

Pills for Type 2 Diabetes

A Guide for Adults



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Fast Facts on Diabetes Pills

- Different kinds of diabetes pills work in different ways to control blood sugar (blood glucose).
- All the diabetes pills in this guide lower blood sugar.
- Combining two different kinds of diabetes pills can work better to lower your blood sugar than a single medicine.
- But combining two kinds of diabetes pills can make it more likely that your blood sugar will drop too low.
- Most diabetes pills can cause weight gain. One kind, metformin (Glucophage®), does not make you gain weight.
- Diabetes pills won't raise or lower your blood pressure enough to affect your health.

What Does This Guide Cover?

Type 2 diabetes means the body has a problem with insulin. This causes blood sugar to get too high. Insulin is a hormone, or chemical, made by the body that is needed to change food into energy. When you have type 2 diabetes, your body either does not make enough insulin, or it doesn't use insulin as well as it should. Diabetes is treated with insulin or oral medicines (pills).

This guide can help you talk with your doctor or nurse about pills for type 2 diabetes. It covers:

- Common kinds of diabetes pills.
- How well they work for adults with type 2 diabetes.
- Side effects.
- Price.

The information in this guide comes from a government-funded review of research about pills for type 2 diabetes.

What Is Not Covered in This Guide?

This guide does not cover all the possible ways to treat type 2 diabetes. It does not include information on diet and exercise. It does not cover insulin or using these pills along with insulin. It does not include older diabetes pills, like chlorpropamide (Diabinese®), or new pills, like sitagliptin (Januvia®). It does not cover children, pregnant women, or type 1 diabetes.

Treating Type 2 Diabetes

Why treat diabetes?

If blood sugar stays high for a long time, people may have a higher chance of heart attacks, strokes, kidney damage, blindness, and amputations. Keeping your blood sugar at a good level might lower your chance of these problems.

How is type 2 diabetes treated?

The first step in controlling your blood sugar is to eat a balanced diet and get more active. Even small changes can make a big difference. Most people also need to take medicine to help keep their blood sugar under control.



Learning About Diabetes Pills

Different kinds of diabetes pills work in different ways to control blood sugar. If one pill is not working well enough on its own, your doctor or nurse may combine it with a second kind of pill. This chart shows the different kinds of diabetes pills and how they work.

Kinds of Diabetes Pills and How They Work

Generic Name	Brand Name	How They Work
BIGUANIDES		
Metformin	Glucophage®	Block the liver from making sugar
SULFONYLUREAS (SECOND-GENERATION)		
Glimepiride	Amaryl®	Raise the amount of insulin in the body
Glipizide	Glucotrol®	
Glyburide	Diabeta®, Glynase PresTab®, Micronase®	
MEGLITINIDES		
Repaglinide	Prandin®	Raise the amount of insulin in the body
Nateglinide	Starlix®	
THIAZOLIDINEDIONES		
Pioglitazone	Actos®	Help the body use insulin better
Rosiglitazone	Avandia®	
ALPHA-GLUCOSIDASE INHIBITORS		
Acarbose	Precose®	Slow the digestion of sugar
Miglitol	Glyset®	

Learning About Blood Sugar

How is blood sugar tested?

There are two common tests for blood sugar. They can help you and your doctor check how well your blood sugar is under control.

Finger stick

One test is a finger stick that you can do at home. This test is done one or more times a day. It can be done first thing in the morning before you eat (fasting) or at other times of the day. Your doctor or nurse will use this information when you go for a checkup. This test tells what your blood sugar level is at that moment in time. The target is usually 100 to 120.

Blood test

The other test is a blood test called hemoglobin A1c (HEE-muh-glo-bin AY-one-see). It is often called just A1c. This test is done at your doctor's office or a lab a few times a year. The A1c shows the average blood sugar level over the past 2 to 3 months. It tells how well blood sugar is managed. Usually the goal is for your A1c to be below 7. This means that your finger-stick blood sugars have been in good range over the past 2 to 3 months.

How well can pills lower your blood sugar?

All the pills in this guide lower blood sugar. The lab test for blood sugar level (hemoglobin A1c or just A1c) is the best way to tell how well the pills work. Most of the diabetes pills can lower your A1c by about 1 point. This means that if you start with an A1c of 8, taking one of these pills could bring it down to 7.

Combining two or more kinds of diabetes pills can lower blood sugar more than taking just one kind. Most combinations of pills can bring it down about 1 extra point. This means if you start with an A1c of 9 and can bring it down to 8 with one kind of pill, you might be able to lower it to about 7 by adding a second pill.



There is not as much research on the newer drugs—acarbose (Precose®), miglitol (Glyset®), and nateglinide (Starlix®). This means that we do not know how they compare with other diabetes pills for lowering blood sugar.

Comparing Diabetes Pills

Some of the diabetes pills have been compared in research studies. Here's what we know.

Weight gain

These pills can make you gain weight:

- glimepiride (Amaryl®)
- glipizide (Glucotrol®)
- glyburide (Diabeta®, Glynase PresTab®, Micronase®)
- pioglitazone (Actos®)
- rosiglitazone (Avandia®)
- repaglinide (Prandin®)

The weight gain is around 2 to 10 pounds.

Metformin (Glucophage®) does not make you gain weight.

We don't know about weight changes with acarbose (Precose®), miglitol (Glyset®), and nateglinide (Starlix®) because there isn't as much research on these three drugs.

Stomach problems

Metformin (Glucophage®) is more likely than other diabetes pills to cause diarrhea, stomach cramps, and gas. Let your doctor or nurse know if you get any of these problems.

Swelling

Pioglitazone (Actos®) and rosiglitazone (Avandia®) are more likely to cause water retention than other diabetes pills. If you get swelling in your face or legs, it might be from water retention. Tell your doctor or nurse.

Cholesterol

There are different kinds of cholesterol. They are often called “bad” and “good.” Low bad cholesterol and high good cholesterol mean a healthier heart and arteries. Talk to your doctor or nurse about ways to reach the right targets for you.

Diabetes pills are mainly for lowering blood sugar. But research shows a few can affect cholesterol.

Bad cholesterol (LDL)

Everyone should try to keep bad cholesterol (LDL cholesterol) as low as possible. Bad cholesterol can clog your arteries. This makes it harder for the blood to flow. Clogged arteries can cause heart attacks and stroke. People with diabetes can have more problems, like heart attacks, when their bad cholesterol is high.

Metformin (Glucophage®) can lower bad cholesterol about 10 points compared with:

- glimepiride (Amaryl®)
- glipizide (Glucotrol®)
- glyburide (Diabeta®, Glynase PresTab®, Micronase®)

This means that if your bad cholesterol is 120, metformin might lower it to 110.

Rosiglitazone (Avandia®) and pioglitazone (Actos®) can raise bad cholesterol. Rosiglitazone (Avandia®) raises bad cholesterol by 10 points more than pioglitazone (Actos®).

Good cholesterol (HDL)

Good cholesterol (HDL cholesterol) helps remove extra cholesterol from the body. When your good cholesterol is higher, your chance of heart disease is lower.

Most diabetes pills do not raise or lower good cholesterol enough to affect your health.

Watching for Possible Problems

What is low blood sugar?

When blood sugar is too low it's called hypoglycemia (high-po-gly-SEE-mee-ah). It can cause you to feel dizzy, clammy, confused, shaky, and weak.

- All diabetes pills can cause blood sugar to drop too low.
- Glipizide (Glucotrol®), glimepiride (Amaryl®), glyburide (Diabeta®, Glynase PresTab®, Micronase®), and repaglinide (Prandin®) are more likely to cause very low blood sugar.
- Low blood sugar is more likely when you take two or more kinds of diabetes pills.

WARNING: If you think you may have low blood sugar, eat or drink something with sugar in it right away. Your doctor or nurse may suggest something like hard candy, juice, or glucose tablets.

What is lactic acidosis?

Taking diabetes pills can raise the chance of a rare condition called lactic acidosis (lak-tik a-suh-DOE-sis). This condition is more likely for people taking diabetes pills who also have kidney or liver problems. Each year, about 1 out of 10,000 people taking any diabetes pill will have lactic acidosis. Common signs of lactic acidosis are:

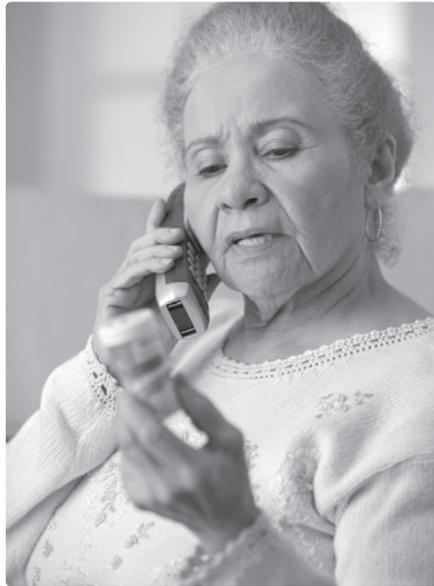
- Trouble breathing.
- Vomiting or stomach pain.
- Weakness or unusual muscle pain.
- Chills or feeling light-headed.

WARNING: If you have any of the signs of lactic acidosis, you should call your doctor or nurse right away.

What about heart problems?

Congestive heart failure, or heart failure, is when the heart can't pump enough blood to the rest of the body. Pioglitazone (Actos®) and rosiglitazone (Avandia®) can make congestive heart failure worse. Call your doctor or nurse if you suddenly gain weight, get swelling in your face or legs, or have shortness of breath. These can be signs of heart failure.

The possible risk of heart attack with rosiglitazone (Avandia®) has been in the news. Research can't tell us yet if rosiglitazone (Avandia®) increases the risk of heart attack compared with all the other diabetes pills in this guide.



Thinking About Diabetes Pills

All the diabetes pills lower blood sugar. Talk to your doctor or nurse about which pills would work best for you. Here are a few things to think about now and some that might come up later.

Does it matter when or how often you take the medicine?

Some diabetes medicines are taken once a day. Others need to be taken more often or with meals. The chart on pages 12 and 13 lists the pills and how often they need to be taken. No matter which medicine you use, be sure to follow the directions on the bottle.

Is cost important to you?

Use the chart on pages 12 and 13 to compare the prices of different drugs. Some of the drugs are available as generics, which cost less. If prescriptions are part of your health insurance plan, check with your plan about the cost to you.

Are you worried about weight gain?

Metformin (Glucophage®) does not cause weight gain. You may want to ask your doctor or nurse if metformin (Glucophage®) would be a good choice for you.

Is your blood sugar still too high even though you are taking a diabetes pill?

Combining two or more kinds of diabetes pills can bring your sugar down more than if you are taking just one pill. Ask your doctor or nurse if adding another diabetes medicine would help.

Does metformin (Glucophage®) give you diarrhea or gas?

Talk with your doctor or pharmacist. There may be a solution.

Combining metformin (Glucophage®) with another diabetes pill may help. People have fewer stomach problems when they take a lower dose of metformin (Glucophage®) in combination with another diabetes pill.

Where Can I Get More Information?

For an electronic copy of this guide and materials about choosing treatments and medicines for other conditions, visit this Web site:
www.effectivehealthcare.ahrq.gov

For a free print copy call:

The AHRQ Publications Clearinghouse, (800) 358-9295

Ask for AHRQ Publication Number 07(08)-EHC010-2A

For more information about diabetes, visit the Medline Plus
Web site: **www.nlm.nih.gov/medlineplus/diabetes.html**



Dose and Price of Diabetes Pills

Generic Name ¹	Brand Name	Dose ²	Price for 1-Month Supply ³	
			Generic	Brand
BIGUANIDES				
Metformin	Glucophage®	500 mg once a day	\$20	\$30
		500 mg twice a day	\$40	\$60
		850 mg twice a day	\$70	\$95
		1000 mg twice a day	\$85	\$120
	Glucophage XR®	1000 mg once a day	\$45	\$60
		2000 mg once a day	\$90	\$115
SECOND-GENERATION SULFONYLUREAS				
Glimepiride	Amaryl®	1 mg once a day	\$10	\$15
		2 mg once a day	\$20	\$25
		4 mg once a day	\$35	\$45
		8 mg once a day	\$75	\$85
Glipizide	Glucotrol®	5 mg once a day	\$10	\$15
		10 mg once a day	\$20	\$30
		10 mg twice a day	\$40	\$60
		20 mg twice a day	\$75	\$125
	Glucotrol XL®	5 mg once a day	\$10	\$15
		20 mg once a day	\$50	\$65
Glyburide	Diabeta®, Micronase®	2.5 mg twice a day	\$30	\$35
		5 mg once a day	\$25	\$30
		5 mg twice a day	\$45	\$65
	Glynase PresTab®	1.5 mg once a day	\$10	\$20
		3 mg once a day	\$20	\$35
		6 mg twice a day	\$60	\$115
THIAZOLIDINEDIONES				
Pioglitazone	Actos®	15 mg once a day	NA	\$115
		30 mg once a day		\$190
		45 mg once a day		\$205
Rosiglitazone	Avandia®	2 mg twice a day	NA	\$145
		4 mg once a day		\$110
		8 mg once a day		\$200

Generic Name ¹	Brand Name	Dose ²	Price for 1-Month Supply ³	
			Generic	Brand
MEGLITINIDES (taken before meals)				
Repaglinide	Prandin®	0.5 mg three times a day	NA	\$130
		1 mg three times a day		\$130
		4 mg three times a day		\$265
Nateglinide	Starlix®	60 mg three times a day	NA	\$130
		120 mg three times a day		\$135
ALPHA-GLUCOSIDASE INHIBITORS (taken with meals)				
Acarbose	Precose®	25 mg three times a day	NA	\$80
		50 mg three times a day		\$85
		100 mg three times a day		\$105
Miglitol	Glyset®	25 mg three times a day	NA	\$75
		50 mg three times a day		\$85
		100 mg three times a day		\$95
COMBINATION PILLS				
Glyburide/ metformin	Glucovance®	2.5 mg/500 mg twice a day	\$65	\$75
		5 mg/500 mg twice a day	\$65	\$75
Glimepiride/ rosiglitazone	Avandaryl®	2 mg/4 mg once a day	NA	\$120
		4 mg/4 mg once a day	NA	\$120
Metformin/ rosiglitazone	Avandamet®	500 mg/4 mg twice a day	NA	\$220
		1000 mg/2 mg twice a day	NA	\$130
Metformin/ pioglitazone	Actoplus Met®	500 mg/15 mg twice a day	NA	\$180
		850 mg/15 mg twice a day	NA	\$180

¹These drugs were included in the research studies.

²Doses are similar to those used in the research studies.

³Average Wholesale Price from *Drug Topics Red Book*, 2007.

XR/XL = extended release.

NA = not available as generic.

What Is the Source of This Guide?

The information in this guide comes from a detailed review of 216 research reports. The review is called *Comparative Effectiveness and Safety of Oral Diabetes Medications for Adults With Type 2 Diabetes* (2007) and was written by the Johns Hopkins Evidence-based Practice Center.

The Agency for Healthcare Research and Quality (AHRQ) created the Eisenberg Center at Oregon Health & Science University to make research helpful for consumers. This guide was prepared by Sandra Robinson, M.S.P.H., Bruin Ruge, M.D., Martha Schechtel, R.N., Valerie King, M.D., Theresa Bianco, Pharm.D., and David Hickam, M.D., of the Eisenberg Center. People with type 2 diabetes helped them write this guide.