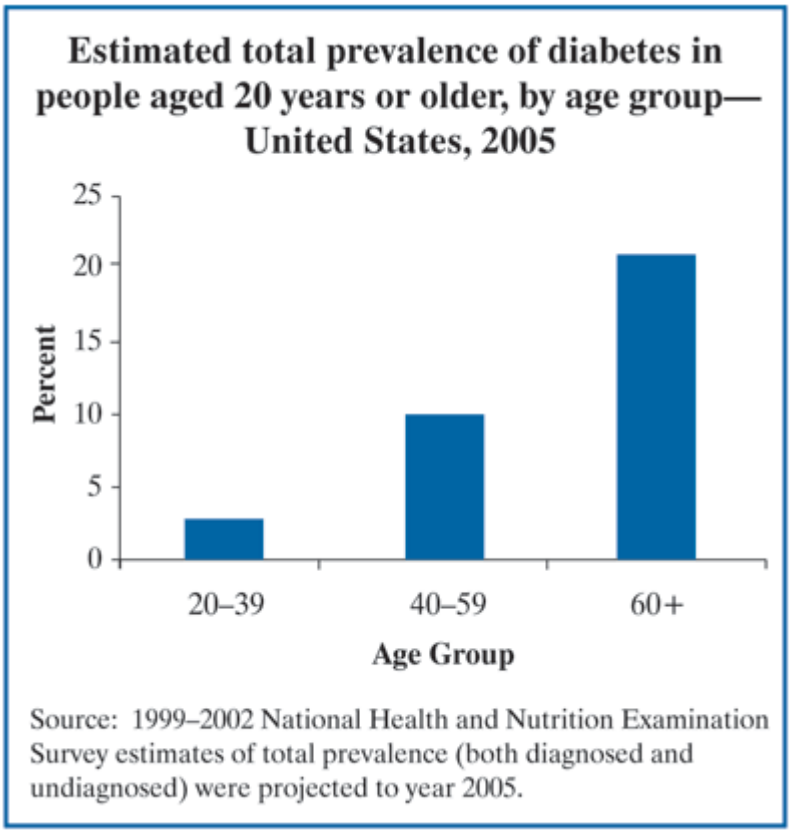
National Diabetes Information Clearinghouse (NDIC)

Diabetes Overview

On this page:

Almost everyone knows someone who has diabetes. An estimated 20.8 million people in the United States—7.0 percent of the population—have diabetes, a serious, lifelong condition. Of those, 14.6 million have been diagnosed, and 6.2 million have not yet been diagnosed. In 2005, about 1.5 million people aged 20 or older were diagnosed with diabetes. For additional statistics, see the *National Diabetes Statistics* fact sheet online at www.diabetes.niddk.nih.gov/dm/pubs/statistics or call the National Diabetes Information Clearinghouse at 1–800–860–8747 to request a copy.



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What is diabetes?

Diabetes is a disorder of metabolism—the way our bodies use digested food for growth and energy. Most of the food we eat is broken down into glucose, the form of sugar in the blood. Glucose is the main source of fuel for the body.

After digestion, glucose passes into the bloodstream, where it is used by cells for growth and energy. For glucose to get into cells, insulin must be present. Insulin is a hormone produced by the pancreas, a large gland behind the stomach.

When we eat, the pancreas automatically produces the right amount of insulin to move glucose from blood into our cells. In people with diabetes, however, the pancreas either produces little or no insulin, or the cells do not respond appropriately to the insulin that is produced. Glucose builds up in the blood, overflows into the urine, and passes out of the body in the urine. Thus, the body loses its main source of fuel even though the blood contains large amounts of glucose.

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What are the types of diabetes?

The three main types of diabetes are

- type 1 diabetes
- type 2 diabetes
- gestational diabetes

Type 1 Diabetes

Type 1 diabetes is an autoimmune disease. An autoimmune disease results when the body's system for fighting infection (the immune system) turns against a part of the body. In diabetes, the immune system attacks and destroys the insulin-producing beta cells in the pancreas. The pancreas then produces little or no insulin. A person who has type 1 diabetes must take insulin daily to live.

At present, scientists do not know exactly what causes the body's immune system to attack the beta cells, but they believe that autoimmune, genetic, and environmental factors, possibly viruses, are involved. Type 1 diabetes accounts for about 5 to 10 percent of diagnosed diabetes in the United States. It develops most often in children and young adults but can appear at any age.

Symptoms of type 1 diabetes usually develop over a short period, although beta cell destruction can begin years earlier. Symptoms may include increased thirst and urination, constant hunger, weight loss, blurred vision, and extreme fatigue. If not diagnosed and treated with insulin, a person with type 1 diabetes can lapse into a life-threatening diabetic coma, also known as diabetic ketoacidosis.

Type 2 Diabetes

The most common form of diabetes is type 2 diabetes. About 90 to 95 percent of people with diabetes have type 2. This form of diabetes is most often associated with older age, obesity, family history of diabetes, previous history of gestational diabetes, physical inactivity, and certain ethnicities. About 80 percent of people with type 2 diabetes are

overweight.

Type 2 diabetes is increasingly being diagnosed in children and adolescents. However, nationally representative data on prevalence of type 2 diabetes in youth are not available. When type 2 diabetes is diagnosed, the pancreas is usually producing enough insulin, but for unknown reasons the body cannot use the insulin effectively, a condition called insulin resistance. After several years, insulin production decreases. The result is the same as for type 1 diabetes—glucose builds up in the blood and the body cannot make efficient use of its main source of fuel.

The symptoms of type 2 diabetes develop gradually. Their onset is not as sudden as in type 1 diabetes. Symptoms may include fatigue, frequent urination, increased thirst and hunger, weight loss, blurred vision, and slow healing of wounds or sores. Some people have no symptoms.

Gestational Diabetes

Some women develop gestational diabetes late in pregnancy. Although this form of diabetes usually disappears after the birth of the baby, women who have had gestational diabetes have a 20 to 50 percent chance of developing type 2 diabetes within 5 to 10 years. Maintaining a reasonable body weight and being physically active may help prevent development of type 2 diabetes.

About 3 to 8 percent of pregnant women in the United States develop gestational diabetes. As with type 2 diabetes, gestational diabetes occurs more often in some ethnic groups and among women with a family history of diabetes. Gestational diabetes is caused by the hormones of pregnancy or a shortage of insulin. Women with gestational diabetes may not experience any symptoms.

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How is diabetes diagnosed?

The fasting blood glucose test is the preferred test for diagnosing diabetes in children and nonpregnant adults. It is most reliable when done in the morning. However, a diagnosis of diabetes can be made based on any of the following test results, confirmed by retesting on

a different day:

- A blood glucose level of 126 milligrams per deciliter (mg/dL) or more after an 8-hour fast. This test is called the fasting blood glucose test.
- A blood glucose level of 200 mg/dL or more 2 hours after drinking a beverage containing 75 grams of glucose dissolved in water. This test is called the oral glucose tolerance test (OGTT).
- A random (taken at any time of day) blood glucose level of 200 mg/dL or more, along with the presence of diabetes symptoms.

Gestational diabetes is diagnosed based on blood glucose levels measured during the OGTT. Glucose levels are normally lower during pregnancy, so the cutoff levels for diagnosis of diabetes in pregnancy are lower. Blood glucose levels are measured before a woman drinks a beverage containing glucose. Then levels are checked 1, 2, and 3 hours afterward. If a woman has two blood glucose levels meeting or exceeding any of the following numbers, she has gestational diabetes: a fasting blood glucose level of 95 mg/dL, a 1-hour level of 180 mg/dL, a 2-hour level of 155 mg/dL, or a 3-hour level of 140 mg/dL. [Top]

What is pre-diabetes?

People with pre-diabetes have blood glucose levels that are higher than normal but not high enough for a diagnosis of diabetes. This condition raises the risk of developing type 2 diabetes, heart disease, and stroke.
Pre-diabetes is also called impaired fasting glucose (IFG) or impaired glucose tolerance (IGT), depending on the test used to diagnose it. Some people have both IFG and IGT.

- IFG is a condition in which the blood glucose level is high (100 to 125 mg/dL) after an overnight fast, but is not high enough to be classified as diabetes. (The former definition of IFG was 110 mg/dL to 125 mg/dL.)
- IGT is a condition in which the blood glucose level is high (140 to 199 mg/dL) after a 2-hour oral glucose tolerance test, but is not high enough to be classified as diabetes.

Pre-diabetes is becoming more common in the United States, according to new estimates provided by the U.S. Department of Health and Human Services. About 40 percent of U.S.

adults ages 40 to 74—or 41 million people—had pre-diabetes in 2000. New data suggest that at least 54 million U.S. adults had pre-diabetes in 2002. Many people with pre-diabetes go on to develop type 2 diabetes within 10 years.

The good news is that if you have pre-diabetes, you can do a lot to prevent or delay diabetes. Studies have clearly shown that you can lower your risk of developing diabetes by losing 5 to 7 percent of your body weight through diet and increased physical activity. A major study of more than 3,000 people with IGT, a form of pre-diabetes, found that diet and exercise resulting in a 5 to 7 percent weight loss—about 10 to 14 pounds in a person who weighs 200 pounds—lowered the incidence of type 2 diabetes by nearly 60 percent. Study participants lost weight by cutting fat and calories in their diet and by exercising (most chose walking) at least 30 minutes a day, 5 days a week.

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What are the scope and impact of diabetes?

Diabetes is widely recognized as one of the leading causes of death and disability in the United States. In 2002, it was the sixth leading cause of death. However, diabetes is likely to be underreported as the underlying cause of death on death certificates. About 65 percent of deaths among those with diabetes are attributed to heart disease and stroke. Diabetes is associated with long-term complications that affect almost every part of the body. The disease often leads to blindness, heart and blood vessel disease, stroke, kidney failure, amputations, and nerve damage. Uncontrolled diabetes can complicate pregnancy, and birth defects are more common in babies born to women with diabetes.

In 2002, diabetes cost the United States $132 billion. Indirect costs, including disability payments, time lost from work, and premature death, totaled $40 billion; direct medical costs for diabetes care, including hospitalizations, medical care, and treatment supplies, totaled $92 billion.

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Who gets diabetes?

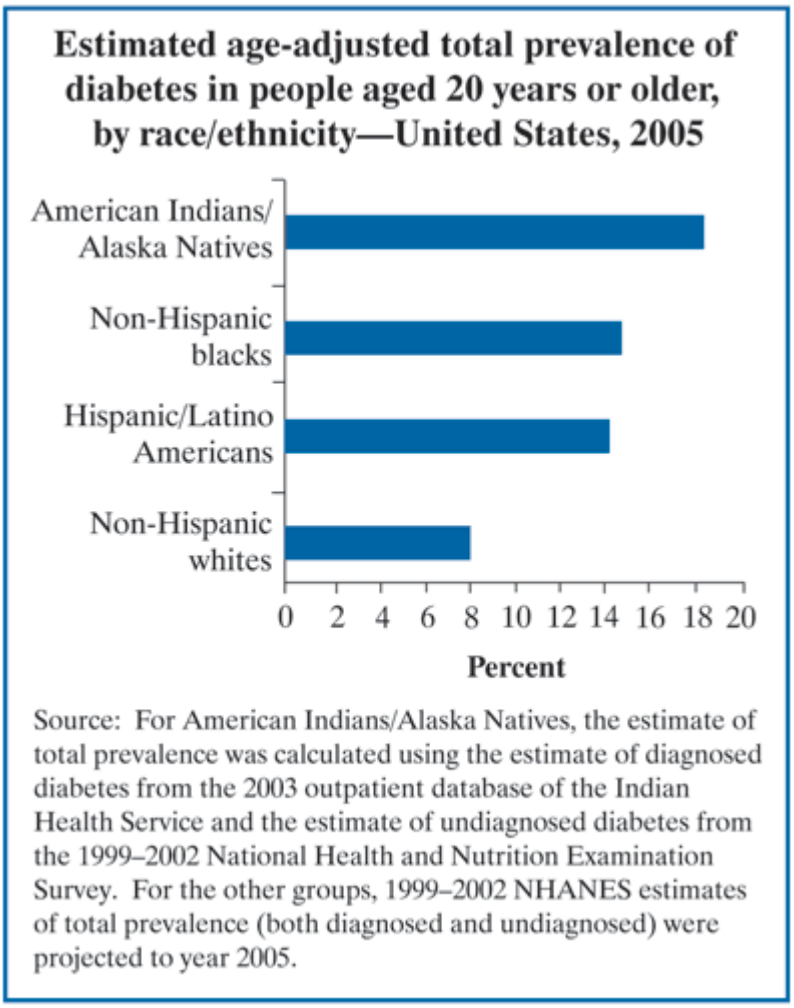
Diabetes is not contagious. People cannot “catch” it from each other. However, certain

factors can increase the risk of developing diabetes.

Type 1 diabetes occurs equally among males and females but is more common in whites than in non-whites. Data from the World Health Organization's Multinational Project for Childhood Diabetes indicate that type 1 diabetes is rare in most African, American Indian, and Asian populations. However, some northern European countries, including Finland and Sweden, have high rates of type 1 diabetes. The reasons for these differences are unknown. Type 1 diabetes develops most often in children but can occur at any age.

Type 2 diabetes is more common in older people, especially in people who are overweight, and occurs more often in African Americans, American Indians, some Asian Americans, Native Hawaiians and other Pacific Islander Americans, and Hispanics/Latinos. On average, non-Hispanic African Americans are 1.8 times as likely to have diabetes as non-Hispanic whites of the same age. Mexican Americans are 1.7 times as likely to have diabetes as non-Hispanic whites of similar age. (Data are not available for estimation of diabetes rates in other Hispanic/Latino groups.) American Indians have one of the highest rates of diabetes in the world. On average, American Indians and Alaska Natives are 2.2 times as likely to have diabetes as non-Hispanic whites of similar age. Although prevalence data for diabetes among Asian Americans and Pacific Islanders are limited, some groups, such as Native Hawaiians, Asians, and other Pacific Islanders residing in Hawaii (aged 20 or older) are more than twice as likely to have diabetes as white residents of Hawaii of similar age.

Diabetes prevalence in the United States is likely to increase for several reasons. First, a large segment of the population is aging. Also, Hispanics/Latinos and other minority groups at increased risk make up the fastest-growing segment of the U.S. population. Finally, Americans are increasingly overweight and sedentary. According to recent estimates from the Centers for Disease Control and Prevention (CDC), diabetes will affect one in three people born in 2000 in the United States. The CDC also projects the prevalence of diagnosed diabetes in the United States will increase 165 percent by 2050.



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How is diabetes managed?

Before the discovery of insulin in 1921, everyone with type 1 diabetes died within a few years after diagnosis. Although insulin is not considered a cure, its discovery was the first major breakthrough in diabetes treatment.

Today, healthy eating, physical activity, and taking insulin are the basic therapies for type 1 diabetes. The amount of insulin must be balanced with food intake and daily activities. Blood glucose levels must be closely monitored through frequent blood glucose checking. People with diabetes also monitor blood glucose levels several times a year with a laboratory test called the A1C. Results of the A1C test reflect average blood glucose over a 2- to 3-month period.

Healthy eating, physical activity, and blood glucose testing are the basic management tools for type 2 diabetes. In addition, many people with type 2 diabetes require oral medication, insulin, or both to control their blood glucose levels.

Adults with diabetes are at high risk for cardiovascular disease (CVD). In fact, at least 65 percent of those with diabetes die from heart disease or stroke. Managing diabetes is more than keeping blood glucose levels under control—it is also important to manage blood pressure and cholesterol levels through healthy eating, physical activity, and use of medications (if needed). By doing so, those with diabetes can lower their risk. Aspirin therapy, if recommended by the health care team, and smoking cessation can also help lower risk.

People with diabetes must take responsibility for their day-to-day care. Much of the daily care involves keeping blood glucose levels from going too low or too high. When blood glucose levels drop too low—a condition known as hypoglycemia—a person can become nervous, shaky, and confused. Judgment can be impaired, and if blood glucose falls too low, fainting can occur.

A person can also become ill if blood glucose levels rise too high, a condition known as hyperglycemia.

People with diabetes should see a health care provider who will help them learn to manage their diabetes and who will monitor their diabetes control. Most people with diabetes get care from primary care physicians—internists, family practice doctors, or pediatricians. Often, having a team of providers can improve diabetes care. A team can include

- a primary care provider such as an internist, a family practice doctor, or a pediatrician
- an endocrinologist (a specialist in diabetes care)
- a dietitian, a nurse, and other health care providers who are certified diabetes educators—experts in providing information about managing diabetes
- a podiatrist (for foot care)
- an ophthalmologist or an optometrist (for eye care)

and other health care providers, such as cardiologists and other specialists. In addition, the team for a pregnant woman with type 1, type 2, or gestational diabetes should include an

obstetrician who specializes in caring for women with diabetes. The team can also include a pediatrician or a neonatologist with experience taking care of babies born to women with diabetes.

The goal of diabetes management is to keep levels of blood glucose, blood pressure, and cholesterol as close to the normal range as safely possible. A major study, the Diabetes Control and Complications Trial (DCCT), sponsored by the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), showed that keeping blood glucose levels close to normal reduces the risk of developing major complications of type 1 diabetes. This 10-year study, completed in 1993, included 1,441 people with type 1 diabetes. The study compared the effect of two treatment approaches—intensive management and standard management—on the development and progression of eye, kidney, nerve, and cardiovascular complications of diabetes. Intensive treatment aimed to keep A1C levels as close to normal (6 percent) as possible. Researchers found that study participants who maintained lower levels of blood glucose through intensive management had significantly lower rates of these complications. More recently, a follow-up study of DCCT participants showed that the ability of intensive control to lower the complications of diabetes has persisted more than 10 years after the trial ended.

The United Kingdom Prospective Diabetes Study, a European study completed in 1998, showed that intensive control of blood glucose and blood pressure reduced the risk of blindness, kidney disease, stroke, and heart attack in people with type 2 diabetes.

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Hope Through Research

NIDDK conducts research in its own laboratories and supports a great deal of basic and clinical research in medical centers and hospitals throughout the United States. It also gathers and analyzes statistics about diabetes. Other Institutes at the National Institutes of Health (NIH) conduct and support research on diabetes-related eye diseases, heart and vascular complications, autoimmunity, pregnancy, and dental problems.

Other Government agencies that sponsor diabetes programs are the CDC, the Indian Health Service, the Health Resources and Services Administration, the Department of

Veterans Affairs, and the Department of Defense.

Many organizations outside the Government support diabetes research and education activities. These organizations include the American Diabetes Association (ADA), the Juvenile Diabetes Research Foundation International (JDRF), and the American Association of Diabetes Educators.

In recent years, advances in diabetes research have led to better ways of managing diabetes and treating its complications. Major advances include

- development of quick-acting, long-acting, and inhaled insulins
- better ways to monitor blood glucose and for people with diabetes to check their own blood glucose levels
- development of external insulin pumps that deliver insulin, replacing daily injections
- laser treatment for diabetic eye disease, reducing the risk of blindness
- successful kidney and pancreas transplantation in people whose kidneys fail because of diabetes
- better ways of managing diabetes in pregnant women, improving their chances of a successful outcome
- new drugs to treat type 1 and type 2 diabetes and better ways to manage this form of diabetes through weight control
- evidence that intensive management of blood glucose reduces and may prevent development of diabetes complications
- demonstration that two types of antihypertensive drugs, ACE (angiotensin-converting enzyme) inhibitors and ARBs (angiotensin receptor blockers), are more effective than other antihypertensive drugs in reducing a decline in kidney function in people with diabetes
- advances in transplantation of islets (clusters of cells that produce insulin and other hormones) for type 1 diabetes
- evidence that people at high risk for type 2 diabetes can lower their chances of developing the disease through diet, weight loss, and physical activity

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What will the future bring?

Researchers continue to look for the cause or causes of diabetes and ways to manage, prevent, or cure the disorder. Scientists are searching for genes that may be involved in type 1 or type 2 diabetes. Some genetic markers for type 1 diabetes have been identified, and it is now possible to screen relatives of people with type 1 diabetes to determine whether they are at risk.

Type 1 Diabetes

A number of Federally-funded research studies and clinical trials are under way. Studies focus on the prevention and causes of type 1 diabetes as well as experimental treatments such as islet transplantation.

The Environmental Determinants of Diabetes in the Young Consortium

The main mission of The Environmental Determinants of Diabetes in the Young (TEDDY) consortium, an international group of clinical centers, is to identify infectious agents, dietary factors, or other environmental factors (including psychosocial events) that trigger type 1 diabetes in those who are genetically susceptible. In addition, the consortium aims to

- create a central repository of data and biological samples for use by researchers
- develop novel approaches to finding the causes of type 1 diabetes
- find ways to understand how the disease starts and progresses
- discover new methods to prevent, delay, and reverse type 1 diabetes

TEDDY is funded by the NIDDK, the National Institute of Allergy and Infectious Diseases (NIAID), the National Institute of Child Health and Human Development (NICHD), the National Institute of Environmental Health Sciences, the CDC, the JDRF, and the ADA. For more information, see www.niddk.nih.gov/patient/TEDDY/TEDDY.htm.

Type 1 Diabetes TrialNet

Type 1 Diabetes TrialNet is a network of experts and facilities dedicated to developing new approaches to the understanding, prevention, and treatment of type 1 diabetes. Clinical centers are located in the United States, Canada, Europe, and Australia.

TrialNet studies are focusing on

- understanding the natural history of type 1 diabetes (to determine its causes and how the disease progresses)
- preventing type 1 diabetes in those at risk
- developing ways to preserve the function of the insulin-producing cells in the pancreas in people recently diagnosed with type 1 diabetes

For more information, see www.DiabetesTrialNet.org or call 1–800–HALT–DM1 (1–800–425–8361).

In many ways, the TrialNet studies build on the advances and insights gained from earlier research in type 1 diabetes. For example, researchers learned a great deal about how to predict type 1 diabetes in at-risk people from the Diabetes Prevention Trial—Type 1 (DPT–1). This study showed that people at risk of developing type 1 diabetes can be identified. The DPT-1 researchers discovered ways to identify two populations at risk of developing type 1 diabetes within 5 years: those at high risk (with at least a 50 percent chance) and those with an intermediate risk (having a 25 to 50 percent risk). Then researchers explored possible ways of preventing type 1 diabetes in both groups. TrialNet will identify people at risk who may be eligible for clinical trials. In addition, TrialNet will conduct trials to save beta cell function in those with new onset type 1 diabetes.

TrialNet is funded by the NIDDK, NICHD, and NIAID. JDRF and ADA also support this effort.

The Immune Tolerance Network

TrialNet works closely with the Immune Tolerance Network, another international, collaborative consortium. Its goal is to find safe and effective ways to induce long-term immune tolerance—prevention of an unwanted immune response by the body. For example, type 1 diabetes might be prevented if scientists could learn how to prevent the immune system from mistakenly attacking the insulin-producing cells in the pancreas. Effective immune tolerance could possibly

- prevent the body's rejection of organ or tissue transplants
- prevent or treat autoimmune diseases

- prevent or treat allergies and asthma

Islet Transplantation

Researchers are working on a way for people with type 1 diabetes to live without daily insulin injections. In an experimental procedure called islet transplantation, islets are taken from a donor pancreas and transferred into a person with type 1 diabetes. Once implanted, the beta cells in these islets begin to make and release insulin.

Scientists have made many advances in islet transplantation in recent years. Since reporting their findings in the June 2000 issue of the *New England Journal of Medicine*, researchers at the University of Alberta in Edmonton, Alberta, Canada, have continued to use a procedure called the Edmonton protocol to transplant pancreatic islets into people with type 1 diabetes. Before use of the Edmonton protocol, during the 1990s, less than 10 percent of islet cell transplant recipients were able to control blood glucose levels for more than 1 year without insulin injections.

The Collaborative Islet Transplant Registry (CITR), funded by NIDDK, was created in 2001. CITR's mission is to expedite progress and promote safety in islet transplantation by collecting, analyzing, and communicating data on islet transplantation. The CITR will study islet transplantation alone as well as islet transplantation following kidney transplant.

The September 2005 CITR annual report noted that with use of the Edmonton protocol, after 1 year, 58 percent of those who had transplants no longer needed to inject insulin. Of those who were still insulin-dependent 1 year after transplantation (33 percent of those followed by the registry), requirements for insulin were decreased. The average reduction in insulin requirements was 69 percent. In summary, a total of 91 percent of those with transplants showed improvement following transplantation. The success of the Edmonton protocol has been confirmed at other study sites, including the NIDDK.

The goal of islet transplantation is to infuse enough islets to control the blood glucose level without insulin injections. For an average-sized person (154 pounds), a typical transplant requires about 1 million islets, extracted from two donor pancreases. Because good control of blood glucose can slow or prevent the progression of complications associated with diabetes, such as nerve or eye damage, a successful transplant may reduce the risk of these complications. However, transplanted islets lose their ability to function over time.

Also, a transplant recipient needs to take immunosuppressive drugs to stop the immune system from rejecting the transplanted islets.

These drugs have significant side effects, and their long-term effects are still unknown. Immediate side effects of immunosuppressive drugs may include mouth sores and gastrointestinal problems, such as stomach upset or diarrhea. Patients may also have increased blood cholesterol levels, decreased white blood cell counts, decreased kidney function, and increased susceptibility to bacterial and viral infections. Taking immunosuppressive drugs increases the risk of tumors and cancer as well. Researchers are trying to find safer or less toxic immunosuppressants or new approaches that will allow successful transplantation without the use of immunosuppressive drugs.

The results of the Edmonton protocol are very encouraging, but more research is needed to develop safer and more effective immunosuppression and to enhance islet survival after transplantation.

Another obstacle to widespread use of islet transplantation is the severe shortage of islets. Only about 6,000 pancreases a year become available for transplantation or for harvesting of islets. However, researchers are pursuing alternative sources, such as creating islets from other types of cells. New technologies could then be employed to grow islets in the laboratory.

Type 2 Diabetes

Diabetes Prevention Program

In 1996, NIDDK launched its Diabetes Prevention Program (DPP). The goal of this research effort was to learn how to prevent or delay type 2 diabetes in people with impaired glucose tolerance (IGT), a strong risk factor for type 2 diabetes.

The findings of the DPP, released in August 2001, showed that people at high risk for type 2 diabetes could sharply lower their chances of developing the disorder through diet and exercise. In addition, treatment with the oral diabetes drug metformin also reduced diabetes risk, though less dramatically. Metformin lowers the amount of glucose released by the liver and also fights insulin resistance, a condition in which the body doesn't use insulin properly. Participants randomly assigned to intensive lifestyle intervention reduced their risk of

getting type 2 diabetes by almost 60 percent. On average, this group maintained their physical activity at 30 minutes per day, usually with walking or other moderate intensity exercise, and lost 5 to 7 percent of their body weight. Participants randomized to treatment with metformin reduced their risk of getting type 2 diabetes by 31 percent.

Of the 3,234 participants enrolled in the DPP, 45 percent were from minority groups that suffer disproportionately from type 2 diabetes: African Americans, Hispanics/Latinos, Asian Americans and Pacific Islanders, and American Indians. The trial also recruited other groups known to be at higher risk for type 2 diabetes, including individuals aged 60 and older, women with a history of gestational diabetes, and people with a first-degree relative with type 2 diabetes. Participants are being followed to check for long-term effects of the interventions, including the effects on risk of CVD.

Type 2 Diabetes in Children and Teens

Two studies focusing on type 2 diabetes in children and teens are under way. The TODAY (Treatment Options for type 2 Diabetes in Adolescents and Youth) study, a 13-site study sponsored by NIDDK, will compare treatments for type 2 diabetes in children and teens. Participants will undergo one of three treatments:

- taking one diabetes medication (metformin)
- taking two diabetes medications (metformin and rosiglitazone, another medication that fights insulin resistance)
- taking metformin and participating in an intensive lifestyle change program designed to promote weight loss by cutting calories and increasing physical activity

The main goal of the study is to determine how well each type of treatment controls blood glucose levels. The study also will evaluate how long each type of treatment is effective.

The STOPP-T2D (Studies to Treat or Prevent Pediatric Type 2 Diabetes) study, sponsored by NIDDK with support from the ADA, is exploring methods to lower risk factors for type 2 diabetes and CVD in middle-school children (grades 6 through 8) at eight sites. A 3-year program will focus on the benefits of improving nutrition, promoting physical activity, and making changes in behavior.

Preventing and Treating CVD in People with Type 2 Diabetes

CVD is the main killer of people with type 2 diabetes. For this reason, the NIH is studying

the best strategies to prevent and treat CVD in people with diabetes in three major studies. These studies are all joint efforts of the NIDDK and the National Heart, Lung, and Blood Institute.

The Look AHEAD (Action for Health in Diabetes) trial is the largest clinical trial to date to examine the long-term health effects of voluntary weight loss. This multi-center, randomized clinical trial is studying the effects of a lifestyle intervention designed to achieve and maintain weight loss over the long term through decreased caloric intake and increased exercise. Look AHEAD will focus on the disorder most associated with being overweight or obese, type 2 diabetes, and on the outcome that causes the greatest morbidity and mortality in people with type 2 diabetes, CVD.

The Action to Control Cardiovascular Risk in Diabetes (ACCORD) trial, a multi-center, randomized trial, is studying three approaches to preventing major cardiovascular events in individuals with type 2 diabetes. ACCORD is designed to compare current practice guidelines with more intensive glycemic control in 10,000 individuals with type 2 diabetes, including those at especially high risk for CVD events because of age, evidence of subclinical atherosclerosis, or existing clinical CVD. More intensive control of blood pressure than is called for in current guidelines and a medication to reduce triglyceride levels and raise HDL (good) cholesterol levels will also be studied in subgroups of these 10,000 volunteers. Each treatment strategy will be accompanied by standard advice regarding lifestyle choices, including diet, physical activity, and smoking cessation, appropriate for individuals with diabetes.

The primary outcome to be measured is the first occurrence of a major CVD event, specifically heart attack, stroke, or cardiovascular death. In addition, the study will investigate the impact of the treatment strategies on other cardiovascular outcomes; total mortality; limb amputation; eye, kidney, or nerve disease; health-related quality of life; and cost-effectiveness.

The Bypass Angioplasty Revascularization Investigation 2 Diabetes (BARI 2D) trial, a 5-year, multi-center clinical trial, is comparing medical versus early surgical management of patients with type 2 diabetes who also have coronary artery disease and stable angina or ischemia. At the same time, BARI 2D will study the effect of two different strategies to

control blood glucose—providing insulin versus increasing the sensitivity of the body to insulin—on the risk of cardiovascular mortality and morbidity.

A complete listing of clinical trials can be found at www.ClinicalTrials.gov.

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Points to Remember

What is diabetes?

- a disorder of metabolism—the way the body uses or converts food for energy and growth

What are the main types of diabetes?

- type 1 diabetes
- type 2 diabetes
- gestational diabetes

What are the impacts of diabetes?

- It affects 20.8 million people—7.0 percent of the U.S. population.
- It is a leading cause of death and disability.
- It costs $132 billion per year.

Who gets diabetes?

- people of any age
- people with a family history of diabetes
- others at high risk for type 2 diabetes: older people, overweight and sedentary people, African Americans, Alaska Natives, American Indians, Asian Americans, Native Hawaiians, some Pacific Islander Americans, and Hispanics/Latinos

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For More Information

To learn more about type 1, type 2, and gestational diabetes, as well as diabetes research,

statistics, and education, contact:

National Diabetes Education Program

1 Diabetes Way

Bethesda, MD 20892–3560

Phone: 1–800–438–5383

Internet: www.ndep.nih.gov

To find a clinical trial, check NIH's database at www.ClinicalTrials.gov online.

To participate in studies about type 1 diabetes, contact:

Type 1 Diabetes TrialNet

Phone: 1–800–425–8361

Internet: www.DiabetesTrialNet.org

The following organizations also distribute materials and support programs for people with diabetes and their families and friends:

American Diabetes Association

National Service Center

1701 North Beauregard Street

Alexandria, VA 22311

Phone: 1–800–342–2383

Internet: www.diabetes.org

Juvenile Diabetes Research Foundation International

120 Wall Street, 19th Floor

New York, NY 10005

Phone: 1–800–533–2873

Internet: www.jdrf.org

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The National Diabetes Information Clearinghouse (NDIC) is a service of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). The NIDDK is part of the National Institutes of Health of the U.S. Department of Health and Human Services. Established in 1978, the Clearinghouse provides information about diabetes to people with diabetes and to their families, health care professionals, and the public. The NDIC answers inquiries, develops and distributes publications, and works closely with professional and patient organizations and Government agencies to coordinate resources about diabetes.

Publications produced by the Clearinghouse are carefully reviewed by both NIDDK scientists and outside experts.

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