The Christ Hospital™ Health Network

Diabetes

what you should know

Vital information about:

- your heart
- cardiac risk factors
- lifestyle modification
- treatment options

Charles J. Glueck, MD & Dean J. Kereiakes, MD, FACC

This book may discuss pharmaceutical products and/or uses of products that have not been approved by the United States Food and Drug Administration. For approved product information, please consult the manufacturer's complete prescribing information for the product.

The Christ Hospital™ Health Network

Provided as an Educational Service by
The Christ Hospital Health Network

Published by Robertson & Fisher Publishing Company, Cincinnati, Ohio

Authors: Charles J. Glueck, MD and Dean J. Kereiakes, MD, FACC
Contributing Editors: Paul Ribisl, PhD; Rona Wharton, MEd, RD, LD; and Douglas Wetherill, MS.

The information contained in this book is not intended to serve as a replacement for professional medical advice. Any use of the information in this book is at the reader's discretion. The authors and the publisher specifically disclaim any and all liability arising directly or indirectly from the use or application of any information contained in this book. A health care professional should be consulted regarding your specific situation.

ISBN 1-892807-34-3

Treatment Disclaimer

This book is for education purposes, not for use in the treatment of medical conditions. It is based on skilled medical opinion as of the date of publication.
However, medical science advances and changes rapidly. Furthermore, diagnosis and treatment are often complex and involve more than one disease process or medical issue to determine proper care. If you believe you may have a medical condition described in the book, consult your doctor.

Table of Contents

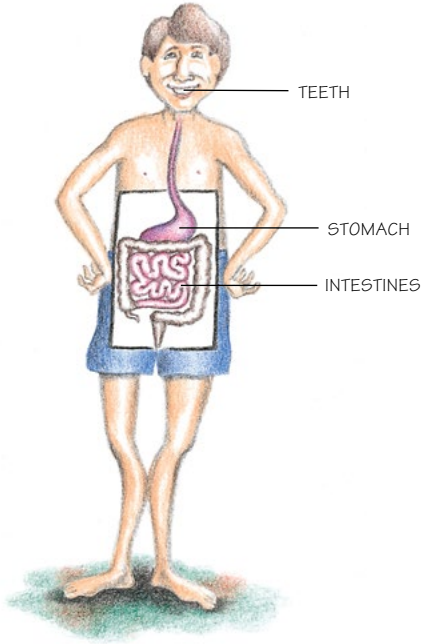
Introduction

Diabetes is a chronic disease that, left untreated, can be life-threatening. Yet nearly one-third of those who have diabetes are undiagnosed — and untreated. The American Diabetes Association (ADA) estimates that, of the 30.3 million people in the United States who have diabetes, 7.2 million are undiagnosed, leaving them at great risk for serious complications.

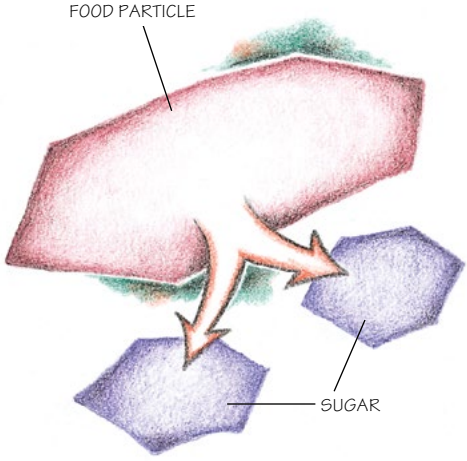
What exactly is diabetes? Most people know that diabetes is related to sugar in the body. How does the body use sugar? Read on. — Charles and Dean

About Diabetes

For our friend Hartley,
mealtime is called
“happy time.”

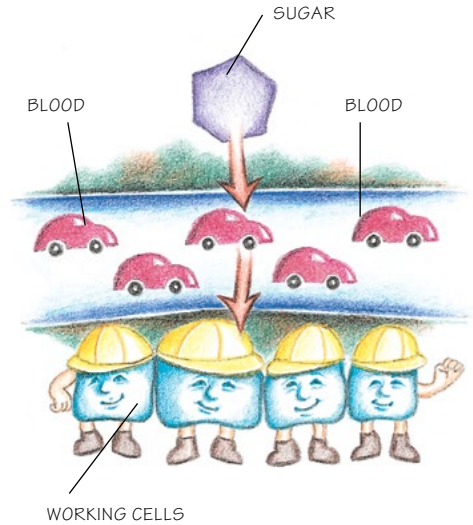


While Hartley eats, his digestive system (teeth, stomach, and intestines) breaks the food down into smaller particles that are used by his body.



Some food is broken down into particles of **sugar.** Sometimes this sugar is referred to as **carbohydrates** or **glucose.**

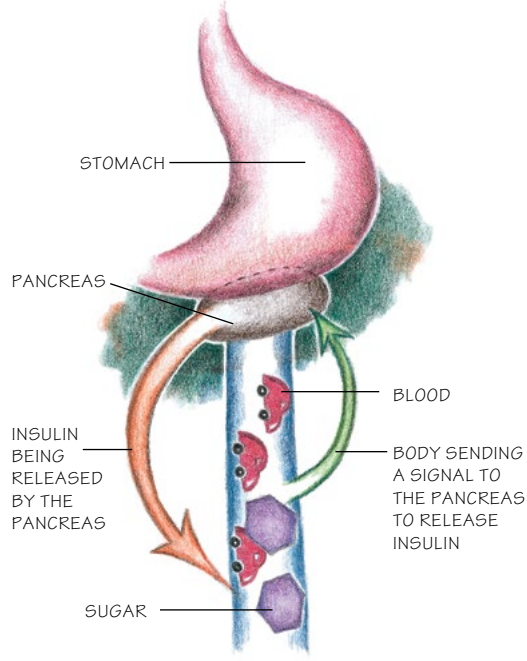
Sugar moves from the digestive system to the blood and travels throughout the body to feed the working cells. The sugar is the energy packet the cells need to do work like running and breathing.



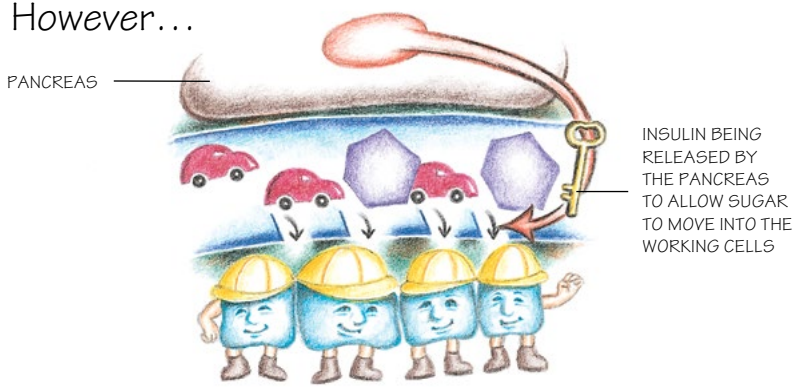
The body also stores sugar in the liver. When the body needs glucose and none is available from eating, the body converts sugar stored in the liver to sugar that can be used by the working cells.

At the same time the sugar moves into the blood, the body sends a signal to the **pancreas** telling it to release **insulin** into the bloodstream.

Insulin is released from the "beta" cells of the pancreas.



Insulin acts like a **key** that unlocks the doors of the cells to let sugar move in. The working cells can then use the sugar for energy to do their jobs. This is how your body uses sugar. However…



…without the key (insulin), the sugar cannot get out of the bloodstream and into the working cells.

The sugar builds up in the blood, and the working cells get hungry. This is what happens in diabetes: the body cannot move sugar from the blood into the cells.

The cells in the body may, particularly in obese individuals, make it harder for insulin to move sugar into the cells, a process known as **insulin resistance**. When insulin resistance occurs, the pancreas reacts by producing even more insulin, and pushing sugar into the cells. Eventually, the pancreas reaches its limit for producing insulin, and although much of the sugar gets into the cells, some does not, resulting in the development of **type 2 diabetes**.

Types of Diabetes

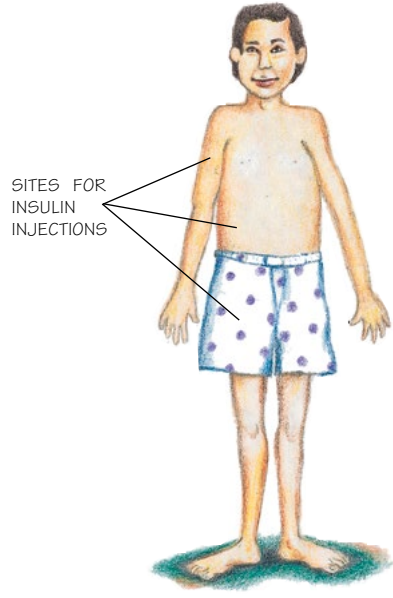
Type 1

Type 2

There are 2 reasons diabetes prevents sugar from moving from the blood to the cells.

One reason is that the body cannot produce insulin. This is known as **type 1** diabetes. A person with type 1 diabetes must replace the missing insulin through multiple daily injections or insulin pump therapy.

Remember, insulin is used by your body to feed your cells. Insulin must be injected every day. There are many places the shots can be given.



The other type of diabetes is called **type 2** diabetes. This type of diabetes is a result of the body's resistance to insulin accompanied by a sick pancreas. Even if the body produces extra insulin, the sugar has a hard time getting from the blood to the working cells.

Type 2 diabetes affects 90% of all people who have diabetes while ...

10% have type 1 diabetes.

Let's recap everything so far:

1) A person with **type 1 diabetes** cannot produce any insulin.
2) A person with **type 2 diabetes** has insulin resistance (cannot use insulin effectively) and does not produce enough insulin to overcome insulin resistance.

Either type of diabetes may be dangerous to your health.

Both types of diabetes may result in **big trouble** if the diabetes is not controlled. If you have diabetes, you should keep your blood sugar level between 90 mg/dL and 130 mg/dL or other limits determined by your doctor. Only by testing your blood sugar **frequently** can you manage to control it between these limits.

The body works best when the blood sugar is within these limits. It is a constant struggle to walk the fine line between blood sugar that is too low and that which is too high.

Another, longer-term measure of blood sugar is called **hemoglobin** or **A1C**. The target A1C is 7% or lower, which indicates good blood sugar control. (This test is discussed in more detail on pages 40-44. Read on!)

Too low

Low blood sugar can make you feel jittery, sweaty, and dizzy. If your blood sugar falls to very low levels (usually below 60 mg/dL), then you might even pass out.

This can be due to too much insulin, too much exercise, not enough carbohydrates, or excessive alcohol intake. It is very important that you eat some carbohydrates to boost your blood sugar back up to normal.

Too high

Over time, high blood sugar can cause damage to your eyes, kidneys, heart, skin, and nerves. In the short term, high blood sugar can cause excessive urination, excessive thirst, changes in vision, and increased likelihood of having bacterial or fungal infections.

High blood sugar may be due to not enough insulin to cover the food you eat, not enough insulin to overcome insulin resistance, some medications, or another illness that can interfere with glucose metabolism.

If your blood sugar is too high, your body may start breaking down fat for fuel and start producing **ketones**.

KETONE

Ketones

When the body does not receive energy from sugar, fats start breaking down to produce energy. If too many fats break down, they may be converted into a poison called **ketones**. Symptoms of elevated ketone levels may include nausea, vomiting, increased heart rate, and rapid breathing. Ultimately, a person producing ketones may end up in a coma.

A person with type 2 diabetes may not experience the same problems as someone with type 1 diabetes. For example, Type 2 diabetes is a major risk for heart disease. A person with type 2 diabetes carries the same risk of heart disease as someone who has already had a heart attack.

It is important to know the dangers of diabetes and to work at keeping it under control.

Do You Have Any Symptoms?

What are the major signs you may have diabetes?

Generally, they are considered to be:

- Frequent urination
- Excessive thirst
- Excessive hunger
- Unexplained weight loss
- Urinary tract infections
- Red, itchy rash in the folds of the skin, usually caused by fungus

Other common symptoms that may occur separately or together include:

- Fatigue
- Blurred vision
- Poor healing of cuts and scrapes
- Dry mouth
- Excessive or unusual infections
- Impotence (in males)

OR

- Lack of feeling or a "tingly" or burning sensation in the hands or feet. These are symptoms of neuropathy that indicate diabetes is affecting the peripheral nerves.

If you have any of these symptoms, you should schedule an appointment with your doctor.

What to Expect at You Doctor's Office

The test is very simple:

A) Do not eat or drink anything (except water) after midnight.

B) Go to your doctor the next morning to have your blood drawn after 8:00 a.m.

C) The sugar in your blood will be measured.

Your doctor will be able to determine your **fasting blood sugar**. The doctor will probably also order a hemoglobin A1C test at the same time.

How do you determine if you have diabetes?

Only your doctor can diagnose diabetes.

The doctor may measure fasting serum insulin to better understand type 2 diabetes. If the insulin level is higher than 20 uU/ml, then you have hyperinsulinemia, caused by the cells in the body being resistant to the action of insulin.

A very important number to remember!

20

uU/ml

Just as important ..

If your **fasting blood sugar** is between 100 mg/dL and 125 mg/dL, the American Diabetes Association (ADA) says that you have **impaired fasting glucose** or **IFG**.

Other important numbers to remember:

100 to 125

mg/dL

IFG

Why is impaired fasting glucose or IFG important? If a person has IFG, he or she has a greater chance of eventually developing diabetes.

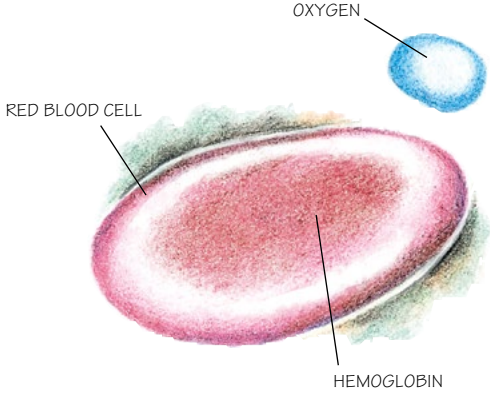
Type 2 diabetes can progressively worsen over time. However, its progression may be delayed or stopped if it is caught early. Someone who has a normal sugar response may gradually become inactive, overeat, and become overweight. He or she may develop insulin resistance and ultimately may increase the chances of developing diabetes.

It is important that both you and your doctor develop a realistic and aggressive approach for dealing with diabetes.

A1C

Your doctor may also ask you to have a hemoglobin A1c test to determine how controlled (close to normal) your blood sugar has been over the last 3 months.

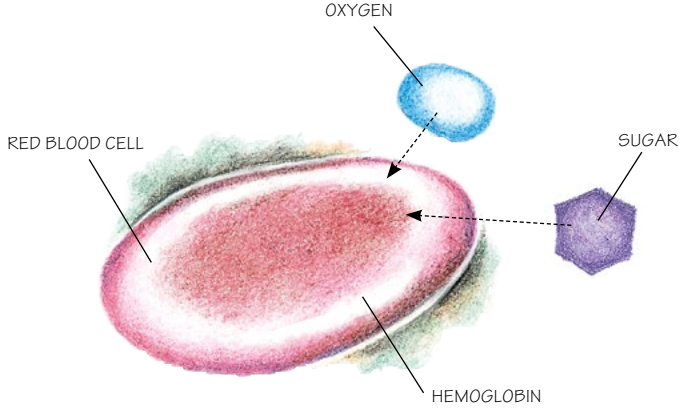
How does this test work?



This gets a little complicated. Hang in there.

Hemoglobin is a part of your blood.

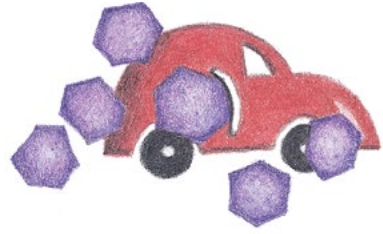
When hemoglobin is around blood sugar, the sugar starts sticking to the hemoglobin.



The more sugar in the blood, the more it sticks to the blood cells. They become "sugar coated."

RED BLOOD CELL USED TO CARRY OXYGEN AND NUTRIENTS

"SUGAR COATED" RED BLOOD CELL



What are the normal values for A1C?

Without diabetes. . . . . Less than 6%
Diabetes in good control . . Less than 7%
Diabetes out of control . . . Greater than 8%

Talk to your doctor about what your A1C target should be.

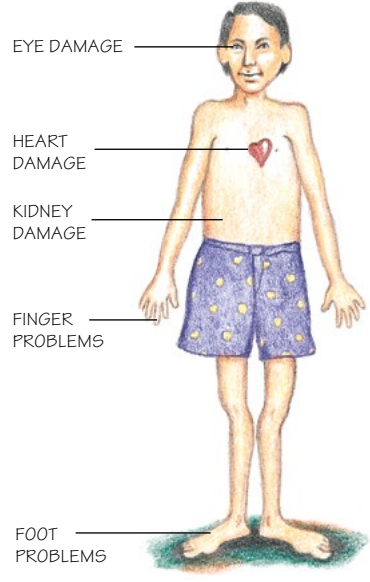
According to the American Diabetes Association (ADA), individuals should be tested for diabetes according to the following guidelines:

1) Testing should be done at age 45 and above. If the results are within normal limits, the individual should be rechecked every 3 years.
2) Testing should be considered before age 45 or should be carried out more often for people who:
    - Are overweight
    - Have a first-degree relative (parent, brother, or sister) with diabetes

- Are members of an ethnic population that is at high risk of developing diabetes (e.g., African-American, Hispanic, Native American)
- Have delivered a baby weighing more than 9 pounds, or have been diagnosed with **gestational diabetes**
- Have blood pressure above 140/90 mmHg
- Have an HDL-cholesterol level less than 35 mg/dL and/or a triglyceride level more than 250 mg/dL
- Have been diagnosed with **impaired fasting glucose** on a previous test

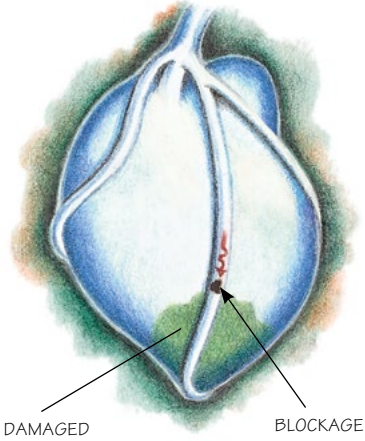
How Serious is Diabetes

Complications of diabetes may include damage to the eyes, the kidneys, and the nerves (with "pins and needles" or painful feelings in the hands or feet). Diabetes also increases the risk of heart attack and stroke.



The heart

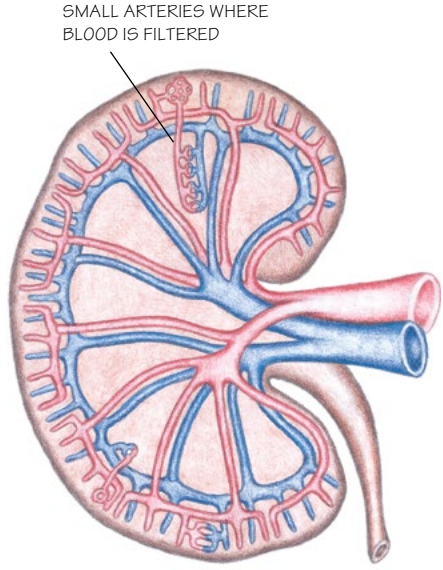
The ADA reports that increased blood sugar levels may damage the heart 4 to 7 years before the symptoms of diabetes appear. In other words, damage may be occurring to the body, but the individual does not realize it. People who have diabetes are 2 to 4 times more likely to develop heart disease. Consequently, they are more at risk of developing plaque in their arteries. If plaque clogs the arteries of the heart, blood flow to the heart muscle is reduced, and the heart muscle may not receive enough oxygen.

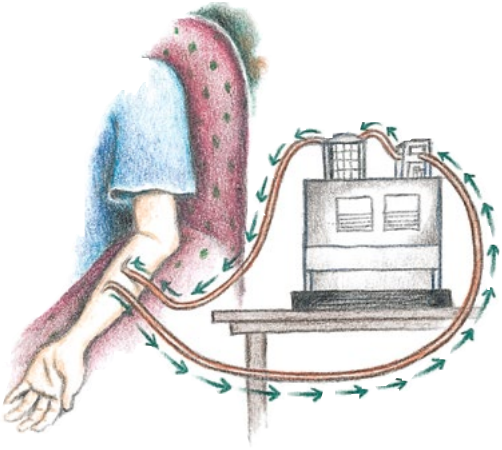


Lack of oxygen to the heart may cause a portion of the heart to be damaged (heart attack). For more information on what contributes to plaque development, see page 106.

Kidneys

The kidneys filter waste products out of the blood. If sugar-induced damage occurs to the kidneys, the kidneys may not be able to filter properly. This may cause **protein** to leak into the urine, which is a sign that something is wrong with the kidneys.





Dialysis

Poor kidney function is a common complication of diabetes. If the kidneys start to fail, **dialysis** may be needed to remove waste from the blood.

Feet and fingers

Sugar can attach to the nerves and arteries that supply the fingers and feet. Damage to the nerves may result in 1 or more of the following symptoms:

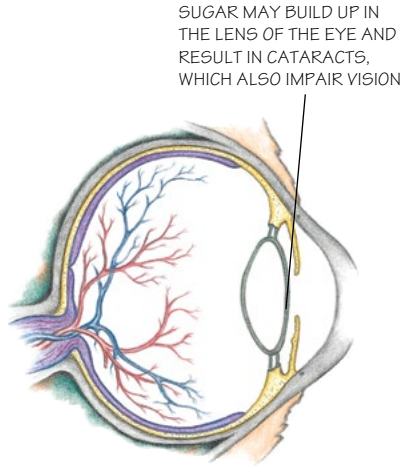
1) Tingly, "pins and needles" feelings in the hands or feet
2) Burning pain in the hands or feet
3) Loss of feeling in the hands or feet (much less likely)

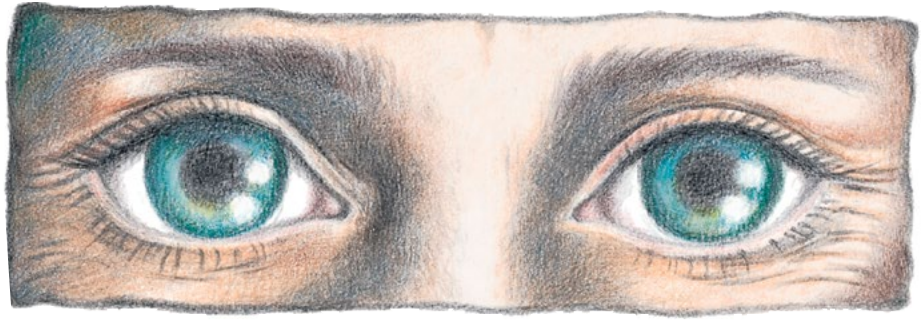
Damage to the arteries may limit blood flow to these areas.

Lack of proper attention to the lower legs and poor circulation are the leading causes of amputation for people who have diabetes.

Eyes

Similarly, people who have diabetes may have restricted blood flow to the eyes. The body may try to compensate by developing new arteries. These new arteries can cause scarring or can leak. The seeping blood may distort the retina, impair vision, and even cause blindness.





If you have had diabetes more than 5 years, or if you are 30 years old or older, it is important that you receive a yearly **eye exam. Ophthalmologists** use eye drops to dilate the pupils so that they can examine the blood vessels in the back of the eyes properly.

Treatment of Diabetes

Large research studies have reported that careful control of blood glucose may reduce complications. How can you achieve good control? Try these:

- Self-monitoring of blood glucose
- Diet
- Education
- Exercise
- Medications
- Attitude

Frequent self-monitoring of blood sugar

How often should you check your blood sugar?

There is a big difference between type 1 and type 2 diabetes regarding the frequency of measurement. In type 1 diabetes, at a minimum you should check your blood sugar before each meal and before bedtime. Blood sugar may be

checked at home, school, or work. This means people with type 1 diabetes should ideally monitor their blood sugar **4 times a day**.

In type 2 diabetes, particularly when overall blood glucose is well controlled, checking first thing in the morning before breakfast is probably sufficient. However, when type 2 diabetes is first diagnosed, checking 4 times per day is appropriate until blood glucose is stabilized.

You should also test your blood sugar any time you suspect that it is too high or too low. It is important to know what your blood sugar level is so you can take the correct action to adjust it. If your blood sugar is too low, you should eat some sugar or hard candy, or drink some orange juice. If your blood sugar is **too high**, you may need a shot of insulin and, in rare instances, fluid or electrolyte replacement. If your blood sugar level is frequently **too low or too high**, talk to your doctor about adjusting your oral medication or insulin. **You should always talk to your doctor before making any adjustments.**

Diet

Because diabetes is about sugar, and sugar comes from what you eat, your diet becomes VERY important. You may have to meet with a registered dietitian to set up a meal plan just for you. And it will be a healthy way of eating!

Unfortunately, 1 diet does not work for everyone with diabetes. The dietitian will generally review your lab results and lifestyle and then discuss treatment options. The diet becomes a form of treatment — **medical nutrition therapy** — which is just for you.

Education

Education is a major factor in controlling your diabetes. A **certified diabetes educator** can review how you monitor your blood sugar, provide you with the latest recommendations, and possibly suggest lifestyle changes.

Exercise

Physical inactivity is related to the development of type 2 diabetes. So, exercise is very important. Exercise is also important for people who have type 1 diabetes, but your food and insulin regimens may have to be changed to provide enough energy for exercise. Your diabetes educator or dietitian can help you with any changes.

Because everyone is different, you should obtain approval from your doctor before you begin a vigorous exercise routine.

Medications

As mentioned earlier, medication may significantly improve your control of diabetes. The 3 main types of medication include:

1) Insulin (type 1 and type 2)

2) Oral medication (type 2)

3) Injectable medication (type 2)

1. Insulin

People who have **type 1** diabetes cannot produce insulin and, therefore, need insulin injections.

Because various amounts of insulin are needed throughout the day, there are different types of insulin available. You and your doctor can work together to get the right insulin treatment for you.

2. Oral medication

Type 2 diabetes may be controlled by proper diet and exercise. If type 2 diabetes cannot be controlled by diet and exercise, you may need an oral or injectable medication or could require insulin.

There are 4 basic types of oral medicine for diabetes that work very differently.

1) One class of drugs reduces insulin resistance and lowers insulin levels by making the cells in the body more receptive to insulin (biguanides, thiazolidinediones).

In most cases of type 2 diabetes, the first drug to be started is a biguanide called metformin. For some people who cannot tolerate metformin because of impact on the digestive tract, pioglitazone should be started. Pioglitazone is not recommended for individuals with heart failure.

2) Another class of antidiabetic drugs (sulfonylureas) stimulates the pancreas to provide more insulin. However, this class of drugs may actually increase the risk of heart attack and often causes low blood glucose (hypoglycemia). Use of this class of drugs has declined as safer and better drugs have become available.

3) A third class of oral medication is DPP-4 inhibitors. These slow the emptying of the stomach, which slows absorption of glucose. They also help stimulate the pancreas to produce insulin and help manage the release of sugar from the liver.

4) A fourth class of oral agents is the SGLT2 inhibitors. They reduce reabsorption of glucose from the kidneys and have the added benefit of facilitating weight loss. Side effects may include increased risk of urinary tract infection or vaginitis.

3. Injectable medications

GLP-1 receptors are easily injected at home, most commonly once a week or, for some drugs in this class, once a day. They make your own insulin work more efficiently and promote weight loss as well.

Talk to your doctor about which class of medications is most effective for you. Very often it is necessary to take more than a single medication for type 2 diabetes. Common combinations are

metformin plus a DPP-4 inhibitor, or metformin plus a GLP-1 receptor. If optimal control is not achieved with these 2-drug combinations, then often an SGLT2 inhibitor is added as a third drug.

Attitude

Diabetes is a serious disease. However, with an accepting attitude, you can live a normal, healthy life.

Start by being honest with yourself. You have to **want** to get in control. It requires a lot of discipline. If you are successful, there is less chance that diabetes will prevent you from doing what you want to do. And, ultimately, you can put diabetes in its proper perspective — allowing yourself to be a person first, and a person who has diabetes second.

Appendixes

A. Risk factors for complications

B. Heart medications

C. Exercise

A. Risk factors for complications

After you have been diagnosed with diabetes, what risk factors may result in other health complications?

1) Family history of premature coronary artery disease
2) Obesity
3) Smoking
4) Hypertension or high blood pressure
5) Elevated cholesterol and its major component, LDL-cholesterol

1. Family history

A **family history** of cardiovascular disease could reflect genetics and/or an unhealthy family lifestyle. If most of your family members smoke, are sedentary, and have a poor diet — then these are harmful habits that increase the risk of heart disease in your family. However, unlike your genes, these behaviors can be changed.

On the other hand, if your family has a healthy lifestyle but there is still a high incidence of cardiovascular disease, then it is likely that genetics is playing a role. We are learning more about the importance of genetic risk for vascular disease. In the future, treatment may be tailored to an individual's own genetic makeup. In either case, by practicing a healthy lifestyle, you can help reduce your risk rather than giving up and thinking you have no control over your destiny.

2. Overweight or obesity

The American Heart Association describes obesity as a major risk factor for cardiovascular disease. What exactly is obesity?

Metropolitan Life's height/weight tables are often used to determine a recommended weight for an individual based on age and gender. Generally, those who are 20% over the recommended weight for their height are considered to be overweight — but not necessarily obese. Obesity refers to fatness rather than weight. Men who have greater than 25% of their body weight as fat

and women who have more than 35% are considered to be obese. Obesity and being overweight carry significant health risks, are directly related to cardiovascular risk factors, and may:

- raise triglycerides (the "bad" blood fat)
- lower HDL-cholesterol (the "good" cholesterol)
- raise LDL-cholesterol (the "bad" cholesterol)
- raise blood pressure
- increase the risk of developing diabetes, and
- increase the risk of metabolic syndrome and insulin resistance

Obesity may be related to both genetics (nature) and lifestyle (nurture). Generally speaking, obesity occurs when the calories we consume exceed the calories we burn through activities of daily living and exercise. We store the excess calories as fat reserves, thus contributing to obesity and ultimately increasing the risk of coronary disease. Obesity has increased in men and women in every decade over the past 50 years.

There is a misconception that Americans are overeating and eating too much fat. In fact, as a nation we are eating less fat, fewer calories, and still gaining weight — primarily due to the lower levels of physical activity in our youth and adult lives. A sedentary lifestyle could be the real culprit.

Recently, a dramatic increase in obesity has been observed in children and adolescents. According to the Centers for Disease Control, obesity rates in adolescents ages 2–19 is about 17% or 12.7 million children in the United States alone. Obesity in children may lead to high blood pressure and pre-diabetes, and it may also lead to chronic conditions such as heart disease, type 2 diabetes, stroke, several types of cancer, and osteoarthritis.

3. What about smoking?

What about smoking? Don't do it. Smoking is bad for the entire cardiovascular system because it:

- Introduces carbon monoxide into the body
- Directly harms the blood vessels
- Increases blood pressure and heart rate
- Increases the risk of a heart attack

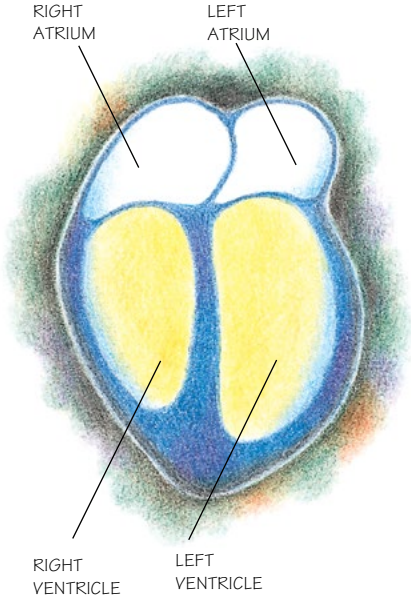
Smoking has harmful effects, especially for anyone who has already had a heart attack or bypass surgery. More importantly, there is an increased risk of a second heart attack or need for stent placement or another bypass surgery if you continue to smoke after an initial cardiac incident.

Smoking is also a risk factor for **peripheral vascular disease** (blockages of the arteries to the brain, kidneys, and legs).

4. Hypertension or high blood pressure

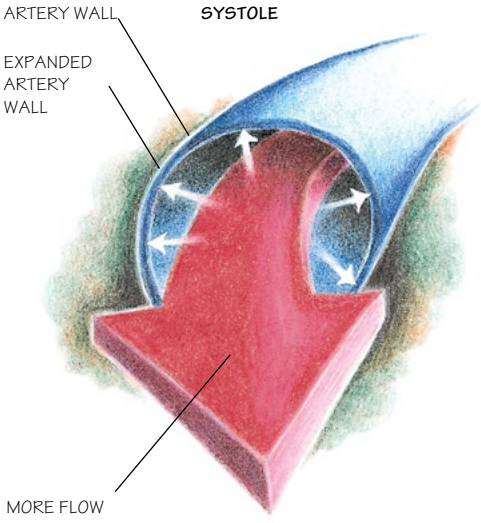
Hypertension is commonly referred to as high blood pressure. It is important to know what blood pressure is… and then understand some of the lifestyle modifications you can take to manage your blood pressure. For some people, lifestyle changes are not enough to lower blood pressure, and your doctor may need to add medication(s) to manage your condition.

Let's start with a brief description of the heart.

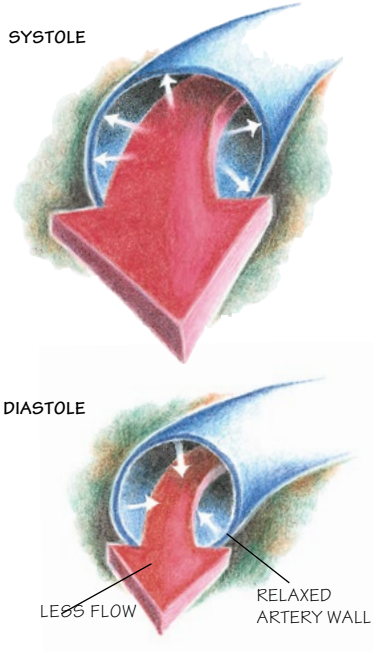


The heart is made of 4 chambers. The top 2 chambers are called the **atria** and the bottom 2 chambers are called the **ventricles**. The ventricles are larger than the atria, and the left one is more muscular. When the ventricles contract, they propel blood out of the heart.

Here's a simple explanation of blood pressure



Blood comes out of the heart (**left ventricle**) in 1 big thrust. The artery expands to handle the blood. The amount of pressure put on the expanded artery wall is called **systolic pressure**.



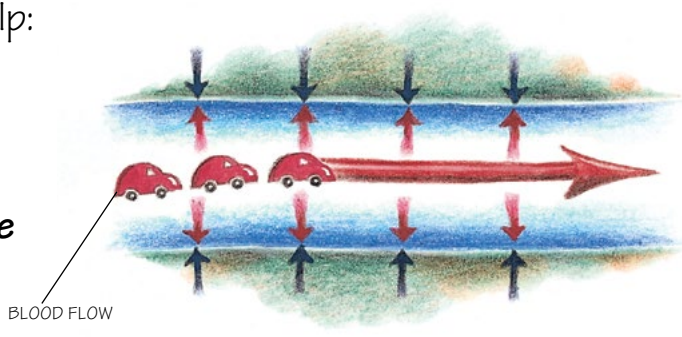
After the artery expands during systole, it relaxes back to its normal size.

It is similar to a rubber band that goes back to its normal shape after being stretched. Normal pressure on the artery wall during relaxation is called **diastolic pressure**.

How does hypertension relate to cardiovascular disease?

Blood pressure is a result of the blood flowing through the artery (cardiac output) and the resistance of the artery wall (vascular resistance). If that sounds too technical, here… this may help:

Blood pressure = Cardiac output x vascular resistance



If a lot of resistance is created by either the blood or the artery wall, then there is more pressure as the blood travels through the artery. If it takes more energy to get blood through the arteries, then your heart has to work harder with each beat. Most people with high blood pressure do not realize they have it. No wonder hypertension is called the "silent killer."

What contributes to hypertension?

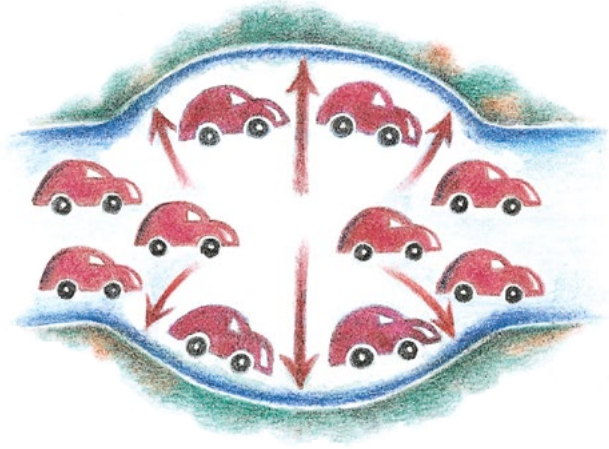
Several factors contribute to hypertension and cardiovascular disease. These include:

- Excess dietary salt
- Excess alcohol intake
- Stress
- Obesity, particularly morbid obesity
- Age
- Genetics and family history
- Physical inactivity
- High saturated fat diet

Excess dietary salt

Salt helps conserve water in your body. The American Heart Association Step 2 diet recommends that the average person consume no more than 2,400 mg of salt per day, especially those individuals who are salt sensitive. Excess dietary salt may contribute to both hypertension and to your body retaining too much water.

If you are retaining too much water, then you are increasing your blood volume (cars) without adding space. This increase will result in more pressure in the arteries.



Excess alcohol consumption

A common concern for individuals with cardiovascular disease is alcohol consumption — mainly because there seems to be conflicting evidence about the benefits versus the risks of drinking. Experts agree that excess alcohol consumption over time can lead to many harmful effects, including high blood pressure, cirrhosis of the liver, and damage to the heart. The issue is the balance between **moderate** and **excessive** alcohol consumption.

While evidence shows that there is a protective effect for **moderate** alcohol consumption, this benefit disappears with excessive intake. Men should consume no more than 2 drinks* daily, and women, because of their smaller body size, should not consume more than 1 drink* each day. The 7 to 14 allowable drinks in a week should not be consumed in a few days or during a weekend of binge drinking. Drinking alcohol for cardio-protection is not a good idea.

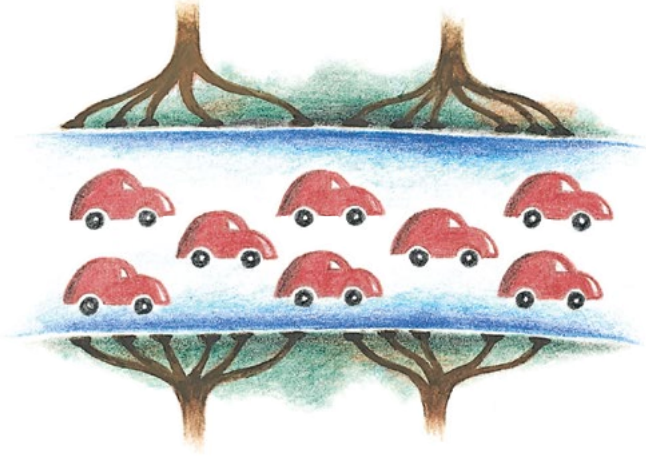
***A guide**: One drink is defined as 5 ounces of wine, 12 ounces of beer, or 1-1/2 ounces of 80-proof liquor.

People who should not drink alcohol include individuals with high levels of triglycerides in their blood (over 300 mg/dL), women who are pregnant, individuals who are under age, people with a genetic predisposition for alcoholism or who are recovering from alcoholism, and those taking certain medications. Because alcohol affects blood pressure, people who have high blood pressure should not have more than 1 drink per day.

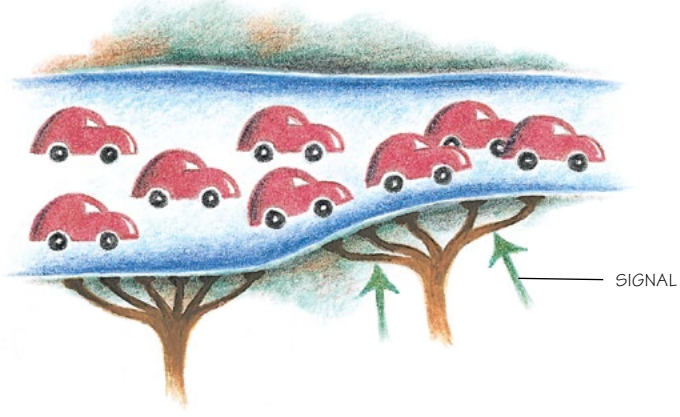
What about stress?

When you are under stress, your brain releases signals to the body through the nerves and hormones. These signals allow your body to respond to various situations. Whether chronic stress or reactions to stress raise blood pressure is hard to define and even harder to treat because stressors are usually related to the environment and lifestyle.

Arteries have nerves attached to them. The nerves can either cause the arteries to relax or can put more tension on the walls of the arteries. If you are under a lot of stress, the nerves send signals to tighten or narrow the arteries.



Narrowing the artery is like taking away a lane of traffic. The same number of cars (blood) need to move through a smaller space (artery). This increases the pressure inside the artery.

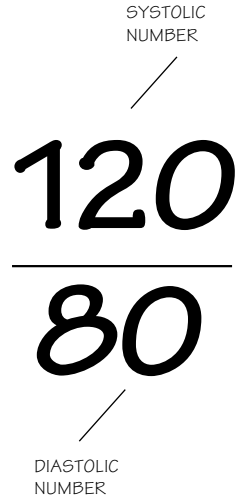


What is my blood pressure goal?

The recommendation for appropriate levels of blood pressure is determined by your age. Individuals who are 60 years or older should talk to their doctor about possible treatment options if their systolic blood pressure is 150 mmHg or higher, or if their diastolic blood pressure is 90 mmHg or higher. Similarly, individuals between 18 and 60 years old should talk to their doctor if their systolic blood pressure is 140 mmHg or higher, or if their diastolic blood pressure is 90 mmHg or higher.

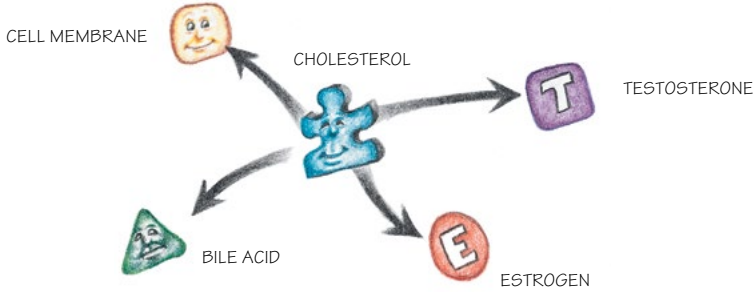
Managing high blood pressure

Talk to your doctor about your blood pressure goals. Because blood pressure can vary depending on what you are doing, your doctor may ask you to have your blood pressure retested, or he or she may ask you to buy an automatic blood pressure cuff and monitor your blood pressure at home monthly, weekly, or more frequently with changes in blood pressure medication.



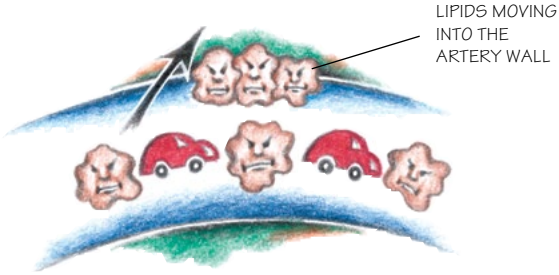
5. Elevated cholesterol

Cholesterol is a waxlike substance that serves as a building block within the normal **cell membrane**. Cholesterol is also used to make **hormones**, especially **estrogen** and **testosterone**. It is also used to make **bile acids** that help break down fat in our intestines.

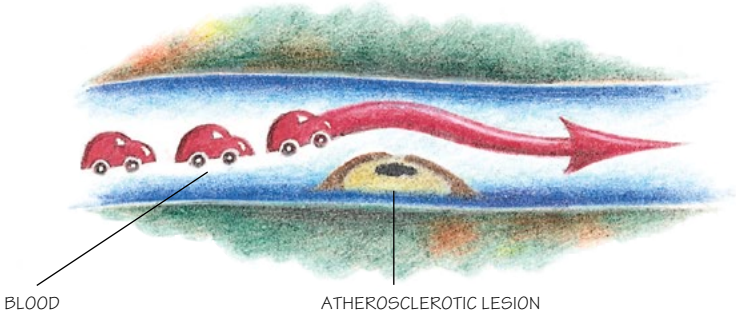


Why is cholesterol so harmful?

Fatty streaks in the arteries start to develop in the first decade of life as a result of **lipids** moving into the cell wall of the artery.



When people smoke or they have risk factors such as diabetes, high blood pressure, obesity, high cholesterol, and physical inactivity, these fatty streaks may become more advanced **atherosclerotic lesions**.

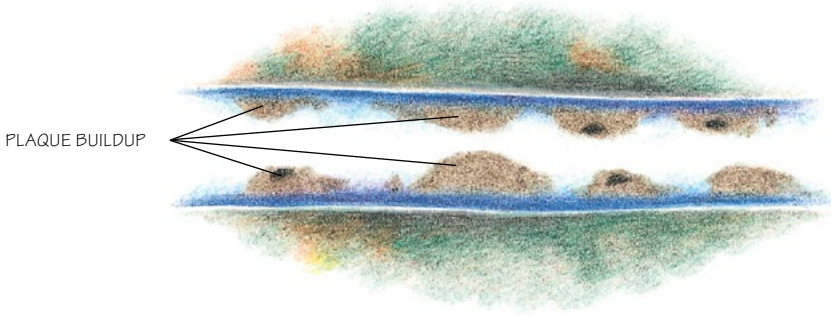


The body views these fatty streaks as "infection."
It tries to fight the "infection" by producing inflammation.
Fatty streaks may eventually progress to **plaque**
(atheromas or fibroatheromas).

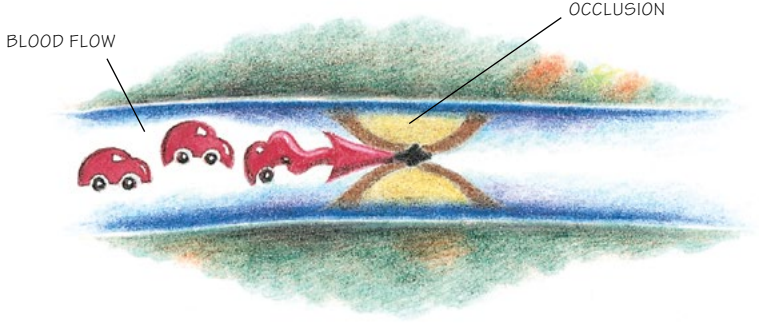
Simply, the progression of cholesterol inside the artery wall is:

Damaged Artery→Fatty Streaks→Inflammation→Plaque

Buildups of plaque may occur at multiple points along the length of the artery, often starting where the artery divides into branch points or forks in the road. Plaque buildups are not limited to the arteries of the heart. They can occur and restrict blood flow in arteries throughout your entire body, including the brain (**stroke**) and legs (**claudication**).



The total blockage of the artery may occur due to: (a) the **buildup** of plaque, (b) the formation of a blood clot on the plaque, or (c) the plaque **rupturing** and causing a larger blood clot to form. The complete blockage of the artery is called an ***occlusion***.



What should my cholesterol levels be?

The American Heart Association (AHA) and the American College of Cardiology (ACC) create the guidelines for managing blood cholesterol. High cholesterol has a long-term, cumulative effect on damaging a person's entire cardiovascular system, so the guidelines stress the importance of lifestyle modifications such as:

(1) adhering to a heart-healthy diet, (2) exercising regularly based on your doctor's recommendations, and (3) avoiding tobacco products.

For individuals who cannot lower their cholesterol with diet and exercise alone, the AHA/ACC guidelines provide recommendations on when to start cholesterol-lowering medications. Your doctor may use a "risk calculator" or other screening tests to determine the best treatment option.

The first-line medication to lower cholesterol is a statin. Statins have the most scientific evidence supporting their role in reducing the risk of heart disease, heart attacks and strokes.

Two other medications your doctor may consider are ezetimibe and PCSK9 inhibitors. Ezetimibe may be

prescribed along with a statin for some individuals with high cholesterol. For a small portion of the population that does not respond well to statin therapy or cannot tolerate statins, a doctor may prescribe a PCSK9 inhibitor. PCSK9 medications are very effective but are also fairly expensive. Talk to your doctor about whether a statin (with or without ezetimibe) or PCSK9 inhibitor provides the most benefit based on your medical history and your health care coverage.

High triglycerides can contribute to cardiovascular disease, so your doctor may also prescribe a medication to help lower your triglycerides.

The guidelines also place a special emphasis on the detection of a family history of high cholesterol.

The guidelines recommend that children with a family history of high cholesterol should be tested for high cholesterol between the ages of 9 and 11 and again between the ages of 18 and 21.

B. Heart medications

1. ACE (angiotensin converting enzyme) inhibitors, AII angiotensin receptor) blockers and vasodilators

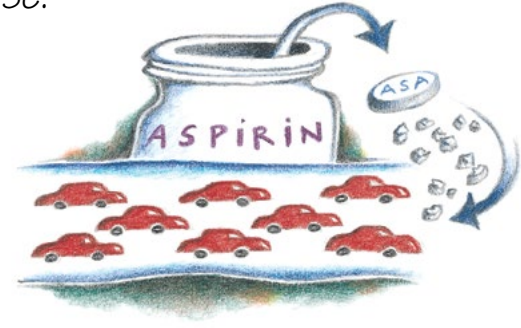
Say that 3 times fast! Because high blood pressure is a major concern for people who have diabetes, the ADA recommends a maximum resting blood pressure of 130/80 mm Hg. These drugs act to enlarge the diameter of the arteries

(reduce vascular resistance), thereby permitting an easier flow of blood and decreasing the workload of the heart. ACE inhibitors have been shown to reduce overall blood pressure in people who have diabetes and also to protect the kidneys. ACE inhibitors are very important when a test of urine shows even a very small amount of protein caused by diabetes. This is called **microalbuminemia**.

These drugs may vary with respect to their peak effective daily dose and the required frequency of

2. Aspirin

The ADA recommends that aspirin be taken by "high-risk" men and women who have either type 1 or type 2 diabetes and who are at risk of developing cardiovascular disease.



Ask your doctor if you would benefit from taking an enteric-coated aspirin. These aspirin usually come in doses of 81 mg or 325 mg. You may not be a candidate for aspirin therapy if you are allergic to aspirin, have a bleeding tendency, are already on anticoagulant therapy, or experienced recent gastrointestinal bleeding and/or liver problems.

Talk with your doctor before taking any medications, including aspirin.

C. Exercise

Before you start your exercise routine, there are a couple of things that you should do.

1) Monitor your blood glucose

2) Check your feet

Glucose too high

Before and after any exercise session, you should monitor your blood glucose. If your blood sugar is too high (more than 240 mg/dL), you must test your urine for ketones. This requires a special test strip. If ketones are present in your urine, you should not exercise. Call your doctor.

Glucose too high before exercise

240 mg/dL

Test for ketones in urine.

Glucose too low

If your blood sugar is too low (less than 100 mg/dL), you should eat a light snack with 15 grams of carbohydrates — such as a piece of fruit or a couple of graham crackers — before you exercise.

Glucose too low before exercise

100

mg/dL

Eat a light snack with 15 grams of carbohydrates.

Shoes

For people who have diabetes, important pieces of exercise equipment are the proper shoes and socks for walking or jogging.

Select shoes that fit your feet properly. Shoes that are either too tight or too loose may cause your feet to develop blisters or sores. These areas may become infected.

Sock selection is equally important. During exercise, even your feet perspire. Select polypropylene socks that will transmit sweat away from your foot to the shoe and to the atmosphere. This will help prevent your feet from chafing.

Be sure that you:

A) Clean your feet thoroughly with soap and warm water after you exercise.

B) Completely dry your feet.

C) Check your feet for any open sores or blisters.

D) Put on fresh socks.

Currently, only about 30% of adults in the United States regularly exercise during their leisure time. What are some important considerations when starting an exercise program?

1) Type of exercise
2) Amount and regularity of exercise
3) Intensity of exercise

You should always consult with your doctor about type and duration of exercise prior to beginning an exercise routine.

1. Type of exercise

Aerobic exercise

To meet your general fitness goals, the best type of exercise is **aerobic** exercise.

Aerobic exercise does not necessarily require special equipment or a health club membership.

Aerobic exercises are those that require a lot of oxygen. These exercises include walking, jogging, cycling, swimming, cross-country skiing, or rowing.

30 minutes a day, 5 days a week

2. Amount and regularity of exercise

The U.S. Surgeon General recommends that healthy adults exercise 30 minutes, 5 days a week.

There are nearly 50 half hours in a 24-hour day. Exercising for 30 minutes daily requires ***only about 2%*** of your total day. Try to find 1, or 2, or 3 exercises you like to do. You'll enjoy the variety.

3. Intensity of exercise

Warm up

By walking or cycling slowly, you move the blood out to the working muscles.

A warm-up should start slowly and last 5 to10 minutes.

Getting started

If you have a history of cardiovascular disease, or if you are just starting a program, **check with your doctor before starting an exercise routine**. Your doctor is aware of the many factors that may need to be considered in modifying your exercise intensity. Please be sure to ask your doctor for a recommended target heart rate range.

To begin your exercise program, it may be best for you to exercise only 15 to 20 minutes daily for the first few weeks. This may help you more easily establish a consistent exercise routine. Check with your doctor for input

How hard and how often should I exercise?

When you are just starting out, try to exercise very comfortably. Here are 4 quick tips.

1) Try to exercise so that you are breathing noticeably but are not out of breath. Remember this simple rule: you should be able to carry on a conversation while you are exercising.
2) Sweating is a good thing. This means that your body is working hard enough and receiving the necessary stimulus for the muscles and the heart.

3) If you are not fatigued and are completely recovered from exercising on the previous day, then you should exercise daily.

4) Give yourself a warm-up before exercise (several minutes of easy walking) and a cooldown at the end of exercise (again, several minutes of easy walking). Ask an exercise specialist for some recommendations for stretching after your workout, and discuss the intensity of the exercise with your doctor. **If you feel any chest discomfort, lightheadedness, or other concerning symptom, stop your exercise.**

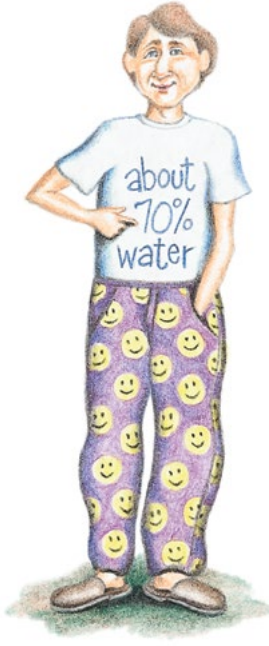
Important!

To begin your exercise program, it may be best for you to exercise only 15 to 20 minutes daily for the first few weeks. This may help you more easily establish a consistent exercise routine. Check with your doctor for input on your exercise program.

VERY, VERY important

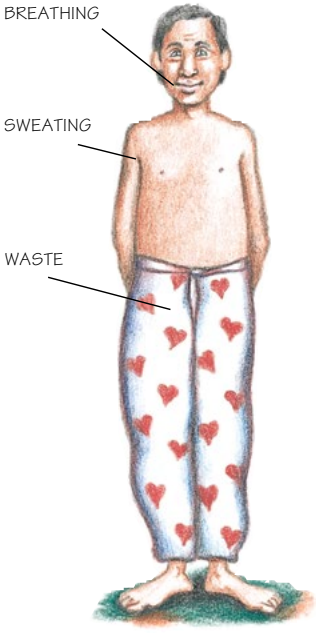
Cool down. As important as the warm-up and the aerobic exercise are to improving your fitness, you must also include a cooldown as part of your exercise routine.

Your cooldown should be just like your warm-up. At the end of your exercise routine, give yourself 5 to 10 minutes of nice, easy walking. You also may want to include some mild stretching.



Another consideration — water

Water is needed for virtually every function of the body. The body is approximately 70% water.



During the course of the day, you lose water through sweating, breathing, and waste. Replacement of water (rehydration) is important — especially when participating in an exercise program.

You should drink 6 to 10 (8-ounce) glasses of water per day. Sorry, caffeinated drinks and alcohol do not count. They are "diuretics," meaning that they actually may cause you to lose even more water.

And Now for a Little Heart to Heart…

Whew! That is a lot of information packed into a tiny book. The reality is that diabetes is very complicated. You simply cannot take 1 tablet a day and forget about it. Diabetes requires constant attention. However, large research studies have reported that people who strive to lower their A1C to less than 7% greatly reduce the number of complications associated with diabetes.

So, where should you start? See your doctor and have a complete physical exam. (The next section of this book contains questions you may want to ask your doctor.)

Your doctor can direct you to invaluable resources, including a certified diabetes educator and a registered dietitian. Then, if your doctor approves, you should get started on a simple exercise program — mainly walking. You may not be able to completely reverse your condition, but you can take simple steps that may lead to a more complete and healthy life.

Afterword

Your doctor will manage your care very closely. Generally, the cardiologist may recommend that you:

- quit smoking
- take a beta blocker drug (after a heart attack)
- lower your blood pressure to 130/80 mmHg or lower
- discuss a cholesterol treatment plan with your doctor
- take a daily enteric-coated aspirin (81 mg or greater) unless you have other medical complications
- keep strict control of diabetes and lower your A1C below 7%
- follow a heart-healthy diet and begin a basic exercise program, mainly walking.

Your doctor will prescribe medications designed to improve your overall health. Be sure to follow these medication guidelines:

- Refill your prescriptions unless otherwise instructed by your doctor or physician's assistant.
- Take the medication as instructed.
- Take the medication at the prescribed time of day.
- Try not to miss taking the medication. Similarly, don't take extra doses.

Contact your doctor before discontinuing any medication.

Talk to your doctor or cardiologist about:

- How often you should have an office visit with your primary care doctor and cardiologist (generally once a year with each doctor)
- How often you should have a cholesterol test
- How often you should have a glucose and hemoglobin A1C test
- When you should get a flu vaccine
- For individuals with heart failure, talk to your cardiologist about how often you should have an echocardiogram
- Discuss how long you will be on antiplatelet medication

In addition to talking to your doctor about heart disease, be sure to discuss the following:

- If you are over age 50, discuss when you should have your next colorectal exam
- If you are a male over age 50, discuss whether you should have a PSA test
- If you are a female between 21 and 65, discuss when you should have your next Pap smear
- If you are a female over age 40, discuss when you should have your next mammography exam

Additional questions for your doctor:

- What are my medications? What is each one for?
- What time of day should I take each one?
- Do I have any exercise limitations? What are they?
- Should I have a treadmill test before I start to exercise? What is my target heart rate?
- Are there any concerns that I should be aware of before having/resuming sexual activity?
- Based on my weight, blood pressure, and blood cholesterol level, should I talk to someone about changing my diet?

The Christ Hospital hopes that you have found the information in this book to be helpful. For additional information about services offered within The Christ Hospital Diabetes and Endocrine Management Team, please click on The Christ Hospital logo below:

Bibliography

American College of Sports Medicine position stand. "The Recommended Quality and Quantity of Exercise for Developing and Maintaining Cardiorespiratory and Muscular Fitness in Healthy Adults." *Medicine and Science in Sports and Exercise* April 1990.

American Diabetes Association (2014). Living with diabetes. Retrieved October 19, 2014, from http://www.diabetes.org.

American Heart Association Consensus Panel Statement. "Preventing Heart Attack and Death in Patients With Coronary Disease." *Circulation* 1995; 2-4.

Burke, A.P., and A. Farb, G.T. Malcom, Y. Liang, J. Smialek, R. Virmani. "Coronary Risk Factors and Plaque Morphology in Men with Coronary Disease Who Died Suddenly." *New England Journal of Medicine* 1 May 1997: 1276-1282.

Centers for Disease Control and Prevention (2014). Childhood Obesity Facts. Retrieved March 4, 2018, from https://www.cdc.gov/obesity/data/childhood.html. Cogswell, M.E. "Nicotine Withdrawal Symptoms." *North Carolina Medical Journal* 1 Jan. 1995: 40-45.

Collins, R., and R. Peto, C. Baigent, P. Sleight. "Aspirin, Heparin, and Fibrinolytic Therapy in Suspected Acute Myocardial Infarction." *New England Journal of Medicine* 20 March 1997: 847-860.

Da Costa, F.D., et al. "Myocardial Revascularization with the Radial Artery: A Clinical and Angiographic Study." *Annals of Thoracic Surgery* Aug. 1996: 475-480.

Eckel, R.H. "Obesity in Heart Disease." *Circulation* 1997: 3248-3250.

Ervine, R.B. (2009). Prevalence of Metabolic Syndrome Among Adults 20 Years of Age and Over, by Sex, Age, Race and Ethnicity, and Body Mass Index; United States, 2003-2006. Retrieved October 19, 2014, from http://www.cdc.gov/nchs/data/nhsr/nhsr013.pdf.

Executive Summary of the Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). JAMA, May 16, 2001, Vol. 285, No. 19: 2486-2497.

Friedman, G.D., and A.L. Klatsky. "Is Alcohol Good for Your Health?" *New England Journal of Medicine* 16 Dec. 1993: 1882-1883.

Gellar, A. "Common Addictions." *Clinical Symposia.* Ciba-Geigy Corporation 1996.

Grossman, E., and F.H. Messerli. "Diabetic and Hypertensive Heart Disease." *Annals of Internal Medicine* 15 Aug. 1996: 304-310.

Grundy, S.M., and J.I. Cleeman, C.N.B. Merz et al. "Implications of recent clinical trials for the national cholesterol education program adult treatment panel III guidelines." *Circulation* 2004; 110:227-239.

Grundy, S.M., and N.J. Stone, A.L. Bailey et al. "2018 AHA/ACC/AACVPR/AAPA/ABC/ACPM/ADA/AGS/APhA/ASPC/NLA/PCNA guideline on the management of blood cholesterol: a report of the American College of Cardiology/American Heart Associateion Task Force on Clinical Practice Guidelines." *Circulation* 2018; DOI10:1161/CIR.0000000000000625.

Henningfield, J.D., and R.M. Keenan. "The Anatomy of Nicotine Addiction." *Health Values* March/April 1993: 12-19.

Hermiller, J.B., and M. W, Jrucoff, D. J. Kereiakes, et al. on behalf of the DAPT study investigators. "Benefits and risks of extended dual antiplatelet therapy after everolimus-eluting stents." JACC CI. 2016; 9:138-147.

http://www.diabetes.org accessed on November 9, 2002.

Inflamation and Heart Disease. Retrieved December 29, 2017 from http://www.heart.org.

James, P.A., and S. Oparil, B. Carter, Evidence-Based Guideline for the Management of High Blood Pressure in Adults. Retrieved October 19, 2014, from http://jama.jamanetwork.com/article.aspx?articleid=1791497.

Joint National Committee. The Fifth Report of the Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure. Bethesda (MD): National Institutes of Health, National Heart, Lung, and Blood Institute; 1993. NIH publication No. 93-1008.

Kannel, W.B., and R.B. D'Agostino, J.L. Cobb. "Effects of Weight on Cardiovascular Disease." *American Journal of Clinical Nutrition* March 1996: 4195-4225.

Kenney, W.L. et al. *American College of Sports Medicine Guidelines for Exercise Testing and Prescription*. 5th ed. Media, Pa.: Williams & Wilkins, 1995.

Margolis, S., and P.J. Goldschmidt-Clermont. *The Johns-Hopkins White Papers*. Baltimore: The Johns-Hopkins Medical Institutions, 1996.

McCarron, D.A., and M.E. Reusser. "Body Weight and Blood Pressure Regulation." *American Journal of Clinical Nutrition* March 1996: 4235-4255.

Meeker, M.H., and J.C. Rothrock. *Alexander's Care of the Patient in Surgery,* 10th ed. St. Louis: Mosby, 1995.

Office of the Surgeon General (2010). *The Surgeon General's Vision for a Healthy and Fit Nation*. Rockville, MD: U.S. Department of Health and Human Services.

Pearson, T.A., and G.A. Mensah, R.W. Alexander, et al. "Markers of inflammation and cardiovascular disease. Application to clinical and public health practice. *Circulation* 2003; 107:499-511.

Peterson, J.A., and C.X. Bryant, *The Fitness Handbook; 2nd edition,* St. Louis: Wellness Bookshelf, 1995.

Ryan, T.J., and J.L. Anderson, E.M. Autman, et al. "ACC/AHA Guidelines for the Management of Patients with Acute Myocardial Infarction: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee on Management of Acute Myocardial Infarction)." *Journal of the American College of Cardiology* 1 Nov. 1996: 1328-1428.

St. Jeor, S.T., and K.D. Brownell, R.L. Atkinson, C. Bouchard, et al. "Obesity Workshop III." *Circulation 1996*: 1391-1396.

Schlant, R.C., and R.W. Alexander. *The Heart*, 8th ed. New York: McGraw-Hill, 1994.

Superko, H.R. "The Most Common Cause of Coronary Heart Disease can be Successfully Treated by the Least Expensive Therapy — Exercise." *Certified News* 1998: 1-5.

United States Surgeon General. Department of Health and Human Services. *The Health Consequences of Smoking. Nicotine Addiction.* Washington, D.C.: U.S. Department of Health and Human Services, 1988.

United States Surgeon General on his priorities at https://www.surgeongeneral.gov/priorities/prevention/strategy/active-living.html accessed March 4, 2018.

Voors, A.A., et al. "Smoking and Cardiac Events After Venous Coronary Bypass Surgery." *Circulation* Jan 1, 1995: 42-47.

Voutilainen, S., et al. "Angiographic 5-Year Follow-up Study of Right Gastroepiploic Artery Grafts." *Annals of Thoracic Surgery* Aug. 1996: 501-505.

White H.D., and J.J. Van de Werf. "Thrombolysis for Acute Myocardial Infarction." *Circulation* 28 April 1998: 1632-1646.

Yufuf S., and F. Zhao, S.R. Mehta, et al. "Effects of clopidogrel in addition to aspirin in patients with acute coronary syndromes without ST-segment elevation." *New England Journal of Medicine* 2001; 345:494-502.

Zelasko, C.J. "Exercise for Weight Loss: What are the Facts?" *Journal of the American Dietetic Association* Dec. 1995: 973-1031.

About the Authors

Dr. Charles J. Glueck is an internationally recognized lipidologist, former Professor of Medicine and Director of the General Clinical Research Center at the University of Cincinnati School of Medicine, and for 30 years Director of the Cholesterol, Metabolism, and Thrombosis Center of the Jewish Hospital of Cincinnati. He has published more than 500 scientific articles and papers.

Dr. Dean J. Kereiakes is one of the country's preeminent cardiologists. Dr. Kereiakes is Medical Director for The Christ Hospital Heart and Vascular Center and The Carl and Edyth Lindner Center for Research and Education, as well as Clinical Professor of Medicine at The Ohio State University. He frequently lectures worldwide and has published more than 900 scientific articles and papers.

Your Health: What You Should Know™

Current titles in the *Your Health: What You Should Know series™:*

Congestive Heart Failure: What You Should Know™
Diabetes: What You Should Know™
Heart Disease: What You Should Know™
High Cholesterol: What You Should Know™
Women's Health Over 40: What You Should Know™
Women's Health Under 40: What You Should Know™

Click on the logo below to go to purchase additional titles:

available at
amazon