

NUTRI NEWS



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DIABETES: A NATIONWIDE EPIDEMIC

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Diabetes is becoming more widespread in the United States each year. Almost everyone knows someone who has diabetes. An estimated 17 million people in the United States, 6.2 percent of the population, have diabetes mellitus – a serious, lifelong condition. Of those who are 20 years of age or older, 16.9 million or 8.6% have diabetes. People age 65 years or older account for 7 million cases of diabetes and represent 20.1 percent of all people in this age group. Fully one-third or about 5.9 million people have not yet been diagnosed and 11.1 million people have a confirmed diagnosis of diabetes. Each year, about 1 million people age 20 and older are diagnosed with diabetes. About 151,000 people less than 20 years of age have diabetes. This represents 0.19 percent of all people in this age group. Approximately one in every 400 to 500 children and adolescents has type 1 diabetes. Clinic-based reports and regional studies indicate that type 2 diabetes is becoming more common among American Indian, African American, and Hispanic/Latino children and adolescents.

- **Men:** 7.8 million. 8.3 percent of all men have diabetes.
- **Women:** 9.1 million. 8.9 percent of all women have diabetes.
- **Non-Hispanic whites:** 11.4 million. 7.8 percent of all non-Hispanic whites have diabetes.
- **Non-Hispanic blacks:** 2.8 million. 13 percent of all non-Hispanic blacks have diabetes. On average, non-Hispanic blacks are two times more likely to have diabetes than non-Hispanic whites of similar age.
- **Hispanic/Latino Americans:** 2 million. 10.2 percent of all Hispanic/Latino Americans have diabetes. On average, Hispanic/Latino Americans are 1.9 times more likely to have diabetes than non-Hispanic whites of similar age. Mexican Americans, the largest Hispanic/Latino subgroup, are two times more likely to have diabetes than non-Hispanic whites of similar age. Similarly, residents of Puerto Rico are two times more likely to have diagnosed diabetes than U.S. non-Hispanic whites. Sufficient data is not available to derive more specific current estimates for other groups.

Fast Facts About Diabetes

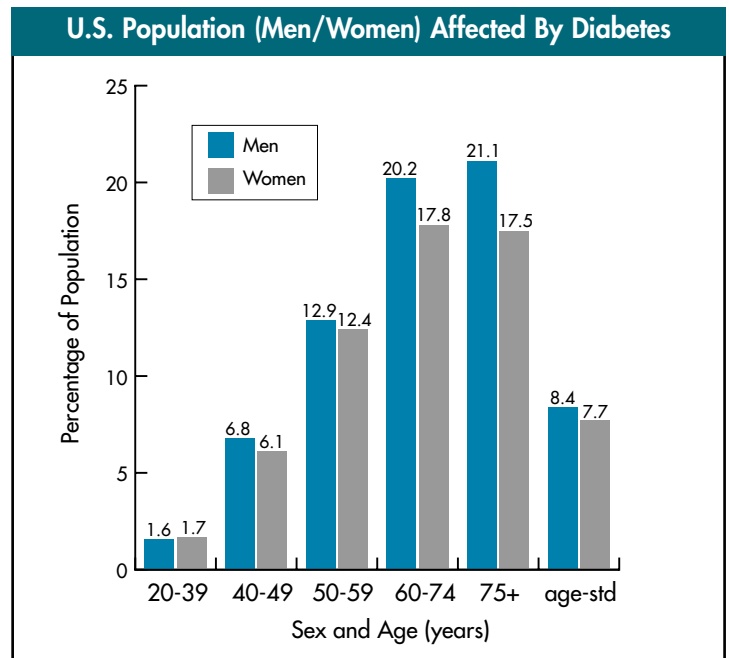
- 1 million new cases each year in people over age 20 in the U.S.
- One-third of diabetics are undiagnosed.
- In 1999, approximately 450,000 deaths occurred among people with diabetes aged 25 years and older. This figure represents about 19 percent of all deaths in the U.S. for people that are 25 years of age or older.
- Diabetes was the sixth leading cause of death listed on U.S. death certificates in 1999.
- Diabetes is the leading cause of new cases of blindness among adults 20 to 74 years old.
- Diabetes is the leading cause of treated end-stage renal disease, accounting for 43 percent of new cases.
- From 1997 to 1999, 82,000 amputations were performed each year among people with diabetes.

INSIDE THIS ISSUE

Gestational Diabetes	page 4
Insulin Resistance Syndrome and Hyperinsulinemia	page 4
Impaired Glucose Tolerance	page 5
Complications of Diabetes	page 5
Preventive Measures	page 6
Laboratory Testing and Diagnosis	page 7
Traditional Medical Treatments	page 7
Functional Medical Treatments	page 11
Alternative/Complementary Medical Treatments	page 13

continued on page 2

- **American Indians and Alaska Natives who receive care from the Indian Health Service (IHS):** 105,000, 15.1 percent of American Indians and Alaska Natives receiving care from IHS have diabetes. At the regional level, diabetes is least common among Alaska Natives (5.3 percent) and most common among American Indians in the southeastern United States (25.7 percent) and in certain tribes from the Southwest. On average, American Indians and Alaska Natives are 2.6 times more likely to have diabetes than non-Hispanic whites of similar age.
- **Asian Americans and Native Hawaiian or other Pacific Islanders:** Prevalence data for diabetes among Asian Americans and Native Hawaiians or other Pacific Islanders are limited. Some groups within these populations are at increased risk for diabetes. For example, data collected from 1996 to 2000 suggest that Native Hawaiians are 2.5 times more likely to have diagnosed diabetes than white residents of Hawaii of similar age.



Mortality from Diabetes

In 1999, approximately 450,000 deaths occurred among people with diabetes that were 25 years and older. This figure represents about 19 percent of all deaths in the United States of people 25 years and older.

- Overall, the risk for death among people with diabetes is about two times that of people without diabetes. However, the increased risk associated with diabetes is greater for younger people (3.6 times for people 25 to 44 years of age versus 1.5 times for those 65 to 74 years old) and women (2.7 times for women 45 to 64 years old versus 2 times for men in that age group).
- Diabetes was the sixth leading cause of death listed on U.S. death certificates in 1999. This is based on the 68,399 death certificates in which diabetes was listed as the underlying cause of death. Diabetes was listed as a contributing cause of death on an additional 141,265 death certificates. However, many decedents with diabetes do not have the disease entered on their death certificate; only about 35 to 40 percent have it listed anywhere on the certificate and only about 10 to 15 percent have it listed as the underlying cause of death.

High Risk Factors for Diabetes

The experts suggest that adults 45 years and older be tested

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for diabetes. If their blood glucose is normal at the first test, they should be tested at 3-year intervals. People under age 45 should be tested if they are at high risk for diabetes. These high-risk factors include:

- Being more than 20 percent above ideal body weight or having a body mass index (BMI) of greater than or equal to 27. BMI is the ratio of weight in kilograms to height in meters squared (kg/m²).
- Having a mother, father, brother, or sister with diabetes.
- Being African American, Alaska Native, American Indian, Asian American, Hispanic American, or Pacific Islander American.
- Giving birth to a baby weighing more than 9 pounds or having diabetes during pregnancy.
- Having blood pressure at or above 140/90 millimeters of mercury (mmHg).
- Having abnormal blood lipid levels, such as high density lipoprotein (HDL) cholesterol less than 35 mg/dL or triglycerides greater than 250 mg/dL.
- Having abnormal glucose tolerance when previously tested for diabetes.

What is Diabetes?

Diabetes mellitus is a group of diseases characterized by high levels of blood glucose resulting from defects in insulin production, insulin action, or both. Diabetes can be associated with serious complications and premature death, but people with diabetes can take steps to control the disease and lower the risk of complications.

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 is supposed to automatically produce 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 (type 1), or the cells do not respond appropriately to the insulin that is produced (type 2). Glucose builds up in the blood, overflows into the urine, and passes out of the body. Thus, the body loses its main source of fuel even though the blood contains large amounts of glucose. A relative lack of glucose going to the muscles results in fatigue, which causes many to seek medical care. There are three main types of diabetes, they are: Type 1 Insulin Dependant Diabetes, Type 2 Non-insulin Dependant Diabetes and Gestational (Pregnancy) Diabetes. Of the three types, type 2 is by far the most common and the most amenable to comprehensive treatment.

Type 1 Diabetes

Type 1 diabetes was previously called insulin-dependent diabetes mellitus (IDDM) or juvenile-onset diabetes. Type 1 diabetes develops when the body's immune system destroys pancreatic beta cells, the only cells in the body that make the hormone insulin that regulates blood glucose. The pancreas then produces little or no insulin. Someone with type 1 diabetes needs to take insulin daily to live. This form of diabetes usually strikes children and young adults, who need several insulin injections a day or an insulin pump to survive. Type 1 diabetes may account for 5 to 10 percent of all diagnosed cases of diabetes. Risk factors for type 1 diabetes include autoimmune, genetic, and environmental factors. Symptoms of type 1 diabetes usually develop over a short period, although beta cell destruction can begin years earlier. Symptoms include increased thirst and urination, constant hunger, weight loss, blurred vision, and extreme fatigue. If not diagnosed and treated with insulin, a person 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. type 2 diabetes was previously called non-insulin-dependent diabetes mellitus (NIDDM) or adult-onset diabetes. About 90 to 95 percent of people with diabetes have type 2. This form of diabetes usually develops in adults age 40 and older and is most

common in adults over age 55. A rapid increase in the younger population is now being seen. What was once a traditional “middle-age” onset disease has now infiltrated the young adult and even the adolescent age group. This alarming increased rate in younger patients has sparked the attention of the medical industry to actively begin educational outreach programs to increase awareness in both patients and providers.

About 80 percent of people with type 2 diabetes are overweight. Type 2 diabetes is often part of a metabolic syndrome that includes obesity, elevated blood pressure, and high levels of blood lipids. Unfortunately, as noted above, 25% of children and adolescents are now overweight and type 2 diabetes is becoming more common in young people.

When type 2 diabetes is diagnosed, the pancreas is usually producing enough insulin but the body cannot use the insulin effectively, a condition called insulin resistance. The body senses this lack of effectiveness and frequently increases its production of insulin erroneously to regulate elevated blood glucose levels. After several years of overproduction, or hyperinsulinism, 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 it as a main source of fuel. The excess glucose in the blood stream is then converted to storage energy, i.e. fat. Via production of glycerides then triglycerides, excess glucose metabolites are sent to the adipocyte to be saved for a rainy day – that frequently never comes for many patients.

The symptoms of type 2 diabetes develop gradually. They are not as sudden in onset as in type 1 diabetes. Some people have no symptoms. Symptoms may include fatigue or nausea, frequent urination, unusual thirst, weight loss, blurred vision, frequent infections, and slow healing of wounds or sores. Fully a third of diabetics are walking around undiagnosed by the best health care industry on the planet! In my opinion, the screening parameters set forth by the American Diabetic Association are only fueling this missed opportunity to uncover diabetes at the earliest stage. I will discuss my recommendations for improved screening later in this newsletter.

Type 2 diabetes is associated with older individuals (until recently), obesity, family history of diabetes, prior history of

gestational diabetes, impaired glucose tolerance, physical inactivity, and race/ethnicity. African Americans, Hispanic/Latino Americans, American Indians, and some Asian Americans and Pacific Islanders are at a particularly high risk for type 2 diabetes. Type 2 diabetes is increasingly being diagnosed in children and adolescents.

Gestational Diabetes

Gestational diabetes is a form of glucose intolerance that is diagnosed in some women during pregnancy. Gestational diabetes occurs more frequently among African Americans, Hispanic/Latino Americans, and American Indians. It is also more common among obese women and women with a family history of diabetes. During pregnancy, gestational diabetes requires treatment to normalize maternal blood glucose levels to avoid complications in the infant. Though it usually disappears after delivery, the mother is at increased risk of getting type 2 diabetes later in life. After pregnancy, 5 to 10 percent of women with gestational diabetes are found to have type 2 diabetes. Women who have had gestational diabetes have a 20 to 50 percent chance of developing diabetes in the next 5 to 10 years. Other specific types of diabetes result from specific genetic conditions (such as maturity-onset diabetes of youth), surgery, drugs, malnutrition, infections, and other illnesses. Such types may account for 1 to 5 percent of all diagnosed cases of diabetes.

Insulin Resistance Syndrome and Hyperinsulinemia

The term “insulin resistance” describes a condition of the reduced sensitivity of a cell to the action of insulin. Insulin must bind “effectively” to the cell receptor as one of the first steps in appropriate glucose metabolism. If insulin is less than effective at the receptor, glucose levels tend to rise signaling a “need” for more insulin. The body responds by secreting excessive insulin, at times reaching 4-5 times the expected physiologic level. This secondary hyperinsulinemia can have a deleterious effect on the pancreas as it tries in vain to keep up with this excessive demand. The pancreas begins to fail and sets the stage for type 2 diabetes. Eager physicians are quick to prescribe a first- or second-generation diabetic medication, betting on the

pancreas to produce even more insulin and further hastening the demise of the pancreas beta cells. This insulin resistance or insensitivity leads to glucose intolerance and dysglycemia. Insulin Resistance Syndrome (IRS) also referred to as Syndrome X or Metabolic Syndrome refers to a set of metabolic abnormalities. IRS is associated with glucose intolerance, abnormally low HDL (high density lipoprotein) cholesterol and/or high triglyceride levels, high blood pressure and upper body obesity. All of these factors are independent risk factors for coronary heart disease (CHD). CHD develops from a direct effect of insulin that stimulates lipogenesis in arterial tissue and enhances the growth of arterial smooth muscle promoting atherosclerosis. Increased insulin levels decrease fibrinolysis, increasing the risk for coronary thrombosis. Insulin also increases the hepatic production of triglycerides and lowers production of HDL (good cholesterol). High blood pressure may also be caused from the elevated insulin's effect on renal sodium reabsorption. Weight loss is a major benefit to those with Insulin Resistance Syndrome. High dose vitamin E has been reported to improve insulin resistance in type 2 diabetic patients. Zinc, selenium and vitamin C have been associated with decreasing oxidative stress in diabetic patients.

Impaired Glucose Tolerance

Impaired glucose tolerance (IGT) and impaired fasting glucose (IFG) are considered to be pre-diabetic conditions, and studies suggest that they may be reversible. IGT results from Insulin resistance covered in the above section.

IGT is a condition in which the blood glucose level is elevated (between 140 and 199 milligrams per deciliter or mg/dL in a 2-hour oral glucose tolerance test), but is not high enough to be classified as diabetes.

IFG is a condition in which the fasting blood glucose level is elevated (between 110 and 125 mg/dL after an overnight fast), but is not high enough to be classified as diabetes.

Among U.S. adults 40 to 74 years of age, 16 million (15.6 percent) have IGT and 10 million (9.7 percent) have IFG.

Complications of Diabetes

Heart disease – The leading cause of diabetes-related deaths is heart disease. Adults with diabetes have heart disease

death rates about 2 to 4 times higher than adults without diabetes.

Stroke – The risk for stroke is 2 to 4 times higher among people with diabetes.

High blood pressure – About 73 percent of adults with diabetes have blood pressure greater than or equal to 130/80 mmHg or use prescription medications for hypertension.

Blindness – Diabetes is the leading cause of new cases of blindness among adults 20 to 74 years old. Diabetic retinopathy causes from 12,000 to 24,000 new cases of blindness each year.

Kidney disease – Diabetes is the leading cause of treated end-stage renal disease, accounting for 43 percent of new cases. In 1999, 38,160 people with diabetes began treatment for end-stage renal disease, and a total of 114,478 people with diabetes underwent dialysis or kidney transplantation.

Nervous system disease – About 60 to 70 percent of people with diabetes have mild to severe forms of nervous system damage. The results of such damage include impaired sensation or pain in the feet or hands, slowed digestion of food in the stomach, carpal tunnel syndrome, and other nerve problems. Severe forms of diabetic nerve disease are a major contributing cause of lower-extremity amputations.

Amputations – More than 60 percent of non-traumatic lower-limb amputations in the United States occur among people with diabetes. From 1997 to 1999, about 82,000 non-traumatic lower-limb amputations were performed each year among people with diabetes.

Dental disease – Periodontal or gum diseases are more common among people with diabetes than among people without diabetes. Among young adults, those with diabetes are often at twice the risk of those without diabetes. Almost one third of people with diabetes have severe periodontal diseases with loss of attachment of the gums to the teeth measuring 5 millimeters or more.

Complications of pregnancy – Poorly controlled diabetes before conception and during the first trimester of pregnancy can cause major birth defects in 5 to 10 percent of pregnancies and spontaneous abortions in 15 to 20 percent of pregnancies. Poorly controlled diabetes during the second and third

trimesters of pregnancy can result in excessively large babies, posing a risk to the mother and the child.

Other complications – Uncontrolled diabetes often leads to biochemical imbalances that can cause acute life-threatening events, such as diabetic ketoacidosis and hyperosmolar (non-ketotic) coma. People with diabetes are more susceptible to many other illnesses, and once they acquire these illnesses they often have a worse prognosis than people without diabetes. For example, they are more likely to die with pneumonia or influenza than people who do not have diabetes.

Preventive Measures

Research studies in the United States and abroad have found that lifestyle changes can prevent or delay the onset of type 2 diabetes among high-risk adults. These studies included people with IGT and other high-risk characteristics for developing diabetes. Lifestyle interventions included diet and moderate-intensity physical activity (such as walking for 2½ hours each week). For both sexes and all age and racial and ethnic groups, the development of diabetes was reduced 40 to 60 percent during these studies that lasted 3 to 6 years.

Studies have also shown that medications have been successful in preventing diabetes in some population groups. In the Diabetes Prevention Program, a large prevention study of people at high risk for diabetes, people treated with the drug metformin reduced their risk of developing diabetes by 31 percent. Treatment with metformin was most effective among younger, heavier people (those 25 to 40 years of age who were 50 to 80 pounds overweight) and less effective among older people and people who were not as overweight. There are no known methods to prevent type 1 diabetes. Several clinical trials are currently in progress.

Glucose control – Research studies in the United States and abroad have found that improved glycemic control benefits people with either type 1 or type 2 diabetes. In general, for every 1 percent reduction in results of A1C blood tests, the risk of developing microvascular diabetic complications (eye, kidney, and nerve disease) is reduced by 40 percent.

Blood pressure control – Controlling blood pressure can reduce cardiovascular disease (heart disease and stroke) by approximately 33 to 50 percent and can reduce microvascular disease (eye, kidney, and nerve disease) by approximately 33 percent. In general, for every 10 millimeters of mercury (mmHg) reduction in systolic blood pressure, the risk for any complication related to diabetes is reduced by 12 percent.

Control of blood lipids – Improved control of cholesterol and lipids (for example, HDL, LDL and triglycerides) can reduce cardiovascular complications by 20 to 50 percent.

Preventive care practices for eyes, kidneys, and feet – Detection and treatment of diabetic eye disease with laser therapy can reduce the development of severe vision loss by an estimated 50 to 60 percent. Comprehensive foot care programs can reduce amputation rates by 45 to 85 percent. Detection and treatment of early diabetic kidney disease can reduce the development of kidney failure by 30 to 70 percent.

Appropriate nutritional supplementation – Adding adequate amounts of high grade nutritional supplements shown to be of benefit in diabetes may help improve daily glucose control, stabilize carbohydrate metabolism and prevent further complications from diabetes due to the glycosylated end products caused by elevated glucose levels.

Routine exercise – low glycemic index diet – Routine exercise directly helps improve glucose metabolism by increasing the activity of glucose transport protein, independent of the action of insulin. Combined with an appropriate low glycemic diet, exercise has been shown to be nearly twice as effective as a leading anti-diabetic medication. A recent study was halted prematurely due to the profound superior benefit of diet and exercise over the prescription medication. It would behoove practitioners and clinicians caring for diabetic patients not to underestimate the significant impact that diet and exercise has on diabetes morbidity. Too often health care providers neglect this all important aspect of care and education. If you are not proficient at providing a quality educational experience for your diabetic patients, please refer them to a facility that can implement this critical component of their total care plan.

Laboratory Testing and Diagnosis

An American Diabetes Association expert committee has recommended a lower fasting plasma glucose (FPG) value to diagnose diabetes. The new FPG value is 126 milligrams per deciliter (mg/dL) or greater, rather than 140 mg/dL or greater. This recommendation was based on a review of the results of more than 15 years of research. This research showed that a fasting blood glucose of 126 mg/dL or greater is associated with an increased risk of diabetes complications affecting the eyes, nerves, and kidneys. When diagnosis was based on a blood glucose value of 140 mg/dL or greater, these complications often developed before the diagnosis of diabetes. The experts believe that earlier diagnosis and treatment can prevent or delay the costly and burdensome complications of diabetes.

The prior criteria for diagnosing diabetes relied heavily on performing an oral glucose tolerance test (OGTT). In this test, the person must come in fasting, drink a glucose syrup, and have a blood sample taken 2 hours later. This complicated procedure made detection and diagnosis of diabetes a difficult and cumbersome process, and the expert committee recommended that it be eliminated from clinical use. The change to using fasting plasma glucose for determining the presence of diabetes will make detection and diagnosis of diabetes more routine. The fasting value can be easily obtained during routine physician visits, in clinics at the place of employment, and other situations. Currently, about 5 to 6 million adults in the United States have diabetes but do not know it. The simpler testing method of measuring fasting glucose should help identify these people so they can benefit from treatment sooner.

Diabetes can be detected by any of three positive tests. To confirm the diagnosis, there must be a second positive test on a different day.

- A casual plasma glucose level (taken at any time of day) of 200 mg/dL or greater when the symptoms of diabetes are present.
- A fasting plasma glucose value of 126 mg/dL or greater.
- An OGTT value in the blood of 200 mg/dL or greater measured at the two-hour interval.

The committee recommended that the OGTT not be used.

Testing for Diabetes During Pregnancy

The expert panel also suggested a change in the testing for diabetes during pregnancy, stating that women at low risk for gestational diabetes do not need to be tested. This low-risk group includes women who are:

- Younger than 25 years of age
- At normal body weight
- Without a family history of diabetes
- Not members of a high-risk ethnic group

All women who are not in the low-risk category should be tested for gestational diabetes during the 24th to 28th weeks of pregnancy. The testing procedure requires drinking a glucose drink and measuring blood glucose one hour later. If the blood glucose value is 140 mg/dL or greater, the woman should be evaluated further.

Traditional Medical Treatments

- In order to survive, people with type 1 diabetes must have insulin delivered by a pump or injections.
- Many people with type 2 diabetes can control their blood glucose by following a careful diet and exercise program, losing excess weight, and if needed taking oral medication. It is important to strive to educate patients about the beneficial nutritional and physiological aspects of treatment. Many times these treatments are overlooked by the medical profession, or minimal time is spent on these recommendations in lieu of writing a prescription medication as a first line treatment.
- Traditional physicians may treat people with diabetes with several medications to control their cholesterol and blood pressure in an effort to prevent premature cardiac and renal complications.
- Among adults with diagnosed diabetes, about 11 percent take both insulin and oral medications, 22 percent take insulin only, 49 percent take oral medications only, and 17 percent do not take either insulin or oral medications.

Insulins								
Insulin products available and defined according to derivation, onset*, peak, and duration** of action. Route of administration is also shown.								
Preparation	Brand	Rx/OTC	Manufacturer	Source	Onset (hours)	Peak (hours)	Duration (hours)	Route
Insulin Aspart	Novolog ³	Rx	Novo Nordisk	human	<0.25	1-3	3-5	SC
Insulin Lispro	Humalog ³	Rx	Lilly	human	<0.25	1	3.5-4.5	SC
Insulin Lispro Protamine/ Insulin Lispro	Humalog Mix 75/25 ³	Rx	Lilly	human	≤0.25	0.5-1.5	24	SC
Insulin Injection Regular (R)	Humulin R ¹	OTC	Lilly	human	0.5	2-4	6-8	SC, IM, IV
	Iletin II Regular	OTC	Lilly	pork	0.5	2-4	6-8	SC, IM, IV
	Novolin R ²	OTC	Novo Nordisk	human	0.5	2.5-5	8	SC, IM, IV
	Velosulin BR ²	OTC	Novo Nordisk	human	0.5	1-3	8	SC, IM, IV
Insulin Isophane Suspension (NPH)/ Regular Insulin (R)	Humulin 70/30 ¹	OTC	Lilly	human	0.5	2-12	24	SC
	Humulin 50/50 ¹	OTC	Lilly	human	0.5	3-5	24	SC
	Novolin 70/30 ²	OTC	Novo Nordisk	human	0.5	2-12	24	SC
Insulin Isophane Suspension (NPH)	Humulin N ¹	OTC	Lilly	human	1-2	6-12	18-24	SC
	Iletin II NPH	OTC	Lilly	pork	1-2	6-12	18-26	SC
	Novolin N ²	OTC	Novo Nordisk	human	1.5	4-12	24	SC
Insulin Zinc Suspension (L)	Humulin L ¹	OTC	Lilly	human	1-3	6-12	18-24	SC
	Iletin II Lente	OTC	Lilly	pork	1-3	6-12	18-26	SC
	Novolin L ²	OTC	Novo Nordisk	human	2.5	7-15	22	SC
Insulin Extended Zinc Suspension (U)	Humulin U ¹	OTC	Lilly	human	4-6	8-20	24-48	SC
Insulin Glargine	Lantus ³	Rx	Aventis	human	1.1	none	≥24	SC

*Onset is always for the SC route. All times are approximate.
**Maximum occurs between these times; actual effect may last longer.
Insulins listed are available in a concentration of 100 Units/mL; Humulin R, in a concentration of 500 Units/mL for SC injection only, is available by prescription from Lilly for insulin resistant patients who are hospitalized or under close medical supervision.
¹Recombinant (using *E. coli*).
²Recombinant (using *S. cerevisiae*).
³Recombinant human insulin analogue (using *E. coli*).

12/2001

The various insulins and oral medications for type 2 diabetes are listed in the table titled “Insulins.”

Classes of diabetic medications

Physicians have five different “classes” of oral prescription drugs which can be used to treat type 2 diabetes and injectable insulin. Several of these oral medications have just been recently released for widespread use.

Sulfonylureas

The long standing class of drugs, the sulfonylureas, have been the mainstay of the oral medications for many years. Sulfonylureas have been used for the treatment of type 2 diabetes since the 1950’s. Acetohexamide (Dymelor), Tolbutamide (Orinase) and Tolazamide (Tolinase) were all first-

generation sulfonylureas. Diabinese or chlorpropamide, was one the newer sulfonylureas, which like its first-generation cousins, has some major drawbacks when treating diabetes. This class has a tendency to put weight on patients and also cause low blood sugar levels. Low blood sugar, called hypoglycemia, occurs when the blood glucose falls below a certain level and causes several symptoms. Signs of hypoglycemia include mental confusion, dizziness, loss of consciousness and others. This is precisely the opposite effect that we wish to see. We want people with diabetes to lose those unnecessary pounds, not accumulate more! Insulin has at times been necessary to treat patients with type 2 diabetes. Naturally, patients would not prefer this type of treatment due to the invasive nature of daily injections, so the oral agents are more popular when they

work to lower blood glucose levels. The sulfonylureas also increase insulin levels by directly stimulating release. There are currently seven of them to choose from, of which the latest three to come to market are called “second generation” sulfonylureas. These latest “offspring” are glyburide (Micronase, Glynase and Diabeta), glipizide (Glucotrol, Glucotrol XL) and the youngest brother glimepiride (Amaryl). Sulfonylureas stimulate more insulin release, however many times the insulin levels are already elevated, thus compounding the problems that are associated with increased insulin levels.

The newer prescriptions for type 2 diabetes are:

Acarbose (Precose) an [alpha-glucosidase inhibitor]

The alpha-glucosidase inhibitors such as Acarbose are best used to treat the elevated glucose levels which occur after eating in diabetic patients. This medication is better for carbohydrate intolerance and is better than sulfonylureas which can promote a rapid drop in glucose levels causing low blood sugar and magnify other medical problems. This drug was released for use in 1996 but was used prior to this in Canada and in Europe. Glyset is the newest of the AGI's.

Ascarbose interferes with an enzyme called alpha-glucosidase in the small intestine. This enzyme is responsible for breaking down various ingested sugars in the small intestine. If they are not able to be broken down, they cannot be absorbed and the blood glucose level is less likely to rise abnormally after eating. This blocks glucose uptake from the small intestine but carries with it some pretty unfriendly side effects. Excessive gas and flatulence, diarrhea and abdominal pain make it a questionable drug to use without the fear of a social “accident.” Elevated liver function test can also occur with Ascarbose. Particular care must be taken as a hypoglycemic event must be treated with oral tablets or gel due to the absorption blocking activity in the small intestine. Patients with inflammatory bowel problems, such as irritable bowel disease, ulcers and colitis should also refrain from this alternative treatment. Patients with kidney problems should also look elsewhere for type 2 medication.

Metformin (Glucophage) a [biguanide]

The biguanids, like metformin, are improved diabetic

drugs as they do not cause weight gain like the sulfonylureas, nor do they increase cardiovascular risk profiles. Metformin causes the liver and the muscle to utilize glucose better. In the muscles, metformin causes glucose to get into the cells more easily to be metabolized. It also causes the liver to slow down production of glucose. Glucophage was introduced in the spring of 1995 and has been shown to lower triglyceride levels, as well as total and LDL cholesterol levels. It also causes a rise in the good cholesterol levels (HDL cholesterol) with a slight loss of weight.

The benefits of this medication however have their costs. People taking the medication report bloating, nausea, cramps, abdominal fullness and diarrhea as the unpleasant side effects. They do, however, usually go away after several days. Patients with kidney problems or congestive heart failure are not to take this medication, nor are any patients with liver problems. Alcohol and binge drinking are not to be mixed with metformin. It should not be taken within 48 hours after any tests which use iodine as the contrast material such as an IVP or CT scan.

Troglitazone (Rezulin) a [thiazolidinedione]

One of the newest medications for diabetes is a thiazolidinedione called Troglitazone or Rezulin, which was taken off the market just after its debut. This medication was the first medication which worked directly on insulin resistance. Rezulin increases the effect of insulin, but not the actual release of the hormone. The term “insulin sensitizer” has been used in the literature to describe how it works. The medication causes glucose to be metabolized through the muscle when insulin is effective. A side effect of this medication is that it may increase cholesterol levels and may cause severe liver damage, which eventually caused the FDA to request its withdrawal from the market. Significant weight gain was also seen in patients taking Rezulin with Glyburide. This pill was used in patients who have type 2 diabetes and are taking insulin. The benefit and potential importance of this medication was that patients taking insulin shots may be able to discontinue their insulin when taking Troglitazone. Troglitazone is now unavailable and the newer thiazolidinediones (Avandia and Actos) hope to have all the benefits with less side effects as their predecessor.

Repaglinide (Prandin) a [meglitinide]

Repaglinide (Prandin) is a benzoic acid derivative that is a blood glucose lowering agent. It will be used as first line therapy by doctors in conjunction with diet and exercise. Diet and exercise can frequently improve diabetes symptoms dramatically, however, it has always been fraught with frustration due to lack of compliance of patients' willingness to participate in an aggressive enough program to make a change. In some cases, repaglinide was used together with metformin to help keep blood glucose levels down to the normal range. Prandin causes increased release of insulin by the beta cells. The insulin is dependent on glucose and levels fall as the glucose levels go down. It works very quickly, then just as quickly quits working to minimize side effects. This has been shown to be particularly useful in diabetic patients with kidney problems. Prandin magnifies the normal response of increased insulin in response to eating a meal. As the glucose level rises after eating, insulin is released and causes unlocking of the gates to the cells so glucose can go from the blood stream into the cell itself. Repaglinide is welcomed as it has minimal hypoglycemic side effects. Weight gain has been associated with repaglinide, similar to the sulfonylureas. Other less common side effects include lowering of platelets, lowering of white cells, and increased liver enzymes. This medication is best taken three times each day with meals. People with kidney or liver problems should refrain from using this medication.

Benefits of the newer therapeutics

The biguanides (Metformin or Glucophage) are not associated with weight gain as are traditionally the sulfonylureas. Acarbose (Precose), which is an alpha-glucosidase inhibitor, targets the after-eating increase in glucose or post-prandial hyperglycemia. Precose is particularly good in patients whose glucose levels increase rapidly after eating a meal high in carbohydrates. The combination therapeutics are of benefit to patients that are resistant to taking multiple medications as are the newer extended release versions of the above medications.

Insulins, new and old – Lispro (Humalog)

A faster acting form of insulin called Lispro (Humalog) is

also available for physicians to prescribe. The FDA is continually looking at newer agents which are under development. The increased emphasis that the Diabetes Control and Complications Trial has placed on diabetes undoubtedly will stimulate more and more prescription drug development in the area of oral treatments for diabetes mellitus.

The newer insulins have a faster time of action and help to keep the after-meal glucose levels from rising too high. They are generally used in the type 1 diabetic but also have uses in the patient with type 2 diabetes. Somewhere around 29% of type 2 diabetics are treated with insulin. This is a sad fact since with adherence to diet, a good exercise routine and increased knowledge of the mechanics of diabetes, insulin could be avoided.

Insulin tells the liver to stop producing glucose and start using it. In addition, insulin tells the muscles to suck in glucose and start burning it for fuel. Insulin can also tell the fat cells to take in glucose, but this occurs to a lesser amount. Insulin dosage and timing will have profound effects on the blood glucose levels. Too much and the blood glucose level falls and hypoglycemia can occur. Too little insulin and there is not enough to drive the glucose into the cells that need it. Insulin can be used in type 2 diabetics with or without some of the oral medications. Usual doses of insulin are given two times a day, morning and evening to try to keep the glucose levels at a near normal range. Eating pushes up the glucose your body needs to deal with. Exercise burns up glucose and can cause hypoglycemia if too much insulin is given or too little food is eaten. The delicate balance between multiple factors, food intake, energy expenditure, medication dosages, illness, and stress all interact to raise or lower the levels of glucose in the blood. What is universally accepted, is that the more closely the blood glucose levels stay in the normal range the less systemic effects diabetes will have. If close attention is paid to balancing energy output with food intake, along with a nutritionally sound vitamin and mineral intake, the type 2 diabetic patient will have a good chance of keeping the levels of glucose in the correct range.

Insulin has its side effects and that is why many diabetics are motivated to avert the need for insulin injections. Hypoglycemia, weight gain, and faster disease occurring in the

blood vessels are all potential side effects of insulin therapy. It is clear that close supervision by a health care provider trained in diabetes is essential when it comes to insulin treatment. Close monitoring by self-administration of glucose testing is critical to follow the effects of the treatment.

Functional Medical Treatments

Alternative therapies are treatments that are neither widely taught in medical schools nor widely practiced in hospitals. Alternative treatments that have been studied to manage diabetes include acupuncture, biofeedback, guided imagery, and vitamin and mineral supplementation. The success of some alternative treatments can be hard to measure. Critics of natural-based therapies are quick to state that many alternative treatments remain either untested or unproven through traditional scientific studies, however many of these studies do exist and are overlooked by those who do not desire to see a benefit exist. The traditional “double-blind” placebo controlled clinical study relates a given single treatment to a specific desired outcome. Frequently, natural-based treatments require clinical descriptive studies for evaluation due to the nature of the treatments’ effects on multiple organ systems and the overall functioning of the whole person.

Chromium – In the early 1970’s, Dr. Walter Mertz, then director of the US Department of Agriculture’s Human Nutrition Research Center, discovered that simple forms of chromium are poorly absorbed (typically less than 2% of the amount consumed) and do not potentiate insulin activity like biologically active chromium. Dr. Mertz isolated a chromium compound from Brewer’s yeast that had a strong activating effect on insulin. He discovered that this “active” chromium was complexed with several amino acids and the B-vitamin niacin and called this chromium complex: “Glucose Tolerance Factor” or “GTF.” Dr. Mertz concluded that niacin was the key to chromium’s biological activity. Neither niacin by itself nor the common chromium picolinate complex had any significant effect on glucose metabolism. Dr. Mertz concluded that the niacin-bound chromium, called “polynicotinate” or “nicotinate” was the biologically active form of chromium that potentiates insulin’s action in the body.

I personally prefer chromium polynicotinate for supplementation in both diabetes and overweight patients. Recommended dosages are up to 1000 micrograms daily divided with meals (200 mcg with breakfast, 400 mcg at lunch and 400 mcg at dinner). These doses are sufficient to promote the 200 mcg absorption that the body needs on a daily basis. The deficiency of chromium in the diet has lead some researchers to state that we would need to consume in excess of 12,000 calories per day to get the required amount of chromium from dietary only sources.

Magnesium – Magnesium may alter both insulin secretion and the biological activity of insulin. Scientists believe that a deficiency of magnesium interrupts insulin secretion in the pancreas and increases insulin resistance in the body’s tissues. Evidence suggests that a deficiency of magnesium may contribute to certain diabetes complications and co-morbidities such as insulin resistance, glucose intolerance and hyperinsulinemia. Low magnesium levels are associated with diabetic patients that have experienced diabetic ketoacidosis. In patients with type 2 diabetes, research has demonstrated that magnesium improves cellular uptake of glucose by insulin.

Vanadium – Vanadium is a compound found in tiny amounts in plants and animals. Early studies showed that vanadium normalized blood glucose levels in animals with type 1 and type 2 diabetes. A recent study found that when people with diabetes were given vanadium, they developed a modest increase in insulin sensitivity and were able to decrease their insulin requirements resulting in improved glucose levels. Although not completely understood, vanadium is thought to enhance the number of insulin receptors on cell membranes and improve the binding of insulin to these receptors and/or increase the glucose transport proteins within the cell membrane. Improved utilization of glucose in the cells prevents excess glucose from being converted to triglycerides and ultimately stored as fat. Dosages of 10-100 mg. of Vanadyl Sulfate have been shown to be beneficial in type 2 diabetes.

Garcinia Cambogia (Hydroxycitric Acid) – Hydroxycitric Acid (HCA), the active ingredient in Garcinia Cambogia, is a rare organic acid similar to the citric acid found in citrus fruits

such as oranges and lemons, but it has several unique properties. HCA has been shown to reduce appetite and inhibit fat production without stimulating the central nervous system like many of the OTC weight loss and prescription diet medications. HCA is extracted from the rind of the fruit of the *Garcinia Cambogia* tree where it has been used for seasonings and as a food preservative by the people of Southeast Asia. HCA blocks a key enzyme responsible for the production of fat from leftover glucose that is not being used immediately for energy. When carbohydrates are consumed they are broken down into glucose and sent throughout the body. Excess glucose that is not immediately needed for energy or metabolism is stored in the body's liver and muscles as glycogen. Glycogen can be rapidly utilized if needed from this storage depot in the liver and muscle, but there is only so much room to store this "immediate backup" form of energy fuel. The glucose in excess of that needed for liver and muscle glycogen storage is transformed into a longer term depot of energy fuel (i.e. triglyceride and fat). The conversion of unused, or excessive glucose, is aided by an enzyme called ATP-citrate lyase. HCA temporarily inhibits the activity of this enzyme thus decreasing fat production from carbohydrate metabolism. In addition it promotes biochemical changes in the liver that promote fat burning and glycogen storage.

Gymnema Sylvestre – *Gymnema Sylvestre* is a compound that was shown to reduce glucose in the urine nearly 70 years ago. It was subsequently shown that *Gymnema* had a blood glucose lowering effect when there was residual pancreatic function, but had no effect on animals lacking pancreatic function. Studies beginning again in 1981 showed that *Gymnema* lowered blood glucose levels and raised serum insulin levels during an oral glucose tolerance test. Further studies revealed that *Gymnema* improved both glycosylated hemoglobin and glycosylated plasma proteins, two indicators of long term glucose control. Further studies in 1990 promoted the concept of beta cell repair/regeneration of the exocrine pancreas as an effect of *Gymnema* causing an improved level of glucose homeostasis. Cholesterol levels, triglyceride levels and free fatty acid levels have all been shown to be lowered by *Gymnema Sylvestre* supplementation.

Fenugreek – Fenugreek is a compound that may improve glucose levels by decreasing the absorption of glucose by the small intestine. It is thought that Fenugreek delays gastric emptying due to its high level of soluble fiber. Fenugreek was also shown to decrease both total cholesterol levels and triglyceride levels in diabetic patients. Defatted Fenugreek seed powder has been shown to produce a 25 percent drop in fasting blood glucose measurements, 24 percent drop in elevated total cholesterol levels, 32 percent decrease in LDL levels, and a 37 percent decrease in serum triglyceride levels.

Biotin – Biotin deficiency has been implicated in glucose intolerance and dysglycemia. Biotin has been shown to improve glucose metabolism without increasing the output of insulin from the pancreas. Biotin is thought to work via an increase in the activity of glucokinase.

B Vitamins – Vitamin B6 is involved in inhibiting the glycosylation of proteins known to cause tissue damage from excessive blood glucose levels and high tissue concentrations of glucose. B1 is involved with carbohydrate metabolism in the Krebs cycle and may prevent complications of diabetes like diabetic neuropathy.

Conjugated Linoleic Acid (CLA) – Conjugated Linoleic Acid or CLA has an effect similar to the prescription diabetic agents called thiazolidinediones. These compounds activate certain receptors that promote both glucose tolerance and lessen hyperinsulinemia.

Alpha-Lipoic Acid – Alpha-Lipoic Acid has been demonstrated to improve insulin sensitivity. The mechanism may be by increasing the activity of glucose transport proteins in patients with type 2 diabetes.

Citrus Aurantium – *Citrus Aurantium* is a member of the citrus family frequently called "Orange Bitters." The metabolic effect stems from an active alkaloid effect that stimulates the sympathetic nervous system thus increasing metabolism.

Omega-6 Fatty Acids – Omega-6 Fatty Acids like black currant seed oil or evening primrose oil may aid in the reversal of nerve damage due to diabetic neuropathy.

Coenzyme Q10 – CoQ10 or ubiquinone is a key component of the energy producing mitochondria, and is critical in the production of cellular energy known as ATP. The specific action of CoQ10 and diabetes is not known, however, increased metabolism via increased ATP production corresponds with a greater need for glucose as a substrate for cellular energy production. A 36 - 59 percent positive response in diabetics has been reported with CoQ10 supplementation. Some have shown that CoQ10 stimulates insulin production and has been shown to reduce fasting blood glucose levels and ketone bodies by 30 percent.

Green Tea – Green tea has been shown to increase metabolism by increasing 24h Energy Expenditure (EE) and a decreasing the 24h Respiratory Quotient (RQ). Green tea has been demonstrated to significantly reduce food intake, body weight, blood cholesterol and triglycerides.

Folic Acid (Folate) – Folate is involved in glucose metabolism and is a critical factor in the metabolism of homocysteine. Folate must be activated to 5-MTHF (5-Methyltetrahydrofolate) for effective action. Up to 25 percent of the population lack the enzyme required for this activation and should take 5-MTHF along with regular folic acid.

B-12 – B-12 is involved in carbohydrate metabolism and is helpful in preventing and/or slowing the progression of diabetic retinopathy.

Niacin – Niacin is an essential component of Glucose Tolerance Factor (GTF), and its association with chromium is critical to effective insulin activity.

Vitamin E – Vitamin E has been shown to be helpful in preventing complications of diabetes by preventing the oxidation of glycosylation products that cause tissue damage throughout the body. Vitamin E has been associated with improving the flexibility of the cell membrane and increasing utilization of glucose. Vitamin E has also been recommended for preventing complications of diabetic retinopathy and heart disease.

Vanadyl Sulfate – Vanadyl Sulfate improves and maintains proper blood glucose balance by increasing the rate of glucose

transport and decreasing the requirements on insulin. Vanadyl Sulfate also aids in the synthesis of muscle mass and the ability to maintain muscle mass.

Selenium – Selenium is a trace element that works closely with glutathione peroxidase and vitamin E to prevent damage from free-radicals. Low levels of selenium are associated with poor immune function, acceleration of cardiovascular disease, and has been implicated in certain cancers.

Zinc – Zinc is a trace mineral involved in a majority of enzymatic reactions throughout the body. Zinc is required for proper activity and function of insulin and in the production of insulin. It is believed that many people in the U.S. are at least mildly zinc deficient, however severe zinc deficiency is very rare. Poor wound healing and immune dysfunction is worrisome for diabetic patients and increased zinc intake can help improve wound healing and promote effective immunity.

Vitamin C – Vitamin C is transported into cells with the help of insulin. Insulin dysfunction can affect this transport and a relative decrease in intracellular vitamin C can occur. Low intracellular vitamin C levels have been implicated in poor wound healing, dysfunctional immunity and increased capillary permeability. Increased vitamin C intake in diabetic patients is recommended to offset these intracellular deficits.

Manganese – Manganese is used for activating enzymes involved with glucose metabolism and is involved as a cofactor in a number of enzymes important in energy production and antioxidant defense such as superoxide dismutase.

Alternative/Complementary Medical Treatments

Acupuncture – Acupuncture is a procedure in which a practitioner inserts needles into designated points on the skin. Some Western scientists believe that acupuncture triggers the release of the body's natural painkillers. Acupuncture has been shown to offer relief from chronic pain and is sometimes used by people with neuropathy, the painful nerve damage caused by diabetes.

Biofeedback – Biofeedback is a technique that helps a person become more aware of and learn how to deal with the body's response to pain. This alternative therapy emphasizes relaxation and stress-reduction techniques. Guided imagery is

a relaxation technique that some professionals use in biofeedback. With guided imagery, a person thinks of peaceful mental images, such as ocean waves. A person may also include the images of controlling or curing a chronic disease, such as diabetes. People using this technique believe their condition can be eased with these positive images.

Additional information on alternative therapies for diabetes

To learn more about alternative therapies for diabetes treatment, contact the National Institute of Health's Office of Alternative Medicines Clearinghouse at (888) 644-6226. The National Diabetes Information Clearinghouse collects resource information on diabetes for the Combined Health Information Database (CHID). CHID is a database produced by health-related agencies of the Federal Government. This database provides titles, abstracts, and availability information for health information and health education resources.

Recent Advances in Diabetes Management

In recent years, advances in diabetes research have led to better ways to manage diabetes and treat its complications. Major advances include:

- The development of a quick-acting insulin analog.
- 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 and replace daily injections.
- Laser treatment for diabetic eye disease that reduces the risk of blindness.
- Successful transplantation of kidneys and the pancreas in people whose own kidneys fail because of diabetes.
- Better ways of managing diabetes in pregnant women, thus improving chances of successful outcomes.
- New drugs to treat 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 antihypertensive drugs called ACE (angiotensin-converting enzyme) inhibitors prevent or delay kidney failure in people with diabetes.
- Promising results with islet transplantation for type 1 diabetes reported by the University of Alberta in Canada. A nationwide clinical trial funded by the NIH and the Juvenile Diabetes Research Foundation International is currently trying to replicate the Canadian studies.
- Evidence that people at high risk for type 2 diabetes can lower their chances of developing the disease through diet and exercise.
- Evidence that high quality nutritional supplementation may augment various dysfunctional biochemical pathways restoring them to a more homeostatic balance.

Future Treatments for Diabetes

In the future, it may be possible to administer insulin through inhalers, a pill, or a patch. Devices are now available (GlucoWatch) that allow a 12 hour monitoring of glucose levels through skin diffusion after a single daily calibration.

Researchers continue to search for the cause or causes of diabetes and ways to prevent and cure the disorder. Scientists are looking 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 see if they are at risk.

The Diabetes Prevention Trial – Type 1 (DPT-1) identifies relatives at risk for developing type 1 diabetes and treats them with an oral form of insulin in the hope of preventing type 1 diabetes. In the same study, researchers recently completed a separate trial in which they found that low-dose insulin injections do not prevent type 1 diabetes in relatives of people with type 1 diabetes.

Transplantation of the pancreas or insulin-producing beta cells offers the best hope of cure for people with type 1 diabetes. Some pancreas transplants have been successful. However, people who have transplants must take powerful drugs to prevent rejection of the transplanted organ. These drugs are costly and may eventually cause other health problems.

Newer less immunogenic modifications are under development. Scientists are working to develop less harmful drugs and better methods of transplanting beta cells to prevent rejection by the body. Using techniques of bioengineering, researchers are also trying to create artificial beta cells that secrete insulin in response to increased glucose levels in the blood.

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, which were released in August 2001, showed that people at high risk for type 2 diabetes could sharply lower their chances of developing the disease through diet and exercise. In addition, treatment with the oral diabetes drug metformin also reduced diabetes risk, though less dramatically. The same study was halted early due to the profound positive impact of diet and exercise versus metformin. Participants randomly assigned to intensive lifestyle intervention reduced their risk of getting type 2 diabetes by 58 percent. On average, this group maintained their physical activity at 30 minutes per day, usually with walking or other moderate inten-

sity 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.

Several new drugs have been developed to treat type 2 diabetes. By using the oral diabetes medications now available, many people can control blood glucose levels without insulin injections. Many people have been able to reduce their prescription medications, avoid prescription medications and avoid insulin by using high grade nutritional supplements designed for use in glucose dysfunction. Many patients are very fearful, and therefore quite motivated, of allowing their condition to worsen to the point of needing insulin. I have experienced a multitude of patients in my clinic that are drug free with sustained normalization of their Hgb-A1-C levels with appropriate daily supplementation and lifestyle modification. Studies are under way to determine how best to use nutritional supplements, prescription medications and combinations of both to manage type 2 diabetes. Medical intervention regarding obesity and weight management is also a key factor in the success of diabetic patients.

Did you know that EVERY 24 HOURS in America:

- **2,700** people are diagnosed with diabetes
- **1,200** people die from diabetes
- **180** amputations are performed because of diabetes
- **120** people begin treatment for end-stage kidney disease because of diabetes
- **75** people lose their eyesight because of diabetes

Did you also know:

- 65% of people with diabetes die from heart disease and stroke
- People with diabetes have the same cardiovascular risk as if they had already had a heart attack
- Recent statistics show there are currently more than 17 million Americans with diabetes
- Centers for Disease Control estimate that by the year 2050, the prevalence of diabetes will increase by 165%
- Diabetes kills more people every year than AIDS or breast cancer – one American dies from diabetes every three minutes

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Resources

National Diabetes Information Clearinghouse

1 Information Way
Bethesda, MD 20892-3560
Email: ndic@info.niddk.nih.gov

National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK)

National Institutes of Health
Office of Communications and Public Liaison
NIDDK, NIH, Building 31, Room 9A04
31 Center Drive, MSC 2560, Bethesda, MD 20892-2560

Office of Disease Prevention and Health Promotion Healthy People 2010

Hubert H. Humphrey Building, Room 738G
200 Independence Avenue, SW.
Washington, DC 20201
Fax (202) 205-9478

National Diabetes Education Program

A joint program of NIH and CDC
<http://ndep.nih.gov>
www.cdc.gov/diabetes

American Association of Diabetes Educators

www.aadenet.org

American Diabetes Association

www.diabetes.org

American Dietetic Association

www.eatright.org

Centers for Disease Control and Prevention

www.cdc.gov/diabetes
www.cdc.gov/nchs

Department of Veterans Affairs

www.va.gov/health/diabetes

Health Resources and Services Administration

www.hrsa.gov

Indian Health Service

www.ihs.gov

Juvenile Diabetes Research Foundation International

www.jdrf.org

U.S. Department of Health and Human Services Office of Minority Health

www.omhrc.gov