans fats, partially saturated vegetable oils produced through a chemical process called hydrogenation, also pose health dangers. These fats -- commonly found in margarine, deep-fried foods, commercial baked goods, and many other products -- are identified on the label as "hydrogenated" or "partially hydrogenated." They raise the harmful blood lipids LDL cholesterol, triglycerides, and lipoprotein(a), all of which have been linked to heart disease. And they depress the healthy HDL cholesterol.

Best Options: Instead, opt for polyunsaturated or monounsaturated fats. Polyunsaturated fats (such as corn, safflower, and soybean oils) and monounsaturated fats (such as olive, peanut, and canola oils) don't raise cholesterol levels. Indeed, research indicates that monounsaturated oils reduce LDL cholesterol and increase HDL cholesterol.

The best way to reduce the saturated fat in your diet is by limiting your consumption of red meat, fatty dairy foods, and poultry skin. Choose skim or 1 percent milk, and buy light or low-fat cheeses and yogurt. To keep trans fats to a minimum, avoid margarine, shortening, and commercial baked goods. When eating dessert, stick with ice milk, low-fat or nonfat frozen yogurt, or fat-free ice cream.

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Alcohol, Sugar, and Eating Out

Healthy Eating Away from Home

For people with diabetes, eating out -- whether at a restaurant, a function, or a friend's home -- is always a challenge. Portions can be hefty and packed with calories and saturated fat. When you eat out, it may help to follow these simple guidelines:

Ask how entrees are prepared, and avoid fried foods or dishes served in heavy sauces or gravies.

Choose skinless chicken, fish, or lean meat that's broiled, poached, baked, or grilled.

Get the server's advice in selecting healthy, low-fat dishes. Restaurants are used to dealing with special diets.

Don't feel obliged to clean your plate. Eat a reasonable portion, and take the remainder home.

Choose steamed vegetables and salads to accompany your meals. Request low-calorie dressings and toppings, and if they're not available, ask for all dressings, butter, and sauces to be served on the side so you can use them sparingly.

If you take insulin and know your meal will be delayed, time your injection appropriately. You may need to eat a roll or piece of fruit to tide you over.

If you crave a dessert, share it.

Limiting Sugar

Although sugar and so-called concentrated sweets that contain a lot of sugar were once considered dangerous for people with diabetes, small amounts won't necessarily thwart your effort to control your blood glucose. Most people with type 1 and type 2 diabetes can consume some sugar as long as they count it as a carbohydrate and don't add it to their diet indiscriminately. Of course, they must adjust their insulin dosage accordingly. Nevertheless, experts still advise limiting simple sugars because they raise blood glucose levels quickly. Artificial sweeteners, such as saccharin or aspartame (NutraSweet), don't raise blood glucose levels.

Consuming Alcohol

You can drink alcohol in moderation if you account for the calories in your daily meal plan. Research has shown that drinking moderate amounts of alcohol can lower heart disease risk. Moderate drinking is defined as one standard drink a day for women and up to two a day for men.

You must be cautious, however. Alcohol can cause low blood sugar or further exacerbate a low blood sugar reaction. And because some effects of alcohol (such as drowsiness or slurred speech) resemble those of hypoglycemia, it can be hard to recognize a true diabetic emergency. Finally, while moderate drinking may have

benefits, there is always the risk of developing alcohol dependence. Certainly no one should drink and drive, and drinking during a pregnancy can hurt your baby.

What Is a "Standard Drink"?

12 ounces of beer, or
5 ounces of wine, or
1.5 ounces of 80-proof distilled liquor

The Importance of Exercise

In the management of diabetes -- and many other diseases, for that matter -- the benefits of exercise can't be overstated. Exercise helps control weight, lower blood pressure, decrease harmful LDL cholesterol and triglycerides, raise healthy HDL cholesterol, strengthen muscles and bones, reduce anxiety, and improve your general well-being. There are added benefits for people with diabetes: Exercise lowers blood glucose levels and boosts your body's sensitivity to insulin, countering the insulin resistance common in type 2 diabetes.

Regular, moderate exercise may also help prevent the onset of type 2 diabetes, particularly among those at high risk. As a result, experts urge everyone with diabetes or at high risk for it to include some physical activity in their daily routine.

How Exercise Affects Glucose

Exercise consumes nutrients, including glucose, and forces cells to draw on the glucose stored in muscle. Once this is depleted, the body turns to sugar in the blood for energy. This would cause a drop in the blood glucose level were it not for your liver, which under normal circumstances produces enough glucose to replenish the blood's supply. The demand for blood sugar can continue even when exercise has ended because muscles continue to remove glucose from the blood to restock their reserves.

For people with diabetes who use insulin, several factors can alter the usual balance between glucose supply and demand and cause hypoglycemia. If exercise occurs when there's too much insulin -- for example, when insulin levels peak after an injection -- the exercising muscle soaks in even more glucose than usual. And your liver's ability to make glucose is diminished. This combination can result in hypoglycemia. Finally, because blood flow increases during physical exertion, absorption of insulin from injection sites may be accelerated, especially if it's injected near the muscles being used. Certain medications for type 2 diabetes, especially sulfonylureas, can also cause blood sugar levels to drop too low during exercise.

So while exercise is encouraged, it can set the stage for low blood sugar, including severe hypoglycemia. To prevent this problem, you'll need to check your blood sugar levels and adjust your diet, insulin doses, and injection sites accordingly.

Exercising Safely

If you have diabetes, consult your doctor before starting or changing a fitness routine. This is especially important if you are overweight or have a history of heart disease, peripheral vascular disease, or diabetic neuropathy. Your doctor may recommend a stress test to make sure it's safe for you to exercise and to determine the intensity that's best for you. You may also need special footwear to protect your feet.

Exercise doesn't have to be strenuous to be beneficial, but try to spend at least 30 minutes a day engaged in some physical activity. While one person may prefer walking, another may choose something more vigorous, such as biking, swimming, or even running a marathon, provided his or her doctor approves.

The Best Times for Exercise

In general, the best time to exercise is one to three hours after eating, when your blood sugar level is likely to be higher. If you use insulin, it's important to test your blood sugar before exercising. If the level before exercise is below 100 mg/dL, eating a piece of fruit or having a small snack will boost it and help you avoid hypoglycemia. Testing again 30 minutes later will show whether your blood glucose level is stable. It's also a good idea to check blood sugar levels after any particularly grueling workout or activity. If you're taking insulin, your risk of developing hypoglycemia may be highest 6-12 hours after exercising.

Because of the dangers associated with diabetes, always wear a medical alert bracelet indicating that you have diabetes and whether you take insulin. Also keep hard candy or glucose tablets with you while exercising in case your blood sugar drops precipitously.

Foot and Vision Problems

Properly fitting footwear is necessary for anyone who exercises regularly, but it's even more important for people with diabetes, who are more likely to have nerve damage that can affect their feet. This nerve damage can result in peripheral neuropathy, which may make your feet less sensitive to irritation and pain. As a result, you may not be aware of the discomfort of ill-fitting shoes, or you may not realize that you have suffered a foot injury, allowing the situation to worsen. Diabetes can also impair your circulation, impeding your natural healing capacity and your ability to fight infection. Fortunately, if you are diabetic and want to exercise, you can take special precautions to protect the health of your feet. If you have severe diabetic eye disease, don't begin exercising without permission from your doctor. If you have active retinopathy, your doctor may discourage you from participating in high-impact sports (jogging, diving, boxing), since they may precipitate bleeding into the eye.

The Health Benefits of Walking

A recent study of 5,125 nurses with diabetes found that moderate exercise such as walking appears to reduce the risk of cardiovascular disease. The participants didn't have a history of cardiovascular disease, stroke, or cancer in 1980, when the Harvard researchers began collecting detailed information on their physical activity. By 1994, 323 of these women had developed heart disease or had a stroke. The researchers found, though, that the women who exercised moderately or vigorously at least four hours a week were 50 percent less likely to develop these problems than the women who exercised less than an hour a week.

Walking was the most studied exercise, and not surprisingly, the more the women walked, the lower their risk. But speed also mattered. While there was nearly a 50 percent reduction in risk for those who walked at an average pace, the gains were even greater for those who walked briskly.

Insulin Therapy for Type 1 Diabetes

Insulin therapy is the basis of treating Type 1 diabetes. Here, learn about the types of insulin available and how to set up an individual treatment plan.

Insulin Therapy

Before 1921, the year that Sir Frederick G. Banting and Charles Best discovered insulin, children who developed type 1 diabetes usually died within a few years of being diagnosed. Although insulin is not a cure, its discovery was the first major breakthrough in diabetes treatment, and it remains the primary therapy for type 1 diabetes.

Insulin is essential to metabolism and good health and if it isn't manufactured by the beta cells in your pancreas, it must be replaced by injection

New Types of Insulin

Insulin can be prepared from beef or pork pancreas, or from bacteria or yeasts that have been genetically engineered to make human insulin. Today, the vast majority of insulin used in the United States is human insulin. The various types of insulins can be used alone or in combination to simulate normal insulin secretion and to help you keep blood sugar levels under control. In addition, several new modified forms of insulin offer either a very long duration of action or very rapid onset with a short duration.

While it's possible to estimate when the insulin peaks and how long it may remain active, there's no guarantee that the pattern will remain consistent. A larger dose usually lasts longer than a smaller one, but the absorption of insulin can vary, so intermediate- and long-acting insulins may peak at different times on different days.

The "Honeymoon" Phase

Many people just diagnosed with type 1 diabetes show signs of a remission shortly after beginning insulin therapy. In that time, the need for insulin may diminish or even disappear. Experts refer to this period of stable, easy-to-manage diabetes as the honeymoon phase. Although people may think the disease has vanished, the impaired beta cells that ordinarily secrete insulin have perked up only temporarily. Enjoy this respite, which can last for months, but understand that the underlying autoimmune disease process still exists. Eventually, you'll need to either resume taking or increase your doses of insulin. The honeymoon can be extended if insulin therapy is continued, and most doctors advise this.

Types of Insulin

Very rapid-acting insulin. Relatively new, very-rapid-acting insulins work within 15 minutes of injection. They peak sooner than rapid-acting insulin (see Table 3), so you can take them closer to mealtime, but they don't last as long. The shorter duration of these very-rapid-acting insulins is helpful because the lingering effects of rapid-acting insulin can cause episodes of hypoglycemia if the next meal isn't eaten on time.

Rapid-acting insulin. Rapid-acting insulin, sometimes referred to as short-acting or regular insulin, starts to lower blood sugar levels about 30 to 60 minutes after injection. Rapid-acting insulin is clear in appearance and normally taken 30 to 45 minutes before a meal, with its action peaking in one to two hours and usually lasting five to eight hours.

Intermediate-acting insulin. Intermediate-acting insulin, which is cloudy in appearance, doesn't begin to work until approximately two hours after it's injected. Depending on the medication used, peak effect occurs anywhere from four to 15 hours after injection, although it may remain active for as long as 18 to 24 hours.

Long-acting insulin. Long-acting insulin has a slow onset and a relatively small peak effect and can last for as long as 36 hours.

Developing a Plan

No regimen works equally well for everyone. The type of insulin, how much is used, and how often it is injected depends on the individual. Your goal is to maintain a blood sugar level that's as close to normal as possible without experiencing hypoglycemia.

Combining Insulin Types

To replace insulin in ways that are similar to the body's natural production of this hormone, many people combine different types of insulin into one injection. Once you've been instructed on how to do this properly, you can mix your own insulin, usually immediately before taking it. (Glargine [Lantus] insulin can't be mixed with other types; it must be injected separately.)

Premixed insulins, containing a fixed ratio of rapid- and intermediate-acting insulins, can also be used. However, most diabetes experts discourage using fixed combinations for type 1 diabetes because the mixtures don't allow for flexible dosing

of rapid-acting or very-rapid-acting insulin (since you must adjust the amount of intermediate-acting insulin when you change doses of these faster-acting insulins).

Insulin may be refrigerated or stored at room temperature, but not frozen. Discard insulin that has expired or looks strange.

Multiple Daily Injections

Most people with type 1 diabetes need multiple daily injections for acceptable glucose control. In the past, therapy for this kind of diabetes usually involved taking one or two fixed doses of insulin to carry you through the day. But because the Diabetes Control and Complications Trial proved that aggressive therapy reduces the risk for complications, most doctors now recommend at least three injections a day.

A typical program includes a combined intermediate- and rapid-acting insulin injection before breakfast (to control blood sugar after breakfast and lunch), an injection of rapid-acting insulin before dinner, and another injection of intermediate-acting insulin before bed (to control sugar overnight). But the program must be tailored to your daily schedule, meal pattern and content, and exercise. In addition, you must frequently monitor your blood sugar levels, and if you follow a demanding insulin regimen, remain in close contact with your medical team.

Administering Insulin

Insulin can't be taken orally because acid and digestive enzymes in your stomach destroy it. While most people are initially skittish about giving themselves several shots a day, injecting insulin quickly becomes routine, and the equipment available today makes injections virtually painless. Most people use syringes or insulin "pens," but other tools, such as jet injectors and insulin pumps, are also available.

Parents often help very young children, but otherwise most people give themselves injections. Whether you'll be injecting yourself or someone else, a diabetes educator will teach you how to measure, prepare, and administer the injections.

Syringes

Almost all insulin in the United States has a concentration of U-100, meaning 100 units per cubic centimeter, and insulin syringes are designed for this concentration. Syringes can hold a total of 100, 50, or 30 units. Choose the size of your syringe based on the total dose of your injection. After the injection, cap the syringe and place it in a plastic or metal container for disposal. You can use your own syringes for more than one injection. Skin infections are rare. Never use a syringe that someone else has used, and never give anyone a syringe that you have used.

Pen Injectors

Several aids are available to make insulin injections easier, the most common of which is the pen injector. Resembling a ballpoint pen, it uses disposable needles and insulin cartridges. Many people find it convenient because it's portable and discreet, and because it provides multiple accurate doses without measuring and filling syringes. The pens carry up to 150 units of insulin. You select the desired dose of insulin simply by turning a dial, and then deliver it by pressing a plunger on the end of

the pen.

Jet Injectors

Insulin jet injectors send a fine spray of insulin through the skin with a high-pressure air mechanism instead of a needle. Jet injectors, which are about the size of the small batons used in relay races, can be less painful than syringes when used correctly, and they may be a more efficient delivery system. Instead of pooling around an injection site, the mist of insulin disperses and reaches the blood faster. However, adjusting the intensity of the spray to provide adequate penetration has proved difficult in practice, and the units haven't gained popularity. They are bulky, somewhat unreliable, and require frequent cleaning. They're also expensive, about \$300-\$700, and some insurance companies don't cover them.

Insulin Pumps

Resembling a pager, the insulin pump is lightweight (about 3 ounces) and small enough to be kept in a pocket, hooked to a belt, or worn around your neck. Pumps hold a supply of insulin that's delivered through plastic tubing (a catheter) attached to a very small needle or plastic tube that is inserted under the skin, usually in the abdomen, and secured by tape. The catheter is changed every one to three days, when the injection site is changed. The computerized pump continuously delivers insulin at a predetermined rate. You'll also be taught how to select an extra helping of insulin, known as a bolus, before each meal to prevent the increase in glucose that would otherwise occur. The bolus is based on the size of your meal, its content, and your blood sugar level before the meal. The pump doesn't get in the way of usual activities, such as exercise, showering, and sexual intercourse.

If you try the pump, your medical team will help you calculate how much insulin it will deliver to you throughout the day and how much more you'll need before meals or snacks. Sometimes problems can occur that affect absorption of insulin (such as an infection at the insertion site or a slowed flow), so regular blood glucose monitoring is crucial.

The biggest drawback is the price: An insulin pump costs roughly \$2,000-\$5,000, with maintenance and supplies (catheters, insulin, and blood testing strips) running about \$100-\$200 a month. However, many insurance companies provide coverage.

Where to Inject Insulin

Insulin can be injected into almost any fatty area under the skin: in your abdomen, thigh, hip, buttock, or the back of your upper arm. You'll want to find an area that's comfortable and easy to reach. To minimize discomfort, rotate injection sites and

look like lumps can develop in areas that have been used for injections too often. Other very rare reactions to an insulin preparation include swelling, redness, or small dents in the skin at injection and other sites.

Treatment for Type 2 Diabetes

Diet, exercise, oral medication, and insulin are the cornerstones of type 2 diabetes treatment

Controlling Type 2

Diet, exercise, oral medication, and insulin are the cornerstones of type 2 diabetes treatment.

Diet and Exercise

Weight loss and exercise are the time-honored starting points for controlling type 2 diabetes. Numerous studies have shown that a diet aimed at reducing calories and weight, either alone or combined with exercise, can improve diabetes. Changes in diet often return blood sugar levels to normal or to levels that don't require additional medication. However, this success is often short-lived. Most people must couple increasingly powerful oral medication or insulin with diet and exercise to keep their blood sugar in an acceptable range.

Oral Diabetes Medications Available

Sulfonylureas

Sulfonylureas, the oldest class of oral antidiabetic medications, work by stimulating your pancreas to make more insulin. These drugs are taken once or twice a day; most people begin with a low dosage that's gradually increased. Sulfonylureas are less effective in thin type 2 people, and approximately 10 to 20 percent of people who try them don't reap any benefit. Moreover, about half of those who benefit initially find that the drugs' effectiveness declines during the first five years.

An essential consideration is the side effects of these medications. All sulfonylureas carry the risk of hypoglycemia, which can be particularly dangerous in the elderly. Drinking alcohol or missing a meal can precipitate an episode. In addition, some people who drink alcohol while taking sulfonylureas (especially chlorpropamide) become flushed and suffer nausea, stomach pains, and a racing heartbeat. It's common for people taking sulfonylureas to gain some weight. People who are allergic to sulfa drugs should not take sulfonylureas. Further, some studies suggest a possible link between sulfonylureas and cardiovascular disease.

Biguanides

Biguanides block the liver's release of glucose and reduce its resistance to insulin. Thus they lower blood sugar levels without stimulating insulin secretion. Typically, metformin (Glucophage), which comes in pill form, is taken two or three times a day with meals, although a longer-acting formula may be taken once or twice a day.

Metformin has several advantages over sulfonylureas. It works well in overweight and average-weight people. It lowers blood sugar levels as effectively as the sulfonylureas without promoting weight gain, and it doesn't usually cause hypoglycemia when used

by itself.

On the other hand, it can sometimes cause unpleasant gastrointestinal effects, such as nausea, flatulence, and diarrhea. But you can often minimize these effects by starting with a small dose and taking it with a meal. Metformin also puts people at risk for lactic acidosis, a very rare but potentially lethal condition in which blood lactic acid levels increase. Because of this danger, people with impaired kidney function, congestive heart failure, liver disease, or circulatory problems should not take this drug. Otherwise, it is extremely safe. Like the sulfonylureas, however, its benefits seem to diminish somewhat over time.

Alpha-Glucosidase Inhibitors

Alpha-glucosidase inhibitors hamper the digestive enzyme that breaks carbohydrates into smaller sugars that can be absorbed by the intestines. Because the drug slows the body's digestion and absorption of carbohydrates, sugar levels rise slowly, and the insulin that's produced has time to do its job more effectively. Acarbose (Precose) was the first in this class of drugs to be approved; now, miglitol (Glyset) is also available.

Although weaker than some other drugs for type 2 diabetes, these medications are helpful in limiting the surges in blood glucose that occur after meals. Acarbose and miglitol are not absorbed into the bloodstream and are very safe. They often cause annoying flatulence and diarrhea, but these side effects usually diminish with time and may be eased by building up the dosage slowly.

Thiazolidinediones

Thiazolidinediones (TZDs) are the first diabetes drugs designed to reduce insulin resistance. Troglitazone (Rezulin), a "first-generation" TZD, was pulled from the market in March 2000 after its use was connected to deaths from liver failure. However, rosiglitazone (Avandia) and pioglitazone (Actos) are still on the market and don't appear to cause liver disease. They work most effectively in combination with other antidiabetic medications.

Still, the FDA has recommended that labels for Avandia and Actos state that drugs in this class have been linked to liver problems. Anyone taking TZDs should have their liver enzymes checked at the start of treatment and every two months during the first year of therapy. If you experience nausea, vomiting, abdominal pain, fatigue, anorexia, or dark urine, have your liver enzymes checked. If you develop jaundice, stop taking the drug and contact a doctor immediately. Additionally, all the TZDs can cause fluid retention and may increase the risk of heart failure.

Meglitinides

Repaglinide (Prandin) and nateglinide (Starlix) are some of the latest additions to the arsenal aimed at type 2 diabetes. Like the sulfonylureas, they stimulate insulin secretion by the pancreas. But they act more rapidly and last for less time than the sulfonylureas. As a result, they reduce the chances of hypoglycemia and are safer for the elderly and people with reduced kidney function. Doses can be adjusted somewhat before meals. If you skip a meal, you can also skip a pill; if you have an extra meal, take another pill.

Insulin Therapy

Insulin is the only drug made from a naturally occurring glucose-lowering hormone, and it is the most potent and effective of the available diabetes medications. Early treatment with insulin may result in a "remission" period, a time during which you can stop taking all blood-sugar-lowering medications. What's more, by some estimates as many as 65 percent of all people with type 2 diabetes may eventually need to use insulin. Yet insulin therapy is usually not initiated in people who have type 2 diabetes until they've had the disease for more than 10 years. This reluctance, on the part of both patients and doctors, most certainly reflects the fact that it has to be administered by injection.

Insulin therapy is simpler for type 2 diabetes than for type 1. Usually, only one or two injections per day are necessary. However, larger doses (generally more than 50 units per day and often much more) are required to override insulin resistance. For instance, you may take one shot of intermediate- or long-acting insulin or one shot of 70/30 insulin -- which is 70 percent intermediate NPH and 30 percent regular -- in the morning to keep blood glucose levels in check the entire day. Or a single injection of NPH, Lente, or glargine (Lantus) at bedtime might suffice. You might also have a two-shot regimen, a mixture of rapid-acting and longer-acting insulin (usually NPH) taken in the morning and again before dinner. Once you develop a sound insulin program, you can often manage your blood sugars with less-frequent monitoring (once or twice a day to adjust your insulin dose) than is needed for type 1 diabetes.

Combination Therapy

Because all the oral medications for diabetes have limited potency, scientists have tried to take advantage of their different mechanisms by using them in various combinations, with or without insulin.

Traditional Treatment

Traditionally, clinicians took a one-treatment-at-a-time approach to type 2 diabetes. If diet and exercise failed, the doctor put the patient on a sulfonylurea. Once the maximum dose was reached, a new medication was started, and once medication options were exhausted, insulin injections began. But this approach was only modestly successful, with most type 2 diabetic patients unable to achieve near-normal blood sugar levels.

New Treatment Views

A multiple-drug approach fits the new view of diabetes as a complex disease with at least two deficits that can be addressed: insulin resistance and inadequate insulin secretion. The combination approach may use lower doses of drugs, each with different mechanisms. The most common and widely studied oral drug combination is metformin plus a sulfonylurea.

Some diabetes experts are now going a step further, arguing that people should be prescribed medications, and even insulin, in conjunction with a diet and exercise plan

as soon as they're diagnosed. The rationale is that insulin-secreting beta cells may be most salvageable early in the course of the disease, so aggressive therapy may prevent blood sugar levels from worsening.

While early combination drug therapy would be expensive, it might be cheaper in the long run than dealing with the complications of the disease. Combination pills currently available combine a sulfonylurea with either metformin or a TZD.

Combination therapy probably increases the risk for hypoglycemia. When you combine drugs that don't usually cause hypoglycemia with drugs that do, the combination leans toward causing low blood sugar.

Hypoglycemia and Diabetic Emergencies

Both Type 1 and 2 are prone to hypoglycemia, or low blood sugar, or may suffer from other diabetic emergencies like comas or DKA. Here, learn what can happen

Understanding Hypoglycemia

Anyone who takes insulin or other glucose-lowering medications, either alone or in combination with other antidiabetic drugs, is prone to hypoglycemia. Hypoglycemia, or low blood sugar, is less common among people with type 2 diabetes than among those with type 1, but it can be serious when it occurs. Blood sugar may fall abnormally low from too much insulin, too much exercise, too little food or carbohydrates, a missed or delayed meal, or a combination of these factors. As you pursue near-normal blood sugar control more aggressively, your risk for hypoglycemia increases.

It's important that people with diabetes, and those who live and work with them, learn to recognize and understand hypoglycemia so it can be prevented and treated before it becomes a life-threatening crisis.

Symptoms of Hypoglycemia

- nervousness
- weakness
- hunger
- lightheadedness or dizziness
- trembling
- sweating
- rapid heartbeat
- feeling cold and clammy
- irritability
- confusion
- drowsiness
- slurred speech
- double vision
- in severe cases, loss of consciousness, seizures, and even coma

Spotting the Signs

Many experts associate hypoglycemic reactions with blood sugar levels below 60 mg/dL, but it's difficult to pinpoint the level at which hypoglycemia symptoms occur because each person responds differently. For instance, your blood sugar might fall below 40 mg/dL without causing any symptoms, while someone else might feel symptoms coming on when his or her blood glucose falls below 70 mg/dL.

Responses to Low Blood Sugar

Over time, the symptoms often become subtler, especially among people with type 1 diabetes. Eventually, for example, you may not experience the palpitations, sweating, and anxiety that once characterized the condition. Instead, your first symptom may be fuzzy thinking. Some people develop a condition, termed hypoglycemia unawareness, in which they experience no warning symptoms even when their blood sugar levels are very low.

Low blood sugar usually sets off alarms in many organ systems. The brain, which relies on glucose to function, is especially sensitive to sugar deprivation. The first signs of hypoglycemia resemble those of an anxiety attack because a decline in blood sugar affects the autonomic nervous system. Epinephrine (also known as adrenaline) is secreted, causing sweating, nervousness, trembling, palpitations, lightheadedness, and often hunger. The release of adrenaline is a corrective response to hypoglycemia because it stimulates your liver to make more sugar.

Severe Hypoglycemic Episodes

More profound levels of hypoglycemia affect brain function and result in fatigue, weakness, blurred vision, dizziness, slurred speech, and confusion and other behavior that resembles inebriation, such as belligerence or silliness. A further drop in blood sugar levels or failure to promptly treat the condition may result in loss of consciousness, seizures, and even death. Rarely, an episode of hypoglycemia while driving may cause a serious car accident.

Not everyone experiences all these symptoms, and it can be hard to tell the difference between hypoglycemia and anxiety over a problem at work or an argument with your spouse. In addition, beta blockers (used to treat high blood pressure and heart disease) and alcohol can exacerbate hypoglycemia by masking early symptoms. Therefore, they must be used cautiously. If hypoglycemia occurs during sleep, the only clues may be damp pajamas (from sweating), vivid nightmares, or a nagging headache on awakening. It's important to be attuned to these early signs and to know what blood sugar levels set off hypoglycemia.

Preventing and Treating Hypoglycemia

Preventing hypoglycemia is preferable to treating it. On the other hand, current intensive therapy for type 1 diabetes isn't an exact science. Your blood glucose levels may be pushed close to the hypoglycemic range, especially during pregnancy, when very tight control is desirable. The art of diabetes care is to balance the long-term need for near-normal control against the short-term risks and discomfort of hypoglycemia.

Monitoring Day-to-Day Changes

Whenever you change your meal schedules, activity levels, and medications, step up

your monitoring of blood sugar levels, and be ready to adjust your insulin or other blood sugar-lowering medications. Remember to discuss these changes with your healthcare team. If you're a person with type 1 diabetes following intensive treatment, check your 3 a.m. glucose level periodically to detect hypoglycemia during sleep, and make adjustments to prevent its recurrence. Experts also strongly recommend that people with type 1 diabetes check their blood sugar before driving a car or engaging in other potentially dangerous activities.

If you're taking insulin, it's likely that despite your best efforts, you'll experience hypoglycemia at some time, although the risk is higher for people with type 1 diabetes than for those with type 2 diabetes being treated with insulin and sulfonylureas. For the latter, low blood sugar usually occurs only with a change in eating patterns, such as missing a meal. But if you binge-drink alcohol, have irregular eating patterns, or have liver or kidney disease, you are at particular risk.

Mild vs. Severe Episodes

For people with type 1 diabetes, mild hypoglycemic episodes (involving hunger, slight shakiness, and an exaggerated realization that mealtime is at hand) may occur as often as once a day. More severe reactions, which require another person's help, occur on average once every 18 months in people treated with intensive therapy, compared with once every five years in those treated less intensively. The most severe cases, including seizure or coma, occur on average no more than every five to six years with intensive therapy and once every 20 years with conventional therapy.

Keep in mind that these are average estimates from the Diabetes Control and Complications Trial. Not everyone experiences such severe hypoglycemia. However, if you start having major episodes, they're likely to recur if you don't seek guidance from your doctor and follow through on his or her advice.

Treating Low Blood Sugar

While it's a good idea to test your blood glucose level if you suspect you're having a hypoglycemic reaction, often there just isn't time. Once you start to feel strange, don't put off treatment. You need to eat or drink some sugar that will reach your bloodstream quickly. If you can't check your blood sugar at the time symptoms begin, don't wait to treat. Treat first and check later.

About 10-15 grams of carbohydrate should suffice. That can be 4-6 ounces of fruit juice, half a can of regular soda, 2 tablespoons of raisins, or some candy (usually five to seven LifeSavers or six jellybeans will be enough). A glass of milk also works well, as do fast-acting glucose tablets, which are sold at pharmacies. You can expect relief 10 to 15 minutes after eating the sugar. But test your blood glucose level at that time, and if it's still low, you may need another snack.

Doctors strongly suggest that people taking insulin carry some hard candy, sugar lumps, or even a tube of cake icing so they're ready to treat themselves at the first signs of hypoglycemia. However, hypoglycemic reaction shouldn't be seen as a justification for pigging out on sweets. It's crucial to get enough glucose to correct the problem, but it's not wise to overload, which will only cause your blood sugar levels to surge later.

Severe Hypoglycemia

Blood sugar levels that dip too low or soar too high can cause serious illnesses that require prompt treatment.

Episodes of low blood sugar are not uncommon, and most are caught early, but if you don't notice the symptoms and your brain is deprived of sugar for an extended period, you could lose consciousness. This is a true emergency that leaves you unable to help yourself. That's why it's important for everyone with diabetes to wear a medical alert bracelet or necklace, or to carry a medical identification card with complete information. It's also imperative that relatives, friends, and colleagues know what to do in an emergency.

Your Emergency Action Plan

When a person with diabetes lapses into unconsciousness or becomes too confused to take treatment orally, the quickest remedy is an injection of glucagon, the hormone that raises blood sugar, or intravenous glucose. People with type 1 diabetes should always have up-to-date glucagon kits at home and at work for emergencies. Because glucagon must be mixed just before it's injected and the person with hypoglycemia will probably be unable to do it, make sure someone at home and work is trained to do so. If glucagon isn't administered, call a paramedic team immediately to administer intravenous glucose and take the person to the hospital. In general, never force an unconscious person to swallow solids or liquids.

Diabetic Ketoacidosis (DKA)

Chronically high blood glucose, or hyperglycemia, substantially increases the risk for long-term complications. However, it also presents more immediate dangers for people with type 1 diabetes. If their blood sugar runs too high, it can cause dehydration and diabetic ketoacidosis (DKA). Although relatively rare and preventable, DKA is an emergency that, if untreated, can lead to coma and possibly death.

DKA occurs when insulin falls to a critically low level. Ketones are natural by-products of fat digestion. When your insulin levels are very low, the rate of fat breakdown increases substantially and your cells can't take up and metabolize all the ketones. Therefore, they accumulate in your bloodstream, making your blood acidic. At the same time, your kidneys excrete large amounts of glucose-rich urine, causing dehydration. DKA produces nausea and vomiting, which cause further dehydration and make it impossible to replenish the lost fluid by mouth.

Causes and Symptoms of DKA

DKA can occur because you missed insulin injections or used too little insulin during a period of illness or unusual stress. Illness and stress increase your vulnerability because the hormones released in these situations oppose the action of insulin. Unless insulin doses are maintained or increased, insulin insufficiency develops. In some people, type 1 diabetes announces itself with an episode of DKA. Symptoms include increased thirst, frequent urination, rapid breathing, nausea, vomiting, fatigue,

abdominal pain, and "fruity" breath.

As the condition progresses, blood pressure falls due to dehydration. Confusion and even coma can develop when blood sugar levels become extremely high. Treatment requires insulin and the intravenous replenishment of fluids. DKA can be life-threatening, and to treat it effectively, the individual may need to be admitted to an intensive care unit.

FAST FACT: One symptom of ketoacidosis is "fruity" breath. This is the result of your body trying to rid itself of one type of ketone, called acetone, through your lungs. Acetone gives your breath a fruity odor. Your body can also expel ketones through urine.

Detecting and Treating DKA

Because the warning signs often develop over several days, regular blood glucose tests can determine when levels are becoming high enough to increase the risk for DKA, usually above 300 mg/dL. You can also detect the development of DKA by monitoring ketones in your urine. This test is easily performed at home using a specially treated urine dipstick for ketones. Urine ketones should be checked whenever your blood sugar levels become unusually high or when you've developed a new illness, especially one with gastrointestinal symptoms such as abdominal pain, nausea, or vomiting. Call your doctor immediately if your urine test shows more than a trace of ketones.

If you detect urine ketones (ketoacidosis) early, before dehydration and full-blown acidosis develop, you can usually treat it at home by drinking extra fluids and taking more insulin. The keys to preventing DKA are to detect worsening glucose control early and never stop your insulin, even if you're too sick to eat. With your doctor's help you can adjust your doses, but stopping insulin altogether is a sure path to DKA.

Hyperosmolar Coma

People with type 2 diabetes rarely develop DKA, but blood glucose levels may occasionally rise to extremely high levels (over 800 mg/dL), leading to severe dehydration and coma. This most commonly occurs in elderly people when blood sugar becomes elevated because of inadequate therapy, illness, stress, or some other situation, like taking a new drug. If the person affected can't respond by drinking more liquids -- either because he or she doesn't feel thirsty (not uncommon in the elderly) or because neurological damage (for example, after a stroke) makes drinking fluids difficult -- blood sugar levels can skyrocket.

As the problem worsens, confusion, sleepiness, seizures, and coma will follow dehydration, resulting in a condition called nonketotic hyperglycemic hyperosmolar coma, or simply hyperosmolar coma. This rare condition can be fatal and requires hospitalization, often in an intensive care unit. Again, careful glucose monitoring and strict adherence to your treatment program can help you prevent hyperosmolar coma.

Pregnancy and Diabetes

With good prenatal care and careful self-management, women with type 1 or type 2 diabetes can easily have a healthy pregnancy.

Risks Involved

In the past, women with diabetes suffered many problems during pregnancy, including a high rate of miscarriages and birth defects. Today, however, with good prenatal care and careful self-management, there's no reason women with type 1 or type 2 diabetes can't have a safe pregnancy and a healthy baby.

FAST FACT: Getting proper care for your diabetes before you become pregnant is an important step toward having a healthy baby. According to the National Institute of Diabetes and Digestive and Kidney Diseases, the rate of major congenital malformations in babies born to women who already had diabetes before conceiving is 5 percent or less when the mothers received preconception care. But for diabetic women who don't receive preconception care, the rate jumps to 10 percent.

Mother-Child Risks

While it's common for diabetic women to have relatively trouble-free pregnancies, some risks still exist for both mother and child. In general, the more diabetic complications you've had before pregnancy, the more likely they'll worsen significantly during pregnancy. Women with severe kidney and eye complications, for instance, can expect that these conditions will be aggravated by a pregnancy. The damage often reverses after delivery, but women with these conditions should discuss potential dangers with their doctors before conceiving.

Consistently high blood glucose levels increase the chances of miscarrying or going into premature labor. They may also cause the baby's organs to form abnormally. Historically, diabetes has been associated with a threefold increase in severe malformations. Some examples include neural tube defects (incomplete development of the brain or spinal cord), anencephaly (absence of the brain or spinal cord), and spina bifida (failure of the backbone to fuse over the spinal cord).

Women with diabetes are also more likely to have large babies, with birth weights of 9 to 12 pounds. This condition can cause a difficult delivery. Doctors will often induce labor a few weeks early or perform a cesarean section if the fetus seems to be too large.

Other problems can also result. The baby may have immature lungs (respiratory distress syndrome) or low blood levels of calcium and glucose at birth.

Having a Healthy Baby

Women with diabetes who strictly control their blood sugar before conception and during pregnancy can substantially improve their chances of having a healthy baby. It's imperative that blood sugar levels and HbA1c be kept as close to normal as possible throughout the pregnancy. In the early stages of fetal development, this can help prevent birth defects, and in the last trimester, it will reduce the chance of the fetus growing too large.

The Importance of Advance Planning

Because glucose control by the mother early in pregnancy is so crucial to the health of the baby, it is important to achieve near-normal glucose control before you become pregnant. This requires advance planning. Ideally, most women with diabetes will have good glucose control and won't need major adjustments in their diabetes treatment plan in preparation for a pregnancy. However, women who have not been able to reduce their glycosylated hemoglobin readings to 7 percent or less (the target range for women with diabetes who are not pregnant) may require treatment adjustments before trying to become pregnant.

The increased monitoring, medical visits, and cost of supplies that go along with a diabetic pregnancy are also good reasons to plan ahead. You may want to check with your insurance provider to find out what it will cover.

Extra Precautions to Take While Pregnant

If you become pregnant, it's important to have frequent contact with your medical team, which will include an obstetrician. You'll have ultrasound tests to monitor the growth and development of the fetus and more frequent glycosylated hemoglobin tests to evaluate your blood sugar control. Blood sugar and HbA1c goals during pregnancy are even more stringent than when you are not pregnant. You will probably be asked to check blood sugars both before meals and two hours after eating. Your doctor may recommend other tests to screen for possible abnormalities in the fetus. A dietitian will also adjust your diet to ensure that the fetus receives proper nutrition and that you get the calories you need. You'll need to adjust your insulin doses often, especially in the last trimester, since insulin requirements can increase dramatically toward the end of pregnancy. Getting enough exercise will be just as important as before pregnancy, and women who are heavy will have to watch that their weight gain isn't excessive.

Gestational Diabetes

Gestational diabetes -- diabetes that develops during pregnancy -- occurs in 3 to 5 percent of pregnancies, usually in the last trimester. This form of diabetes doesn't increase the risk for birth defects. The real worry is having an exceptionally large fetus, which makes having a cesarean section or preterm delivery more likely. Babies delivered to women with gestational diabetes also have a higher rate of hypoglycemia right after birth.

Gestational diabetes typically disappears after delivery, but up to half of these women later develop type 2 diabetes, usually five to 10 years after the pregnancy. Women who've had gestational diabetes should have an oral glucose tolerance test within three months of delivery and continue to have their fasting blood sugar levels checked at least annually.

This form of diabetes seems to resemble type 2 diabetes, and women who are over age 30, overweight, and have a family history of diabetes are more prone to it. It's also more common in women who previously delivered a baby weighing more than 9 pounds or a stillborn infant.

Testing for Gestational Diabetes

A blood screening test -- a 50-gram oral glucose tolerance test usually given between the 24th and 28th weeks of pregnancy (or earlier if gestational diabetes occurred during a former pregnancy) -- can uncover this problem. Gestational diabetes is suspected if your plasma glucose level is 140 mg/dL or higher one hour after ingesting 50 grams of glucose. This finding is then confirmed by a second test, which requires drinking 100 grams of glucose.

Managing Gestational Diabetes

Following a diet and exercise plan may be enough to keep your blood sugar levels tightly controlled during pregnancy. However, insulin resistance tends to increase in the latter part of pregnancy. If your blood sugar level before a meal is more than 105 mg/dL, your doctor will probably recommend insulin. Other medications for blood sugar control are not recommended for pregnant women.

Top Precautions to Prevent Diabetic Episodes

Stay-healthy strategies for living well with diabetes -- from traveling tips to ordering safely at restaurants.

Stay-Healthy Strategies

If diabetes could be described as having a personality, it most surely would be temperamental. It has volatile mood swings and easily flies out of control. It presents constant challenges, demanding discipline, restraint, and planning.

With good self-management, you can enjoy a healthy life and minimize your chances of developing complications.

For Free Delicious Diabetic Recipes visit:

For Free Delicious Diabetic Recipes visit:

The Corner 4 Women Official Forum

<http://thecorner4women.com/Forum/viewtopic.php?t=39>

Essential Steps for Keeping Healthy

- Practice good blood sugar control.
- Monitor your blood sugar levels regularly.
- Have a glycosylated hemoglobin test every three to six months, or more often if you're pregnant.
- Eat a healthy, varied diet, sticking to foods that are low in saturated fat and cholesterol, and limit "concentrated" sweets like candy.
- Exercise regularly and maintain a normal weight.
- Schedule regular visits with your doctor. Have your blood pressure and feet checked at all visits. Your doctor should test your blood lipids and kidney function regularly and do an annual EKG.
- Have an annual eye exam by an ophthalmologist. This should be done from the time of diagnosis in people with type 2 diabetes, and starting five years after diagnosis in people with type 1 diabetes.
- To avoid illness, stay up-to-date on your immunizations. Talk to your doctor

about getting vaccinated against the flu, pneumococcal disease (such as pneumonia and meningitis), hepatitis, tetanus, and diphtheria.

- Practice good foot and skin care.
- Visit a dentist regularly.
- Avoid risky behaviors, such as smoking or drug or alcohol abuse.
- Learn as much as you can about diabetes, and educate others close to you.

Coping with Changes, Special Circumstances

Some circumstances call for taking even more precautions.

When You're Under the Weather

Infections and other illnesses can have serious implications for people with diabetes. When trying to fight an infection, your body produces stress hormones that counteract insulin. Even though you may eat less when you're ill, you may need more insulin to keep blood sugar levels down. People with type 2 diabetes who normally take oral medications may temporarily require insulin.

Not surprisingly, it's especially important to monitor blood sugar levels frequently and to check for ketones in your urine while you're sick. Prepare yourself by consulting with your medical team beforehand about how to handle sick days and what foods to eat when you aren't hungry.

When You're Traveling

Travel also can throw a wrench into diabetes management. Make sure to pack enough oral drugs, insulin, and testing and injection supplies. It's a good idea to take more than necessary because it's not always easy to find supplies in a strange place.

If you're flying, keep all your equipment with you in a carry-on bag. Include a monitoring device, insulin and syringes, sweets for treating hypoglycemia, and a glucagon kit (and a companion who knows how to use it) if you take insulin. Because insulin shouldn't be kept too hot or too cold, you may want to invest in a carrier with special insulation for travel.

Lengthy trips across time zones can disrupt your regimen and require adjustments in eating and insulin schedules. To prevent hypoglycemia, carry snacks, especially because meals may be delayed or served at odd times. Seek advice from your medical team on how to alter your injection schedule, your insulin doses, and your meals to accommodate your travel plans.

Long-Term Diabetic Complications

Untreated or poorly treated diabetes can cause serious long-term complications to the eyes, nerves, and kidneys.

Damage from Diabetes

If it's untreated or treated poorly, diabetes can cause serious complications, such as eye, kidney, and nerve damage. Nearly all complications develop from having high blood glucose levels over many years. These problems threaten people with both type

1 and type 2 diabetes. Vulnerability increases the longer you've had the disease and the higher your blood glucose and HbA1c levels have become.

Experiments on diabetic animals in the 1970s and 1980s showed that tight control of glucose levels reduces complications considerably. However, it wasn't until 1993, when the results of the Diabetes Control and Complications Trial were published, that experts fully recognized the dramatic impact of strict blood sugar control in preventing or delaying complications.

How high blood sugar achieves its nasty ends isn't fully understood, but the answer seems to involve its long-term effects on the body's small blood vessels and on the nervous system. Over time, high glucose levels change the walls of small blood vessels, causing them to thicken and leak. The vessels may eventually clog, impeding blood flow to vital organs.

Eye Damage: Retinopathy

Diabetes increases your risk for vision loss fourfold, and it's the leading cause of new cases of blindness in people ages 20-74. Although most of the harm is caused by damage to the retina (retinopathy), diabetes also makes cataracts and glaucoma more likely.

Diabetic Retinopathy

This condition affects the blood vessels in the retina, the back layer of the eye where images are captured and recorded. The retina converts light energy into electrical impulses and sends visual images to the brain along the optic nerve. After 20 years, nearly all people with type 1 diabetes and 60 percent of those with type 2 diabetes have developed retinopathy. By that time, half of all people with type 1 diabetes and 10 percent of those with type 2 diabetes have the more serious, advanced form, known as proliferative retinopathy. However, tighter glucose control should substantially decrease these numbers in the future.

Scientists don't know what causes retinopathy, but they do know it occurs in two stages. In the first stage, the walls of the small blood vessels become abnormal and weaken. They leak fluid into surrounding tissue, leaving deposits of protein and fat called hard exudates. The vessels also develop microaneurysms, tiny bulges or pockets in their walls that tend to leak red blood cells into the retina. As the condition progresses, the abnormal vessels begin to close, robbing the retina of its blood supply. Nerve fibers die off due to poor circulation and lack of oxygen, creating white cottony patches known as soft exudates. These changes may not alter your vision. But if the fluid or blood leakage occurs near the macula -- the part of the retina responsible for sharp, central vision -- your sight will be impaired.

Severe impairment occurs when retinopathy advances to the proliferative stage, which is when the severely diminished blood flow causes the damaged retina to try to repair itself by sprouting new blood vessels. However, these new vessels grow abnormally and proliferate into the vitreous humor, the gel-filled compartment of the eye in front of the retina. The new vessels are fragile. When they bleed into the vitreous humor, they can block the passage of light and lead to a sudden loss of vision. The blood is usually reabsorbed, but scar tissue often forms. The scars in the vitreous humor can

attach to the retina, pulling it away from the back of the eye. Retinal detachment can lead to permanent vision loss.

Detecting Retinopathy

Early detection and treatment are essential to preventing vision loss and blindness. However, this isn't as simple as it sounds. In its early stages, retinopathy usually has no warning signs or symptoms.

Detecting retinopathy requires a comprehensive eye exam. By dilating the pupil and using an ophthalmoscope, an instrument for examining the deep interior of the eye, a specialist can spot microaneurysms long before you notice any vision changes. The ophthalmologist may use other tests, too. Stereoscopic photography provides a detailed view of the retina. Fluorescein angiography involves photographing the eye after a dye has been given intravenously; the dye provides a detailed map of the retinal vessels, clearly revealing any leakage or areas of decreased blood supply.

People with type 1 diabetes should have an annual exam by an ophthalmologist beginning five years after diagnosis, while those with type 2 should see an eye specialist yearly as soon as they learn they have diabetes. Because of delayed diagnosis, about 10 to 20 percent of people with type 2 already have some degree of eye disease when their diabetes is diagnosed. Retinopathy can flare suddenly during pregnancy, so women with diabetes should schedule an eye exam early in their first trimester and be followed closely until three to six months after delivery. This isn't an issue for women with gestational diabetes.

Treating Retinopathy

Retinopathy is commonly treated with laser therapy. This procedure focuses a thin beam of high-energy light onto the retina, sealing the leaking blood vessels and destroying any new vessels. By stopping leakage near the macula when edema (the accumulation of fluid) is present, laser therapy can help prevent blindness if it's performed early enough.

Laser surgery requires no incision, is relatively painless, and is done in a doctor's office. Treating proliferative retinopathy may require many laser "burns" over several treatment sessions. The goal is to destroy any retinal tissue that's not essential for vision, which reduces new vessel growth and shrinks the existing abnormal vessels. Treating macular edema requires far fewer burns and is usually done in one session. Because laser therapy destroys some eye tissue, peripheral and night vision may be diminished if many burns are required.

If the retina is detaching or there's extensive bleeding and scarring, a vitrectomy may be necessary. This surgical procedure removes blood, scar tissue, and the vitreous humor. The detached retina is repaired, and the vitreous is replaced with saline solution. Although this is often effective, complications may include further retinal detachments or glaucoma.

Eye Damage: Cataracts and Glaucoma

People with diabetes tend to develop cataracts (a clouding of the eye's crystalline lens) more frequently and at a younger age than the general population. Cataracts

progress slowly and painlessly, but you may notice your vision starting to blur or dim and find the glare from the sun or lights annoying. Cataracts are removed surgically when the impairment threatens your ability to perform routine activities. Implanting a new artificial lens usually restores clear vision.

Glaucoma, a disorder characterized by excessive fluid pressure within the eyeball, is also more prevalent among people with diabetes. As with retinopathy, you may not be aware of the problem because there are no symptoms in the early stages. If glaucoma isn't detected and treated, usually with eye drops that reduce the pressure within the eye, the optic nerve can be damaged and blindness can ensue. Vision loss from glaucoma can't be restored, but the disorder can be controlled with medication. In some cases, laser surgery can improve fluid drainage.

Preventing Eye Disease

One of the best ways to protect your vision is to control your blood glucose levels tightly. The Diabetes Control and Complications Trial, and a long-term study following it, found that people who keep their blood sugar at near-normal levels cut their risk of developing eye diseases and macular edema by 75 percent. Retinopathy was also less likely to progress among those who had tight control over their diabetes.

Other steps can help, too. Controlling your blood pressure can keep retinopathy at bay, and an annual eye exam should be a high priority.

Nerve Damage: Neuropathy

Nerve damage, or neuropathy, from diabetes has widespread effects, and again, the blame rests with abnormally high blood sugar levels. When nerve damage occurs, the network of nerves that relays messages to and from different parts of the body slows down, sends the wrong cues, or fails to work. Scientists aren't certain why this happens, but they think the damage may result when glucose attaches to or affects proteins in nerve cells, causing a chemical imbalance inside the nerves or restricting the blood flow to the nerves.

Nerve damage can cause changes in sensory perception, pain, or problems with digestive, bladder, bowel, or sexual function. About 60 to 70 percent of people with diabetes have some signs of neuropathy that may be detectable only with a physical exam or special testing, and a smaller percentage has more severe symptoms. Serious neuropathy, especially when combined with vascular complications, can lead to foot ulcers and the loss of lower limbs.

Peripheral Neuropathy

The most common type of nerve damage, known as peripheral neuropathy, affects the long nerves that extend from your spine to your arms and legs. Symptoms include numbness, tingling, and reduced sensitivity to light touch. Although more rare, a burning, shooting, or stabbing pain may also occur.

The real danger of this condition is that it lessens your sensitivity to vibration, touch, and pain, especially in your feet. This puts you at greater risk of injuring your feet due to poorly fitting shoes, high-impact exercise, or even walking. Peripheral neuropathy can make many daily activities difficult and can impair your ability to drive a car. It's

essential to check your feet daily because a blister or even a puncture wound from a nail can be easily missed. If these problems go unnoticed, infections and decreased blood flow can complicate the situation, leading to sores or ulcers that sometimes become severe enough to warrant amputation.

Focal Neuropathy

A less common type of damage, focal neuropathy, targets a specific nerve or set of nerves, causing a weakness in facial, leg, arm, or eye muscles. Experts suspect that the nerves malfunction because an obstruction in a small blood vessel blocks their blood supply. The condition can appear as hand weakness, an inability to lift your leg, or double vision. The problem typically disappears over two to six months. Carpal tunnel syndrome, a nerve disorder of the hand and wrist, is especially common because the nerves appear to be more sensitive to compression from repeated motion.

Autonomic Neuropathy

This nerve damage involves the autonomic nervous system, the nerves controlling automatic body functions such as digestion, sweating, and erections. Autonomic neuropathy produces a variety of unpleasant effects, such as racing heartbeat, profuse sweating, bloating, dizziness or nausea, vomiting, diarrhea, and constipation. People with this condition may not be able to empty their bladders completely (which can predispose them to bladder infections), and as many as half of diabetic men may develop erectile dysfunction (impotence). This is especially true for men who've had diabetes for many years.

Treating Nerve Damage

Your doctor can usually diagnose diabetic neuropathy at an office visit. During the exam, he or she will test your reflexes and sensory perception. Although tests to confirm the diagnosis aren't usually necessary, some doctors perform nerve conduction tests to see if individual arm or leg nerves are affected. Other specialized tests can be used to diagnose slow stomach emptying, bladder sluggishness, or erectile dysfunction.

Treatment by Glucose Control

Neuropathy, like retinopathy, can be prevented with tight glucose control. Gaining better control over your blood glucose can also ease discomfort. Your doctor may prescribe oral medications or topical creams to reduce pain and ensure a good night's rest. Occasionally, painkillers may be necessary as well.

Bowel disturbances. Eating more fiber may correct bowel disturbances. If your stomach empties too slowly, your doctor may recommend a medication such as metoclopramide (Reglan). If you're bothered by diarrhea, taking an antidiarrheal drug such as loperamide (Imodium) may help.

Erectile dysfunction. For men who suffer erectile dysfunction due to diabetes, about half can be helped by drugs that are phosphodiesterase inhibitors such as sildenafil (Viagra), tadalafil (Cialis), and vardenafil (Levitra); the use of vacuum devices before intercourse; or surgical implants.

Bladder problems. One way to prevent or handle bladder problems or incontinence

is by training yourself to go to the bathroom every hour or two rather than waiting until you feel the urge. If this isn't helpful, your doctor may recommend oral drugs or surgery.

Dizziness. Dizziness or lightheadedness may also require some simple lifestyle changes. If standing up quickly brings on lightheadedness, try taking more time to change positions. Cutting out alcohol and increasing your dietary salt intake may also help.

The many forms of nerve damage are not easy to treat. The best way to avoid them is by keeping your blood glucose levels as close to normal as possible.

Kidney Disease

In the past, about 10 to 35 percent of people with diabetes have developed kidney disease, or nephropathy. Kidney disease is progressive; the deterioration can eventually leave the kidneys unable to filter wastes from the body. This is known as kidney failure or end-stage renal failure. Although diabetes is the leading cause of kidney failure, accounting for about 40 percent of new cases, most people with diabetes don't develop this life-threatening condition.

In type 1 diabetes, the kidneys can suffer damage as early as within five years of diagnosis, although it usually takes 20 years before kidney failure occurs. Kidney disease is more common in type 1 than in type 2 diabetes. But hypertension, which is a problem for many with type 2 diabetes, can increase your chances of developing this condition and accelerates its progression.

What Goes Wrong?

Kidneys filter toxins and wastes from the bloodstream, flushing them out of the body through urine, while retaining important proteins and other useful substances. This filtering work is done by glomeruli, a delicate network of capillaries. But after prolonged exposure to high blood sugar, capillary membranes thicken, and the glomeruli are damaged and distorted.

One of the first signs of kidney disease is an elevation in the level of the protein albumin in the urine. Most healthy people excrete less than 30 mg of albumin, the most abundant protein in blood, in the course of a day. In the initial stage of diabetic kidney disease, called microalbuminuria, more albumin (30-300 mg) appears in the urine each day because of leakage through the damaged glomeruli.

Most people with microalbuminuria go on to develop full-blown kidney disease. The next phase, known as clinical albuminuria (in which up to several grams -- the equivalent of thousands of milligrams -- of albumin are excreted each day), may not occur for another 10 to 15 years. Over the next five to 10 years after the development of clinical albuminuria, more than 90 percent of those affected will undergo a steady loss of the filtering capacity of their kidneys.

Because healthy kidneys can function at about 10 times the capacity of what's needed for survival, symptoms don't occur until 90 percent of kidney function has been lost. The inability to eliminate excess water and salt produces or worsens hypertension.

Your body starts to retain fluid, causing weight gain and the swelling of your hands and feet. Without an effective filtering system, toxins accumulate, causing symptoms such as nausea, fatigue, vomiting, loss of appetite, weakness, and itching. At this point, kidney disease threatens survival and requires extreme measures, such as dialysis or transplantation.

Detecting Kidney Disease

High albumin levels are often uncovered by a random or "spot" urine test done during a regular doctor's appointment. If the level of albumin in your urine is high, your doctor may suggest another random urine test or ask you to provide a 12- or 24-hour urine sample. This involves collecting all urine for the specified period of time in a jug.

Physicians may also measure creatinine levels in the urine sample and a blood sample. Creatinine is a waste product of muscle and, usually, your kidneys easily excrete it. However, as your kidneys lose their filtering ability, creatinine excretion falls, and blood levels rise from a normal range of 0.5-1.5 mg/dL to as high as 10-15 mg/dL. For this reason, the blood creatinine level is a useful gauge of kidney health. Your doctor may also test your blood for sodium, potassium, and other substances and check for anemia, which often accompanies kidney failure.

Treating and Preventing Kidney Disease

Strict blood sugar control is imperative. Long-term follow-up of the Diabetes Control and Complications Trial found keeping blood sugar close to normal decreases the risk of developing microalbuminuria and clinical albuminuria by 59 percent and 84 percent respectively.

Blood pressure must also be carefully controlled. Blood pressure goals are more stringent for everyone with diabetes, even those who don't have high blood pressure. Worsening kidney function is associated with high blood pressure and vice versa. Keeping blood pressure tightly controlled can reduce the progression of kidney damage in people with type 1 and type 2 diabetes. Losing weight and reducing your salt intake can help. If medications are needed, most doctors prescribe ACE inhibitors or angiotensin blockers to control high blood pressure in people with diabetes. These drugs retard the progression of kidney disease and may be used even when blood pressure is normal. These or other blood pressure medicines may also be used to normalize blood pressure into acceptable ranges.

Many doctors recommend low-protein diets for patients whose kidneys are deteriorating. These measures can slow the advancement of kidney disease and the eventual need for dialysis or kidney transplant, but they don't stop the process entirely. Many patients inevitably progress to end-stage renal failure. Although this condition used to be fatal, now there are two treatment options: dialysis and kidney transplantation.

Dialysis

There are two types of dialysis: hemodialysis and peritoneal dialysis. In hemodialysis, blood is removed from an artery and sent through a machine that filters out wastes and toxins and returns the purified blood through a vein. Generally, hemodialysis is

done at a hospital or clinic and involves three weekly treatments, each lasting three to four hours. Peritoneal dialysis, which can be performed at home, uses the abdominal cavity as the filtering basin. A special fluid is introduced into the belly through a tube or catheter, and it draws waste products from blood through the peritoneum (the abdominal membrane). The waste-containing fluid is then drained out and discarded. Although dialysis often makes people feel better, several complications frequently occur, including infections and catheter blockage. In addition, dialysis often accelerates vascular disease and bone loss.

Transplants

A kidney transplant may be more desirable, particularly for younger people, but the surgery hinges on the availability of donor organs. Some people spend two or more years, often on dialysis, waiting for a compatible kidney. However, having a living, related donor makes the wait much shorter. After receiving a new kidney, an individual must take powerful drugs, called immunosuppressants, to prevent his or her body from rejecting the transplanted organ. Over the long term, these drugs may make the individual more susceptible to infection and certain malignancies, and they carry other side effects, such as weight gain and bone loss.

Foot and Leg Damage

Diabetes is responsible for most lower limb amputations not caused by trauma. The underlying problem is a combination of peripheral neuropathy and diminished blood flow from the buildup of plaques that block the large and medium-size arteries feeding the leg. When these conditions coincide and are compounded by changes in small blood vessels, a simple cut on the bottom of the foot or even an ingrown nail can become so severely infected that a toe or foot must be amputated.

How Does This Happen?

Because peripheral neuropathy impairs pain sensation, a foot injury can go unnoticed, worsen, and become a feeding ground for invasive bacteria. Poor circulation exacerbates the problem by impeding the body's infection fighters. The white blood cells, antibodies, and other defenders can't easily reach the infected area, and ulcers develop. Foot ulcers are dangerous and require immediate attention. If not treated, they can penetrate deep below the skin and spread infection into bone.

Toes are most vulnerable to infection. People with severe peripheral neuropathy are also more prone to Charcot's foot, a condition in which joint destruction and deformity interfere with walking. Charcot's foot develops when minor trauma to a joint or bone due to daily wear and tear goes unnoticed. Because no changes are made in the individual's stride, footwear, or exercise program, the foot joints are destroyed.

Put Your Best Foot Forward

The adage "An ounce of prevention is worth a pound of cure" applies to many diabetes complications, and foot and leg damage is no exception. The best way to avoid these problems is to keep your blood sugar levels tightly controlled and to practice good foot care.

- Examine your feet every day for any sores, cuts, scratches, breaks in the skin,

or swollen areas. Don't forget to check between your toes.

- Massage feet with a moisturizing cream to prevent dryness and reduce the chance of cracking, which can lead to skin infection.
- Wash your feet with warm water and soap every day, and dry them carefully. Never soak feet because this can dry and crack skin.
- Keep toenails well cared for to avoid ingrown nails, but if this problem develops, don't try to remove the nail yourself.
- Have all calluses, corns, warts, and other common foot ailments treated by a podiatrist.
- Don't use anything that's too hot or too cold on your feet.
- Put on clean socks or stockings each day.
- Wear well-fitting, comfortable shoes. If neuropathy makes it hard to tell how a shoe feels, consult an expert in fitting footwear for people with diabetes.
- Avoid going barefoot to minimize the chances of injuring your feet.
- Treat any foot injury immediately, and seek professional help for any wound that seems unusual or doesn't heal.

Detection and Treatment

Because people with peripheral neuropathy can't rely on symptoms to tell them something is wrong, they must carefully check their feet and toes every day for a possible injury. Footwear must be carefully fitted.

Your doctor may prescribe oral or intravenous antibiotics for a foot ulcer or sore that's infected, but healing can take anywhere from weeks to months and may require bed rest. When circulatory problems inhibit healing, vascular procedures, such as a bypass, may be necessary. If the infection penetrates to the bone or gangrene sets in, part of the foot or leg may need to be amputated. Usually a prosthesis can be fitted afterward to make walking possible.

Cardiovascular Disease

Three out of four people with diabetes die from a heart disease or stroke. While experts don't fully understand the causal relationship between diabetes and cardiovascular disease, it's clear that diabetes -- especially type 2 diabetes -- is often accompanied by various heart disease risk factors, such as high blood pressure, high cholesterol, high triglycerides, and obesity. Diabetes is also associated with an increased tendency for forming clots. Kidney disease, a complication of diabetes, also considerably boosts the risk for heart disease. And studies have demonstrated an association between the earliest stage of kidney disease (microalbuminuria) and heart disease. In addition, high blood sugar levels cause glycation (the attachment of glucose to proteins and lipids) and increase the tendency for oxidation. Some scientists suspect that oxidized LDL cholesterol initiates the inflammatory damage that causes atherosclerosis, the buildup of fatty deposits in artery walls. These fatty deposits evolve into plaques that thicken artery walls. When the plaques rupture, immune system cells and platelets (blood cell components that initiate the clotting process) rush to the scene. A blood clot forms, obstructing blood flow.

It can take years for complications to appear, but when they do, they're usually serious. Restricted blood flow to the heart may trigger the chest pain called angina. A critical lack of blood can also cause a heart attack, in which a portion of the heart muscle dies. When blood flow to the brain is blocked, a stroke can occur. A symptom of peripheral vascular disease called intermittent claudication involves pain in leg muscles during exercise. This pain arises from obstructions in the arteries of the legs.

Detecting and Treating Cardiovascular Problems

Heart disease can be prevented and treated. That's why early detection of high cholesterol, high triglycerides, and hypertension is so vital. A fasting blood test can measure levels of LDL, HDL, and total cholesterol, as well as triglyceride levels. Because hypertension usually has no symptoms, it's important to have your blood pressure checked regularly.

If you have any chest pain or pressure, trouble breathing, or lightheadedness, you should be examined for heart disease. Because nerve damage can blunt or change the usual symptoms of angina, people with diabetes must watch for jaw or arm discomfort, dizziness, or shortness of breath after minimal exercise.

Your doctor may recommend an electrocardiogram (EKG), a test of the heart's electrical activity, to check for any abnormalities. A stress test, which monitors EKG changes while you exercise on a treadmill, is even more sensitive. Sometimes it includes an injection of thallium or a heart ultrasound (echocardiogram), which highlight damaged areas of the heart. A more invasive and definitive test for decreased circulation is cardiac catheterization, in which a catheter is threaded through an artery until it reaches the heart. There, a dye is administered that defines any blockages or narrowed blood vessels on an x-ray.

Diagnosing peripheral vascular disease can usually be done with a physical exam and medical history. The pulse in your neck, legs, and feet will be checked for any obstructions. Other tests are sometimes necessary, especially if vascular surgery is an option. Ultrasound is a valuable tool for identifying blockage in the peripheral arteries, the vessels that supply blood to your brain and extremities.

Keeping Cholesterol Low is Key

People with diabetes have about a 15 to 25 percent chance of developing serious heart problems over a 10-year period. This degree of risk is similar to that of people with known coronary artery disease. Perhaps more sobering, a person with diabetes who has a heart attack is about twice as likely to die from it as a person without diabetes. As a result, the National Heart, Lung, and Blood Institute recommends the same cholesterol-lowering goals for people with diabetes as for people with known coronary disease: keeping LDL ("bad") cholesterol below 100 mg/dL. People with diabetes who already have heart disease, or have multiple risk factors may want to aim even lower and keep LDL below 70 mg/dL.

Treating Cardiovascular Problems

Prevention is the best medicine. For cardiovascular disease, that includes controlling blood glucose levels, eating right, getting regular exercise, quitting smoking, and paying proper attention to your blood pressure, cholesterol, and triglycerides. Also talk to your doctor about whether a daily baby aspirin (81 mg) would help you stave off heart disease.

A number of medications can reduce cholesterol, triglyceride levels, or both, and antihypertensive drugs can keep blood pressure within the normal range. Despite their advantages, many of these medications have side effects, and it's important to make sure that they don't interfere with blood glucose control or mask the symptoms of hypoglycemia. Some commonly used drugs, such as thiazide diuretics, beta blockers, and niacin can affect glucose control.

If heart disease is present, it may be treated with drugs, surgery, or procedures such as balloon angioplasty (in which a balloon is positioned in a narrowed artery and inflated to widen the vessel) and stent placement to keep the artery from closing again.

Exercise, quitting smoking, drugs, balloon angioplasty, and sometimes surgery may relieve leg pain due to peripheral vascular disease. A stroke may require immediate hospitalization. Therapy can include medications, surgery, and rehabilitation, and bypass surgery may be necessary to treat blocked arteries.

It's just as important to follow the preventive measures outlined above after you've had a heart attack or been diagnosed with heart disease. These practices can improve your overall health and lessen the chance that your diabetes will worsen.

New Advances in Diabetic Treatments

The latest research for controlling type 1 and type 2 diabetes, from innovative insulin delivery systems to potential breakthrough medications.

New Insulin Delivery Systems

Thanks to advances in biomedical technology, the care and treatment of diabetes continues to improve. In time, there may even be a cure. In the shorter term, though, some of the following innovations may soon be available.

Several new devices may revolutionize how insulin is delivered, or at least offer you more ways to get the insulin you need.

Implantable Insulin Pump

Large clinical trials have tested pumps that are surgically implanted under your skin, usually into the wall of your abdomen, and programmed to deliver insulin into your abdominal cavity or a large vein. Like the external insulin pump, they can closely imitate the action of a normal pancreas and eliminate the need for multiple insulin injections every day. About the size of a hockey puck, these pumps are regulated by a hand-held remote-control device and programmed to release insulin continuously.

They can also be set to release an extra dose of insulin at mealtime. Depending on your insulin requirements, the pump's reservoir has to be filled, using a small needle, every one to three months. Its battery lasts about four years.

Studies found that people who use this pump maintain near-normal blood sugar levels without having more hypoglycemic reactions, which is often a problem with intensive therapy using external pumps or multiple injections. The biggest disadvantage is that the pump's catheter, which feeds insulin to the cavity of the abdomen or through a vein, occasionally gets clogged and must be cleared. Sometimes this requires a minor surgical procedure.

The cost is also a limiting factor because it's expected to sell for \$10,000-\$15,000, not including the cost of surgery to implant the device. Finally, the pumps currently available can't adjust insulin delivery automatically because no practical means of continuous glucose monitoring has been developed. In order to "instruct" these pumps, you'll still have to rely on frequently checking your glucose levels. Implantable pumps remain in the research phase and are not yet approved for sale in the United States.

Oral Insulin

Insulin cannot be taken orally because digestive juices destroy it before it can be absorbed. However, in animal studies, a polymer-coated oral insulin has successfully lowered blood sugar levels. The polymer gel protects the insulin from stomach enzymes by shrinking. It then expands and releases the insulin in the intestine, where the environment is more hospitable to absorption. The capsule must undergo more study before it can be tested in humans.

Inhaled Insulin

A new technology that permits patients to take insulin through their airways with a device similar to an asthma inhaler is being tested extensively. A pre-measured dose of very fine insulin powder is administered through a hand-held device placed into the mouth. By squeezing a lever on the device, you release a mist of powder, which you then inhale. The powder goes deep into your lungs, where it's quickly absorbed into your bloodstream as rapid-acting insulin. Mechanically operated, the inhaler needs no batteries or other power source. The specially packaged dry insulin stores easily at room temperature.

Recent Research: Clinical trials involving people with both type 1 and type 2 diabetes have shown that inhaled insulin can reduce blood glucose levels. But researchers have not determined whether glucose levels will be reduced as effectively as by injected insulin. And currently all versions of aerosol insulin are rapid-acting, meaning that it would still be necessary to inject long-acting or intermediate-acting insulin.

So far, no side effects or changes in lung function have been reported. And episodes of hypoglycemia have been about what one would expect in practicing tight blood glucose control. Perhaps most telling was the reaction of the 70 people with type 1 diabetes and 51 with type 2 diabetes involved in two recent clinical trials. When given a choice, 80 percent of the type 1 and 92 percent of the type 2 participants decided to

stick with the inhaled system for a year rather than return to injections.

Safety Concerns: But we still don't know how well inhaled insulin will perform in the long run. Whether it will cause lung problems is of some concern, especially because the inhaled dose is approximately 10 times larger than that used for injections. Large Phase III trials are now under way. If they confirm the earlier results and the long-term safety of this product is established, the FDA could approve inhaled insulin for widespread use in one to three years.

Insulin Patch

Researchers are also working on a skin patch that could supply a continuous low dose of insulin. To adjust the dose before meals, users could simply pull off a tab on the patch to release insulin. Studies on animals have shown promise, but in humans so far the patches can provide only low insulin doses.

Continuous Glucose Monitoring and Transplants

Glucose Monitoring Devices

Reliable, continuous blood glucose monitoring has been the holy grail of diabetes management for more than 30 years. Although two devices for this purpose have been approved, they require further improvements before they are widely useful. The ultimate goal, of course, is to develop a device that patients can use to obtain accurate, frequent glucose results. This would be particularly helpful for patients with hypoglycemia unawareness who are at high risk for severe hypoglycemia. Continuous monitoring would warn them of impending low glucose levels, thus making it easier for them to manage their diabetes. Researchers are investigating several noninvasive strategies including the use of new infrared spectroscopy or implantable sensors. Continued improvements in monitoring research should result in effective solutions in the next five years.

Transplants

Pancreas transplantation is the only therapy that can "cure" type 1 diabetes. Although currently limited by organ supply and other factors, researchers are working on methods to make transplantation a viable option for more people.

Pancreas Transplants

There's been considerable progress in whole-organ pancreas transplants. A person receiving a new pancreas, or segments of another pancreas, may have normal blood sugar and no longer need insulin. However, because of the need for major surgery and lifelong medication to suppress the immune system from attacking a foreign organ, the procedure isn't appropriate for most people with type 1 diabetes. It may be recommended for people who already have complications and are going to have a kidney transplant, because the pancreas transplant can be done at the same time and will be covered by the same immunosuppressant drugs. However, organs for transplantation are scarce.

Islet Cell Transplants

As an alternative to whole-organ transplants, scientists have been exploring methods for transplanting only the insulin-producing islet cells in the pancreas. In this procedure, cells are extracted from a donor pancreas and implanted in another person, usually in the liver (which has a large blood supply that can provide nutrients to the donated cells). There, the new islets begin to make and release insulin. The goal is to infuse enough islets to allow people with type 1 diabetes to forgo daily insulin injections. This therapy could also theoretically help people with type 2 diabetes, but the costs of treating the tens of millions of people with type 2 diabetes probably makes this highly unlikely, even if there were an enormous supply of islet cells, which isn't the case.

Recent Research:

Scientists have made many advances in islet transplantation over the past 25 years. A new procedure called the Edmonton Protocol, developed at the University of Alberta in Edmonton, Canada, has been used since 1999 to treat patients with type 1 diabetes. The Edmonton Protocol differs from previous efforts because it transplants a large number of fresh islets and uses a new combination of immuno-suppressant medications. Approximately 80 percent of patients in the study were "cured," at least in the short term -- achieving normal blood sugars without need for insulin injections. The Edmonton Protocol has been tested by other centers as well with initial positive results.

How It Works:

Researchers use specialized enzymes to remove islets from the pancreas of a deceased donor. For an average-size person, the transplant requires about 1 million islets. To extract this many islets generally requires at least two pancreases, so the procedure involves multiple donors. Because the islets are extremely fragile, transplantation occurs soon after they're removed. The surgeon uses ultrasound to thread a small catheter into the liver. The islets are then injected into a large vein in the liver via the catheter. The entire procedure takes less than an hour. Although the early results of the Edmonton Protocol are very encouraging, more research is needed to answer questions about how long the islets will survive and how often the transplantation procedure will be successful.

Treatment Drawbacks:

One drawback is that recipients must take drugs similar to those used in whole-organ transplants to prevent their immune systems from rejecting the transplanted islets. Also, the demand for islet cells far outstrips the supply of pancreases. An alternative source of cells needs to be found before transplantation can become a practical option for the majority of people with type 1 diabetes.

New Medications for Type 2

Much recent progress has been made in expanding the number of medications available to fight type 2 diabetes. Scientists are developing new drugs to stimulate insulin secretion and decrease resistance. New drugs are being developed to manage dyslipidemia (abnormal levels of lipids), hypertension, and obesity -- all hallmarks of type 2 diabetes. Large trials of medication to prevent type 2 diabetes continue as well.

While potential breakthroughs such as inhaled insulin suggest diabetes control will get even easier in the future, much has already been done to reduce the impact of diabetes. New medications, glucose monitors, and insulin delivery systems now make tight glucose control an easier task. A better understanding of the disease has allowed doctors to refine their approach to treatment and develop more aggressive regimens that are meant to halt the disease in its tracks.

Optimists also see many new treatments flowing from the identification of the human genome's estimated 30,000 genes. But the complexity of the possible combinations of genes involved in diabetes is hardly the stuff of overnight success. While awaiting the next breakthrough, the benefits of strictly controlling your blood glucose, eating a healthy diet, and exercising regularly cannot be overestimated.

FOOTNOTE

This report is intended for informational purposes only and is in no way a complete medical journal or report regarding every aspect of Diabetes, causes or remedies. Always seek medical advice prior to embarking on any self-treatment or alternative medications that may have been suggested here or in any other articles linked to by this report.

Read all that you can on this subject, as knowledge is the key to understanding this disease, or even starting on the road to recovery, prevention or finding possible alternative and more natural treatments or cures.

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Sources, Acknowledgements and further reading information

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Compiled from the **Harvard Health Publications Special Health Reports, Digestive Health.**

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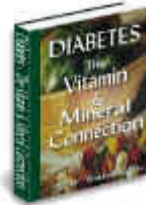
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John Elliott & Luella May

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