



PATIENT RESOURCES

Diabetes Treatments

January 23, 2022

It's very important to take your **diabetes** medications as recommended by your doctor. Left untreated, diabetes can lead to serious, even life-threatening **complications**. Complications can lead to loss of vital body functions (such as with your kidneys), blindness, the need for amputation of toes or feet, and even death (especially from cardiovascular disease). By taking your medications as recommended, you greatly reduce your risk of developing diabetes-related complications.

Treatment includes changes in lifestyle (diet and exercise), plus medicine (if needed). Diabetes can be treated with oral medicines (pills), insulin, and/or other injected medicines. People with type 1 diabetes always need insulin. People with type 2 diabetes usually need treatment with oral medicines for several or even many years, but may eventually need insulin to maintain glucose control.

Endocrine Connection

Your treatment will depend on the type of diabetes you have. There are several types of diabetes:

Type 1 diabetes occurs when the pancreas stops making **insulin**. It is usually seen in children and teens, but may occur later in life. People with type 1 diabetes need insulin to survive.

Type 2 diabetes is the most common type of diabetes. With type 2 diabetes, the body does not produce enough insulin and it becomes resistant to insulin's effects. It occurs more often in adults, many of whom are overweight or obese. However, younger people can also develop type 2 diabetes.

Gestational diabetes is a type of diabetes that occurs only during pregnancy. It usually goes away after the baby is born. Women who have had gestational diabetes are more likely to develop type 2 diabetes later in life, however.

There are many types of medications that can be prescribed for you. The various options may be overwhelming—memorizing all the names and technical terms isn't important, but understanding that there ARE options is what you need to know. Work with your doctor to determine which of these might be most helpful for you.

► Insulin

Insulin helps you manage your blood glucose levels by "unlocking" cells so that they can access your blood glucose for the energy they need. Without sufficient insulin or when your cells have a condition called insulin resistance, where they cannot use the insulin your pancreas makes properly, blood glucose builds up, and can eventually damage your arteries and cause other problems that can lead to complications. Over time, many people need additional help in controlling blood glucose levels. This is when doctors typically prescribe insulin.

Insulin is a hormone made by the pancreas. It helps carry sugar from the blood into the cells. The cells use the sugar as energy for the body to work. If you have type 1 diabetes (T1D), your body makes very little or no insulin. That's why you need to take insulin. If you have type 2 diabetes (T2D), your body makes too little insulin or can't use the insulin it makes properly. You must take insulin if you have T1D. You may need to take insulin to help better manage your blood sugar levels if you have T2D.

► Types of Insulin

The type of insulin you take is based on three factors: how long it takes to start working (onset), when it is at its strongest action (peak), and how long it lasts (duration). Some types of insulin are called basal insulins. These last longer and give you a steady dose of insulin throughout the day and night. Other types are called mealtime, rapid, or bolus insulins. These usually last a shorter time but give you insulin to handle the spikes in blood sugar after a meal.

Mealtime (or "bolus") insulin: Used before meals to control the rise of blood glucose levels after eating.

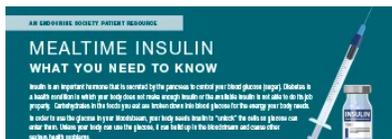
- › Rapid-acting: Insulin glulisine (Apidra), Insulin lispro (Humalog), Insulin aspart (NovoLog), and Inhaled insulin human (Afrezza).
- › Short-acting: Regular (Humulin R, Novolin R).

Background (or "basal") Insulin: Controls your blood glucose levels between meals and throughout the night. This is usually used once or twice daily. It can be used alone or in combination with oral medicines or rapid-acting insulin.

- › Intermediate-acting: NPH (Humulin N, Novolin N)
- › Long-acting: Insulin detemir (Levemir), Insulin glargine (Lantus, Basaglar, Toujeo), and Insulin degludec (Tresiba)

Pre-mixed Insulin: Combination of bolus and basal insulin that controls blood glucose levels after and between meals. These are usually used twice daily before breakfast and dinner. They can be used alone or in combination with oral medicines.

The type of insulin your doctor prescribes will depend on the type of diabetes you have, your lifestyle (when and what you eat, how much you exercise), your age, your body's response to insulin. It also depends on how often you are able or willing to check your blood glucose and give yourself injections. People with type 1 diabetes typically need both basal and mealtime insulin. Most people with type 2 diabetes who use insulin may start with just basal (long-acting) insulin initially.



DIABETES AND INSULIN

There are three main types of diabetes. In people with type 1 diabetes, the immune system attacks the insulin-producing cells in the pancreas and the body can't make enough insulin. They need to take insulin every day to live.

People with type 2 diabetes, which is the most common type of diabetes, usually still make some but not enough insulin, and their cells have trouble using the insulin that is made. They often need to take insulin to help their bodies use the insulin they produce properly over the long term.

Another type of diabetes is called gestational diabetes, which is usually diagnosed during pregnancy and usually goes away after the baby is born. However, the presence of gestational diabetes increases the risk of developing type 2 diabetes later in life. For more information, visit www.endocrine.org/diabetes.

Typically, people with diabetes, in addition to eating right and staying fit through regular exercise, must take medication to keep their blood sugar levels in the right range. For people with type 1 diabetes, only insulin therapy is used.

For patients with type 2 diabetes, there are several types of oral and injectable medications available to maintain their blood glucose in a healthy range. For some type 2 patients, a healthy lifestyle with diet and exercise in addition to medication may be sufficient to get their blood sugar levels under control. For others, there may be other ways to do this. For them, it may be crucial to do so.

People with diabetes should pay attention to their blood glucose levels and keep them in the target range. This is the most important step in preventing complications. The most common complications of diabetes are heart disease, kidney disease, eye disease, nerve damage, and foot problems. People with diabetes should also pay attention to their blood pressure and cholesterol levels. People with diabetes should also pay attention to their dental health. People with diabetes should also pay attention to their skin health. People with diabetes should also pay attention to their mental health. People with diabetes should also pay attention to their social health. People with diabetes should also pay attention to their spiritual health. People with diabetes should also pay attention to their environmental health. People with diabetes should also pay attention to their cultural health. People with diabetes should also pay attention to their community health. People with diabetes should also pay attention to their global health.

TYPES OF INSULIN

Insulin is classified according to how long it takes to start working (onset), when it peaks, and how long it continues to work in the body (duration). There are two main categories: rapid-acting insulin, which starts to work quickly and delivers a steady dose of insulin to the body, and long-acting insulin, which starts to work more slowly and delivers a steady dose of insulin to the body over a longer period.

INSULIN TYPE	ONSET	PEAK	DURATION
Rapid-acting insulin	15-30 minutes	1-3 hours	3-5 hours
Intermediate-acting insulin	1-3 hours	4-12 hours	18-24 hours
Long-acting insulin	1-4 hours	None	18-24 hours
Ultra-long-acting insulin	1-4 hours	None	36-42 hours

Visit endocrine.org for more information.
 Ellen Overton, MD, Endocrinology, Johns Hopkins University



Type 2 Diabetes Medications

People with type 2 diabetes usually need treatment with oral medicines for several or even many years but may eventually need insulin to maintain glucose control. There are many types of medications that can be prescribed for you. The various options may be overwhelming—memorizing all the names and technical terms isn't important, but understanding that there ARE options is what you need to know. Work with your doctor to determine which of these might be most helpful for you.

► **Biguanides**

Metformin is a medication commonly used as the first medication for people with diabetes. It is a pill taken by mouth and it comes in regular and slow release forms. It works by helping stop the liver from converting protein or fat into sugar. It does not cause an increase in the release of insulin but can make the body more sensitive to insulin effects. It may be taken on its own

or with other diabetes pills or insulin. It also comes in a one pill combination with other diabetes medications.

► **DPP-4 Inhibitors**

DPP-4 inhibitor medicines (generic names: sitagliptin saxagliptin, and linagliptin) are a type of incretin-based medicine for type 2 diabetes. This kind of medicine is based on the action of hormones called incretins, which help control how the pancreas works. GLP-1 incretins cause your pancreas to produce more insulin after you eat, helping your body use glucose. The effects of GLP-1 only last a few minutes, because an enzyme (a substance that causes a chemical reaction in your body) called DPP-4 quickly breaks down GLP-1 in the blood. DPP-4 inhibitors block the action of the DPP-4 enzyme. This makes GLP-1 last longer and increases the amount of GLP-1 in your blood. More GLP-1 means less glucose build-up in the blood.

DPP-4 inhibitors come in pill form and are taken by mouth. They are used alone or in combination with other diabetes medicines. They are also available in combination pills that contain a DPP-4 inhibitor and another type of diabetes medicine. Your dose of sitagliptin or saxagliptin (but not linagliptin) may need to be adjusted if you have kidney problems.

► **GLP-1 Receptor Agonists**

GLP-1 receptor agonist medicines, also called incretin mimetics, are a type of incretin-based medicine for type 2 diabetes. This type of medicine is based on the action of hormones called incretins, which help control how the pancreas works. One type of incretin, called GLP-1, causes your

pancreas to produce more insulin after you eat and helps keep blood glucose levels in the normal range. These medicines (exenatide, dulaglutide, lixisenatide, liraglutide and semaglutide) copy, or mimic, the action of GLP-1 made by your body. The effects of GLP-1 only last for a few minutes, but GLP-1 receptor agonists medicines can last for hours or days.

GLP-1 receptor agonists come most commonly as a liquid, which you inject under the skin on your abdomen, thigh, or upper arm. Depending on which medicine you use, you inject it either once or twice daily, or once weekly. Semaglutide also comes as a pill dosed once daily. GLP-1 receptor agonists are used alone or along with other diabetes medicines.

► **SGLT2 Inhibitors**

Sodium-Glucose cotransporter-2 inhibitors is a class of diabetes medications that comes as a pill. This group of medications stops the kidneys from taking glucose back into the blood and the excess glucose is released into the urine. These medicines (canagliflozin, dapagliflozin, and empagliflozin) can be used alone or in combination with other diabetes medications.

► **Insulin Secretagogues**

Insulin secretagogues are one type of medicine for type 2 diabetes. Many people with type 2 diabetes don't make enough insulin. Insulin secretagogues help your pancreas make and release (or secrete) insulin. Insulin helps keep your blood glucose from being too high. Once your body gets the insulin it needs, you feel better. Your doctor might prescribe these

insulin-releasing pills for you when you can't reach your target blood glucose levels with a healthy diet, exercise, and other diabetes medicines.

Insulin-releasing medicines

- › Sulfonylureas (Generic names): Glimepiride, Glipizide, Glyburide
- › Meglitinides (Generic names): Repaglinide, Nateglinide

▶ TZDs

TZDs, also called thiazolidinediones or “glitazones,” are a type of pill for type 2 diabetes. The generic names are:

- › Pioglitazone (used most often)
- › Rosiglitazone (rarely used)

TZDs help keep your blood glucose levels on target by decreasing insulin resistance and making body tissues more sensitive to insulin's effects. Then glucose can enter your cells where it is needed. TZDs also cut down on the amount of glucose made by your liver, which can be far too much in people with type 2 diabetes.

Several other types of diabetes pills are available. Each type works in a different way. Rarely you might take a TZD as your only diabetes medicine but most often you take it with another type of diabetes pill, such as metformin or a sulfonylurea. Some people take combination pills that contain a TZD plus another type of diabetes medicine.

