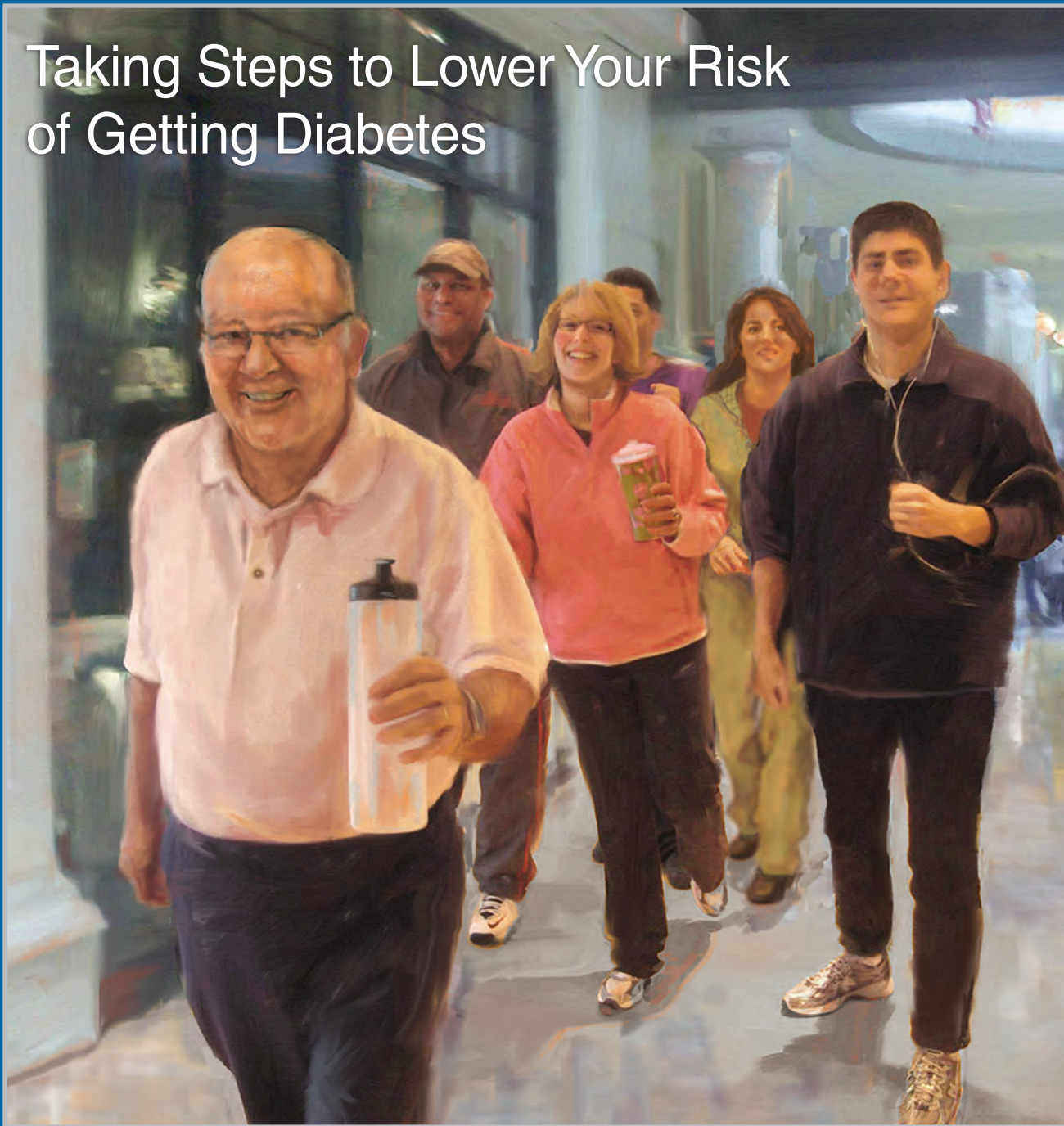


Am I at risk for type 2 diabetes?

Taking Steps to Lower Your Risk of Getting Diabetes



National Institute of
Diabetes and Digestive
and Kidney Diseases

National Diabetes Information
Clearinghouse

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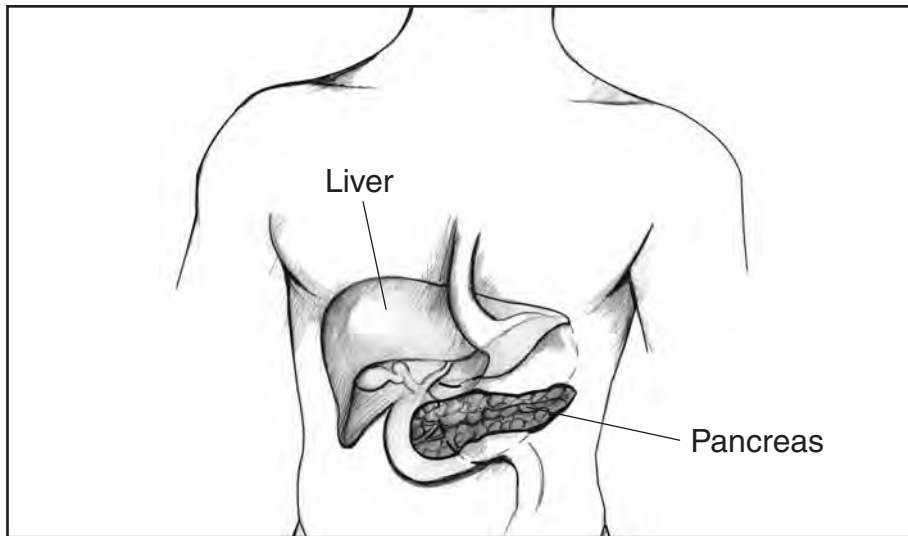
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What is type 2 diabetes?

Type 2 diabetes, formerly called adult-onset diabetes, is the most common type of diabetes. About 95 percent of people with diabetes have type 2. People can develop type 2 diabetes at any age, even during childhood. However, this type of diabetes develops most often in middle-aged and older people. People who are overweight and inactive are also more likely to develop type 2 diabetes.

In type 2 and other types of diabetes, you have too much glucose, also called sugar, in your blood. People with diabetes have problems converting food to energy. After a meal, food is broken down into glucose, which is carried by your blood to cells throughout your body. With the help of the hormone insulin, cells absorb glucose from your blood and use it for energy. Insulin is made in the pancreas, an organ located behind the stomach.



Insulin is made in the pancreas.

Type 2 diabetes usually begins with insulin resistance, a condition linked to excess weight in which your body's cells do not use insulin properly. As a result, your body needs more insulin to help glucose enter cells. At first, your pancreas keeps up with the added demand by producing more insulin. But in time, your pancreas loses its ability to produce enough insulin, and blood glucose levels rise.

Over time, high blood glucose damages nerves and blood vessels, leading to problems such as heart disease, stroke, kidney disease, blindness, dental disease, and amputations. Other problems of diabetes may include increased risk of getting other diseases, loss of mobility with aging, depression, and pregnancy problems.

Treatment includes taking diabetes medicines, making wise food choices, being physically active on a regular basis, controlling blood pressure and cholesterol, and for some, taking aspirin daily.

Can type 2 diabetes be delayed or prevented?

Yes. The results of the Diabetes Prevention Program (DPP) proved that weight loss through moderate diet changes and physical activity can delay or prevent type 2 diabetes. The DPP was a federally funded study of 3,234 people at high risk for diabetes. This study showed that a 5- to 7-percent weight loss, which for a 200-pound person would be 10 to 14 pounds, slowed development of type 2 diabetes.

People at High Risk for Diabetes

DPP study participants were overweight and had higher than normal levels of blood glucose, a condition called prediabetes. Many had family members with type 2 diabetes. Prediabetes, obesity, and a family history of diabetes are strong risk factors for type 2 diabetes. About half of the DPP participants were from minority groups with high rates of diabetes, including African Americans, Alaska Natives, American Indians, Asian Americans, Hispanics/Latinos, and Pacific Islander Americans.

DPP participants also included others at high risk for developing type 2 diabetes, such as women with a history of gestational diabetes and people age 60 and older.

Approaches to Preventing Diabetes

The DPP tested three approaches to preventing diabetes:

- **Making lifestyle changes.** People in the lifestyle change group exercised, usually by walking 5 days a week for about 30 minutes a day, and lowered their intake of fat and calories.
- **Taking the diabetes medicine metformin.** Those who took metformin also received information about physical activity and diet.
- **Receiving education about diabetes.** The third group only received information about physical activity and diet and took a placebo—a pill without medicine in it.

People in the lifestyle change group showed the best outcomes. But people who took metformin also benefited. The results showed that by losing an average of 15 pounds in the first year of the study, people in the lifestyle change group reduced their risk of developing type 2 diabetes by 58 percent over 3 years. Lifestyle change was even more effective in those age 60 and older. People in this group reduced their risk by

71 percent. But people in the metformin group also benefited, reducing their risk by 31 percent. More information about the DPP, funded under National Institutes of Health (NIH) clinical trial number NCT00004992, is available at www.bsc.gwu.edu/dpp.

Lasting Results

The Diabetes Prevention Program Outcomes Study (DPPOS) has shown that the benefits of weight loss and metformin last for at least 10 years. The DPPOS has continued to follow most DPP participants since the DPP ended in 2001. The DPPOS showed that 10 years after enrolling in the DPP,

- people in the lifestyle change group reduced their risk for developing diabetes by 34 percent
- those in the lifestyle change group age 60 or older had even greater benefit, reducing their risk of developing diabetes by 49 percent
- participants in the lifestyle change group also had fewer heart and blood vessel disease risk factors, including lower blood pressure and triglyceride levels, even though they took fewer medicines to control their heart disease risk
- the metformin group reduced the risk of developing diabetes by 18 percent

Even though controlling your weight with lifestyle changes is challenging, it produces long-term health rewards by lowering your risk for type 2 diabetes, lowering your blood glucose levels, and reducing other heart disease risk factors. More information about the DPPOS, funded under NIH clinical trial number NCT00038727, can be found at www.bsc.gwu.edu/dpp.



People in the lifestyle change group exercised, usually by walking 5 days a week for about 30 minutes a day.

Other Types of Diabetes

In addition to type 2, the other main types of diabetes are type 1 diabetes and gestational diabetes.

Type 1 Diabetes

Type 1 diabetes, formerly called juvenile diabetes, is usually first diagnosed in children, teenagers, and young adults. In this type of diabetes, your pancreas can no longer make insulin because your body's immune system has attacked and destroyed the cells that make it. Treatment for type 1 diabetes includes taking insulin shots or using an insulin pump, making wise food choices, being physically active on a regular basis, controlling blood pressure and cholesterol, and, for some, taking aspirin daily.

Gestational Diabetes

Gestational diabetes is a type of diabetes that develops only during pregnancy. Hormones produced by your placenta and other pregnancy-related factors contribute to insulin resistance, which occurs in all women during late pregnancy. Insulin resistance increases the amount of insulin needed to control blood glucose levels. If your pancreas can't produce enough insulin, gestational diabetes occurs.

As with type 2 diabetes, excess weight is linked to gestational diabetes. Overweight or obese women are at particularly high risk for gestational diabetes because they start pregnancy with a higher need for insulin due to insulin resistance. Excessive weight gain during pregnancy may also increase risk. Gestational diabetes occurs more often in some ethnic groups and among women with a family history of diabetes.

Although gestational diabetes usually goes away after the baby is born, a woman who has had gestational diabetes is more likely to develop type 2 diabetes later in life. Babies born to mothers who had gestational diabetes are also more likely to develop obesity and type 2 diabetes as they grow up.

What are the signs and symptoms of type 2 diabetes?

The signs and symptoms of type 2 diabetes can be so mild that you might not even notice them. Nearly 7 million people in the United States have type 2 diabetes and don't know they have the disease. Many have no signs or symptoms. Some people have symptoms but do not suspect diabetes.

Symptoms include

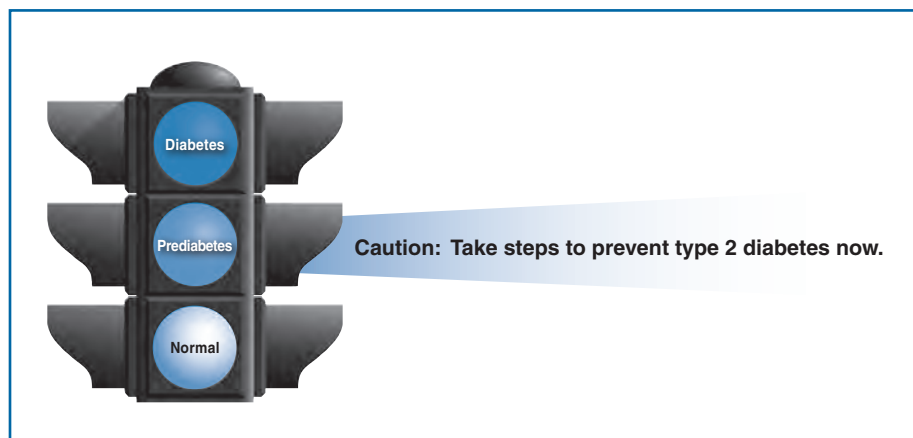
- increased thirst
- increased hunger
- fatigue
- increased urination, especially at night
- unexplained weight loss
- blurred vision
- numbness or tingling in the feet or hands
- sores that do not heal

Many people do not find out they have the disease until they have diabetes problems, such as blurred vision or heart trouble. If you find out early that you have diabetes, you can get treatment to prevent damage to your body.

Should I be tested for diabetes and prediabetes?

Anyone 45 years of age or older should consider getting tested for diabetes and prediabetes. If you are 45 or older and overweight—see the body mass index (BMI) chart on pages 24 and 25—getting tested is strongly recommended. If you are younger than 45, overweight, and have one or more other risk factors, you should consider getting tested. Ask your doctor for an A1C test, a fasting blood glucose test, or an oral glucose tolerance test.

Your doctor will tell you if you have normal blood glucose, diabetes, or prediabetes. If you are told you have prediabetes, take steps to prevent type 2 diabetes. And ask your doctor if you should be tested again in 1 year.



What does having prediabetes mean?

Having prediabetes means your blood glucose is higher than normal but not high enough to be diagnosed as diabetes. In 2009, at least 78 million American adults were estimated to have prediabetes. Having prediabetes also means you are at risk for getting type 2 diabetes and heart disease. However, you can reduce your risk of getting diabetes and even return blood glucose levels to normal by losing a little weight through healthy eating and being more physically active.

What factors increase my risk for type 2 diabetes?

To find out your risk for type 2 diabetes, check each item that applies to you.

- I am age 45 or older.
- I am overweight or obese.
- I have a parent, brother, or sister with diabetes.
- My family background is African American, Alaska Native, American Indian, Asian American, Hispanic/Latino, or Pacific Islander American.
- I have had gestational diabetes.

- I gave birth to at least one baby weighing more than 9 pounds.
- My blood pressure is 140/90 or higher, or I have been told that I have high blood pressure.
- My cholesterol levels are higher than normal. My HDL, or good, cholesterol is below 35, or my triglyceride level is above 250.
- I am fairly inactive.
- I have polycystic ovary syndrome, also called PCOS.
- On previous testing, I had prediabetes—an A1C level of 5.7 to 6.4 percent, impaired fasting glucose (IFG), or impaired glucose tolerance (IGT).
- I have other clinical conditions associated with insulin resistance, such as a condition called acanthosis nigricans, characterized by a dark, velvety rash around my neck or armpits.
- I have a history of cardiovascular disease.

The more items you checked, the higher your risk.

Does sleep matter?

Yes. Studies show that untreated sleep problems, especially sleep apnea, can increase the risk of type 2 diabetes. Sleep apnea is a common disorder in which you have pauses in breathing or shallow breaths while you sleep. Most people who have sleep apnea don't know they have it and it often goes undiagnosed. Night shift workers who have problems with sleepiness may also be at increased risk for obesity and type 2 diabetes.

If you think you might have sleep problems, ask your doctor for help. More information about sleep problems is available from the National Heart Lung and Blood Institute at www.nhlbi.nih.gov/health/public/sleep.

How can I reduce my risk for type 2 diabetes?

You can do a lot to reduce your risk of getting type 2 diabetes. Being more physically active, reducing fat and calorie intake, and losing a little weight can help you lower your chances of developing type 2 diabetes. Taking the diabetes medicine metformin can also reduce risk, particularly in younger and heavier people with prediabetes and women who have had gestational diabetes. Lowering blood pressure and cholesterol levels also helps you stay healthy.

If you are overweight, then take these steps:

- Reach and maintain a reasonable body weight (see page 20). Even a 10 or 15 pound weight loss makes a big difference.
- Make wise food choices most of the time (see page 27).
- Be physically active every day (see page 17).

If you are fairly inactive, then take this step:

- Be physically active every day (see page 17).

If your blood pressure is too high, then take these steps:

- Reach and maintain a reasonable body weight (see page 20).
- Make wise food choices most of the time (see page 27).
- Reduce your sodium and alcohol intake (see page 28).
- Be physically active every day (see page 17).
- Talk with your doctor about whether you need medicine to control your blood pressure (see page 20).

If your cholesterol or triglyceride levels are too high, then take these steps:

- Make wise food choices most of the time (see page 27).
- Be physically active every day (see page 17).
- Talk with your doctor about whether you need medicine to control your cholesterol levels (see page 20).

Making Changes to Lower My Risk

Making big changes in your life is hard, especially if you are faced with more than one change. You can make it easier by taking these steps:

- Make a plan to change behavior.
- Decide exactly what you will do and give yourself a time frame.
- Plan what you need to get ready.
- Track your goals and activity on a food and activity tracker, available at www.ndep.nih.gov/media/gp_foodacttracker.pdf
- Think about what might prevent you from reaching your goals.



Your doctor, a dietitian, or a counselor can help you make a plan.

- Find family and friends who will support and encourage you.
- Decide how you will reward yourself—a shopping trip, movie tickets, an afternoon in the park—when you do what you have planned.

Your doctor, a dietitian, or a counselor can help you make a plan.

Be Physically Active Every Day

Regular physical activity tackles several risk factors at once. Activity helps you lose weight; keeps your blood glucose, blood pressure, and cholesterol under control; and helps your body use insulin. People in the DPP who were physically active for 30 minutes a day, 5 days a week, reduced their risk of type 2 diabetes. Many chose brisk walking as their physical activity.

If you are not fairly active, you should start slowly. First, talk with your doctor about what kinds of physical activity are safe for you. Make a plan to increase your activity level toward the goal of being active at least 30 minutes a day most days of the week. You can increase your level of physical activity in two main ways:

1. Start an exercise program.
2. Increase your daily activity.

Start an exercise program. Pick exercises that suit you. Find a friend to walk with you or join an exercise class that will help you keep going.

- Do aerobic activities, which use your large muscles to make your heart beat faster. The large muscles are those of the upper and lower arms; upper and lower legs; and those that control head, shoulder, and hip movements.
- Do activities to strengthen muscles and bone, such as lifting weights or sit-ups, two to three times a week. Find help—such as a video or a class—to learn how to do these exercises properly.



Do activities to strengthen muscles and bone, such as lifting weights or sit-ups, two to three times a week.

Increase your daily activity. Choose activities you enjoy. You can work extra activity into your daily routine by doing the following:

- Increase daily activity by decreasing time spent watching TV or at the computer. Set up a reminder on your computer to take an activity break.
- Take the stairs rather than an elevator or escalator.
- Park at the far end of the parking lot and walk.
- Get off the bus a few stops early and walk the rest of the way.
- Walk or bicycle whenever you can.



Choose activities you enjoy.

Take Your Prescribed Medicines

Some people need medicine to help control their blood pressure or cholesterol levels. If you do, take your medicines as directed. Ask your doctor if you should take metformin to prevent type 2 diabetes. Metformin is a medicine that makes insulin work better and can reduce the risk of type 2 diabetes.

Eating, Diet, and Nutrition

Your eating, diet, and nutrition choices play an important role in preventing or delaying diabetes. Follow the suggestions below to reach and maintain a reasonable weight and make wise food choices most of the time. Remember that it can take time to change your habits and be patient with yourself. You can also get help from a dietitian or join a weight-loss program to support you while you reach your goals.

Reach and Maintain a Reasonable Body Weight

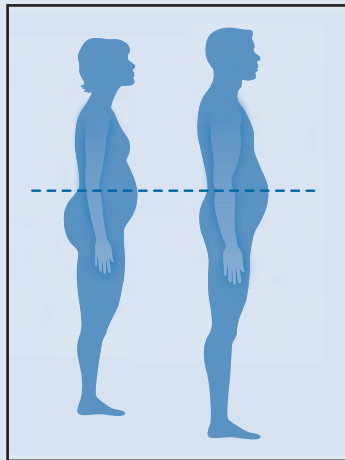
Your weight affects your health in many ways. Being overweight can keep your body from making and using insulin properly. Excess body weight can also cause high blood pressure. Every pound you lose lowers your risk of getting diabetes.

In addition to weight, the location of excess fat on the body can be important. A waist measurement of 40 inches or more for men and 35 inches or more for women is linked to insulin resistance and increases a person's risk for type 2 diabetes. This is true even if your BMI falls within the normal range.

Measure Your Waist

To measure your waist,

- place a tape measure around your bare abdomen just above your hip bone
- make sure the tape is snug but isn't digging into your skin and is parallel to the floor
- relax, exhale, and measure



Source: www.cdc.gov

Find Your BMI

The BMI is a measure of body weight relative to height. The BMI can help you find out whether you are normal weight, overweight, or obese. Use the table on pages 24 and 25 to find your BMI.

- Find your height in the left-hand column.
- Move across in the same row to the number closest to your weight.
- The number at the top of that column is your BMI. Check the word above your BMI to see whether you are normal weight, overweight, or obese.

The BMI has certain limitations. The BMI may overestimate body fat in athletes and others who have a muscular build and underestimate body fat in older adults and others who have lost muscle.

The BMI for children and teens must be determined based on age, height, weight, and sex. The Centers for Disease Control and Prevention (CDC) has information about BMI in children and teens, including a BMI calculator, at www.cdc.gov/nccdphp/dnpa/bmi. The CDC website also has a BMI calculator for adults. A BMI calculator from the NIH is available at www.nhlbi.nih.gov/health/educational/lose_wt/BMI/bmicalc.htm.

The NIH also has a free smartphone app for calculating BMI. You can search “My BMI Calculator” on your phone to find the app. The app also provides links to information about steps you can take to bring your BMI into a healthy range.

Body Mass Index (BMI)

	Normal						Overweight					Obese								Extreme Obesity																
BMI	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
Height (inches)												Body Weight (pounds)																								
58	91	96	100	105	110	115	119	124	129	134	138	143	148	153	158	162	167	172	177	181	186	191	196	201	205	210	215	220	224	229	234	239	244	248	253	258
59	94	99	104	109	114	119	124	128	133	138	143	148	153	158	163	168	173	178	183	188	193	198	203	208	212	217	222	227	232	237	242	247	252	257	262	267
60	97	102	107	112	118	123	128	133	138	143	148	153	158	163	168	174	179	184	189	194	199	204	209	215	220	225	230	235	240	245	250	255	261	266	271	276
61	100	106	111	116	122	127	132	137	143	148	153	158	164	169	174	180	185	190	195	201	206	211	217	222	227	232	238	243	248	254	259	264	269	275	280	285
62	104	109	115	120	126	131	136	142	147	153	158	164	169	175	180	186	191	196	202	207	213	218	224	229	235	240	246	251	256	262	267	273	278	284	289	295
63	107	113	118	124	130	135	141	146	152	158	163	169	175	180	186	191	197	203	208	214	220	225	231	237	242	248	254	259	265	270	278	282	287	293	299	304
64	110	116	122	128	134	140	145	151	157	163	169	174	180	186	192	197	204	209	215	221	227	232	238	244	250	256	262	267	273	279	285	291	296	302	308	314
65	114	120	126	132	138	144	150	156	162	168	174	180	186	192	198	204	210	216	222	228	234	240	246	252	258	264	270	276	282	288	294	300	306	312	318	324
66	118	124	130	136	142	148	155	161	167	173	179	186	192	198	204	210	216	223	229	235	241	247	253	260	266	272	278	284	291	297	303	309	315	322	328	334
67	121	127	134	140	146	153	159	166	172	178	185	191	198	204	211	217	223	230	236	242	249	255	261	268	274	280	287	293	299	306	312	319	325	331	338	344
68	125	131	138	144	151	158	164	171	177	184	190	197	203	210	216	223	230	236	243	249	256	262	269	276	282	289	295	302	308	315	322	328	335	341	348	354
69	128	135	142	149	155	162	169	176	182	189	196	203	209	216	223	230	236	243	250	257	263	270	277	284	291	297	304	311	318	324	331	338	345	351	358	365
70	132	139	146	153	160	167	174	181	188	195	202	209	216	222	229	236	243	250	257	264	271	278	285	292	299	306	313	320	327	334	341	348	355	362	369	376
71	136	143	150	157	165	172	179	186	193	200	208	215	222	229	236	243	250	257	265	272	279	286	293	301	308	315	322	329	338	343	351	358	365	372	379	386
72	140	147	154	162	169	177	184	191	199	206	213	221	228	235	242	250	258	265	272	279	287	294	302	309	316	324	331	338	346	353	361	368	375	383	390	397
73	144	151	159	166	174	182	189	197	204	212	219	227	235	242	250	257	265	272	280	288	295	302	310	318	325	333	340	348	355	363	371	378	386	393	401	408
74	148	155	163	171	179	186	194	202	210	218	225	233	241	249	256	264	272	280	287	295	303	311	319	326	334	342	350	358	365	373	381	389	396	404	412	420
75	152	160	168	176	184	192	200	208	216	224	232	240	248	256	264	272	279	287	295	303	311	319	327	335	343	351	359	367	375	383	391	399	407	415	423	431
76	156	164	172	180	189	197	205	213	221	230	238	246	254	263	271	279	287	295	304	312	320	328	336	344	353	361	369	377	385	394	402	410	418	426	435	443

Source: Adapted from *Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report*. National Institutes of Health, 1998.

If you are overweight or obese, choose sensible ways to get in shape:

- Avoid crash diets. Instead, eat less of the foods you usually have. Limit the amount of fat you eat.
- Increase your physical activity. Aim for at least 30 minutes of physical activity most days of the week.
- Set a reasonable weight-loss goal, such as losing 1 pound a week. Aim for a long-term goal of losing 5 to 7 percent of your total body weight. To estimate this amount in pounds, find the weight closest to yours on the chart below. Follow the row across to see how many pounds you need to lose.

Your weight in pounds	5 percent loss in pounds	7 percent loss in pounds
150	8	11
175	9	12
200	10	14
225	11	16
250	13	18
275	14	19
300	15	21
325	16	23
350	18	25

To find your exact weight loss goal, multiply .05 by your weight in pounds to find your 5 percent goal; multiply .07 by your weight to find your 7 percent goal.

Make Wise Food Choices Most of the Time

What you eat has a big effect on your health. By making wise food choices, you can help control your body weight, blood glucose, blood pressure, and cholesterol.

- Take a look at the serving sizes of the foods you eat. Reduce serving sizes of main courses, meat, desserts, and other foods high in fat. Increase the amount of fruits and vegetables you eat at every meal. Try using a small plate. For more help with choosing serving sizes, see the United States Department of Agriculture's website at www.choosemyplate.gov.



Reduce foods high in fat and increase the amount of fruits and vegetables you eat at every meal.

- Limit your fat intake to about 25 percent of your total calories. For example, if your food choices add up to about 2,000 calories a day, try to eat no more than 56 grams of fat. Your doctor or a dietitian can help you figure out how much fat to have. You can also check food labels for fat content.
- Limit your sodium intake to less than 2,300 milligrams—about 1 teaspoon of salt—each day.
- Talk with your doctor about whether you may drink alcoholic beverages. If you choose to drink alcoholic beverages, limit your intake to one drink for women or two drinks for men per day.
- You may also wish to reduce the number of calories you have each day. People in the DPP lifestyle change group lowered their daily calorie total by an average of about 450 calories. Your doctor or dietitian can help you with a healthy eating plan that emphasizes weight loss.
- Keep a food and physical activity log. Write down what you eat and how much physical activity you are getting. People who keep track are more successful in losing weight.
- When you meet your goal, reward yourself with a nonfood item or activity, such as watching a movie.

Dietary Supplements

Vitamin D studies show a link between people's ability to maintain healthy blood glucose levels and having enough vitamin D in their blood. However, studies to determine the proper vitamin D levels for people with diabetes and for preventing diabetes are ongoing; no special recommendations have been made about vitamin D levels or supplements for people with diabetes.

Currently, the Institute of Medicine (IOM), the agency that recommends supplementation levels based on current science, provides the following guidelines for daily vitamin D intake:

- People ages 1 to 70 years may require 600 International Units (IUs)
- People age 71 and older may require as much as 800 IUs

The IOM also recommended that no more than 4,000 IUs of vitamin D be taken per day.

To help ensure coordinated and safe care, you should discuss your use of complementary and alternative medicine practices, including your use of dietary supplements, with your doctor.

More information about using dietary supplements to help with diabetes is available from the National Diabetes Information Clearinghouse at www.diabetes.niddk.nih.gov/dm/pubs/alternativetherapies/index.aspx.

Hope through Research

The National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) conducts and supports research related to the causes, treatment, and prevention of diabetes. For example, clinical trials include The Avoiding Diabetes Thru Action Plan Targeting Pilot Randomized Control Trial (ADAPT). This trial is an innovative study that uses technology to affect lifestyle behavior change. This study is funded under NIH clinical trial number NCT01473654.

We now know that many people can delay or prevent type 2 diabetes through weight loss, regular physical activity, and lowering their intake of fat and calories. Researchers are working hard to understand the genetic and environmental factors that contribute to a person's tendency to develop obesity, diabetes, and prediabetes. As researchers learn more about the molecular events that lead to diabetes, they will develop ways to prevent and cure different stages of this disease. Already, the DPP has shown that even in participants at higher genetic risk for type 2 diabetes, losing weight through lifestyle change lowered the risk of diabetes. DPP researchers continue to monitor DPP participants through the DPPOS to learn more about the study's long-term effects.

Participants in clinical trials can play a more active role in their own health care, gain access to new research treatments before they are widely available, and help others by contributing to medical research. For more information about current studies, visit www.ClinicalTrials.gov.

For More Information

More information about insulin resistance, the DPP, and how to lower your risk for type 2 diabetes is available in the following publications:

- *Insulin Resistance and Prediabetes*
- *Diabetes Prevention Program (DPP)*

These publications are available at www.diabetes.niddk.nih.gov or by calling 1-800-860-8747.

As part of its Small Steps. Big Rewards. Prevent type 2 Diabetes campaign, the National Diabetes Education Program (NDEP) offers several booklets about preventing type 2 diabetes, including information about setting goals, tracking progress, implementing a walking program, and finding additional resources. These materials are available at www.ndep.nih.gov or by calling the NDEP at 1-888-693-NDEP (1-888-693-6337).

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www.yourdiabetesinfo.org

The National Diabetes Education Program is a federally funded program sponsored by the U.S. Department of Health and Human Services' National Institutes of Health and the Centers for Disease Control and Prevention and includes over 200 partners at the federal, state, and local levels, working together to reduce the morbidity and mortality associated with diabetes.

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Internet: www.diabetes.niddk.nih.gov

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