

# Premixed Insulin for Type 2 Diabetes

A GUIDE FOR ADULTS



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# Fast Facts ON PREMIXED INSULIN

- ▶ When people have type 2 diabetes, their body either does not make enough insulin or does not use insulin as well as it should. Many people with type 2 diabetes need to take insulin shots.
- ▶ Premixed insulin combines two kinds of insulin. The first kind helps the body control blood sugar (blood glucose) all through the day. The second kind helps the body control blood sugar at meal times.
- ▶ There are different types of premixed insulin.
- ▶ The different types of premixed insulin work equally well to lower your A1c. The A1c is a blood test that shows your average blood sugar over the past 2 to 3 months.
- ▶ The chance of your blood sugar dropping too low is the same with the different types of premixed insulin.

## What Does This Guide Cover?

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The information in this guide comes from a government-funded review of research about premixed insulin. This guide compares the benefits, side effects, and costs of a newer type of premixed insulin with other kinds of insulin and pills for diabetes.

Has your doctor or nurse told you that you need insulin for your type 2 diabetes? There are many kinds of insulin and many different ways to take insulin. This guide can help you learn about them. It can help you talk with your doctor or nurse about whether premixed insulin may be a good choice.

## What Is Not Covered in This Guide?

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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 using insulin in pumps or non-insulin shots like exenatide (Byetta<sup>®</sup>) or pramlintide (Symlin<sup>®</sup>). It does not cover the use of insulin by children, pregnant women, or people with type 1 diabetes.

If your doctor has recommended pills for your type 2 diabetes, the Agency for Healthcare Research and Quality (AHRQ) has published another guide that will be useful for you. That guide is called *Pills for Type 2 Diabetes: A Guide for Adults* and is available at the Web site: [www.effectivehealthcare.ahrq.gov](http://www.effectivehealthcare.ahrq.gov)



# Type 2 Diabetes and Insulin

Insulin is a hormone. It is made by an organ near the stomach called the pancreas (PAN-kree-us). Insulin helps the body use sugar from the blood for energy.

With type 2 diabetes, either the pancreas does not make enough insulin or the body does not use insulin as well as it should. Sugar builds up in the blood because the body cannot use it without the help of insulin. This causes blood sugar to stay high. Type 2 diabetes often runs in families.

## Why treat diabetes?

If blood sugar stays high for a long time, people may have a higher chance of heart attacks, strokes, and amputations. They may also have a higher chance of blindness, nerve damage, and kidney damage. Keeping your blood sugar at a good level may 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 be more active. Even small changes can make a big difference. Most people with type 2 diabetes also use pills to control their blood sugar.



Over time, many people need insulin to treat their diabetes. About 3 out of every 10 people with type 2 diabetes take insulin.

# 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 (or forearm) stick that you can do at home. This test is done one or more times a day. You can do it first thing in the morning before you eat (fasting) or at other times of the day, like after a meal. This test tells what your blood sugar level is at that moment in time. The fasting target is usually 80 to 120. After a meal, the target is usually less than 180.

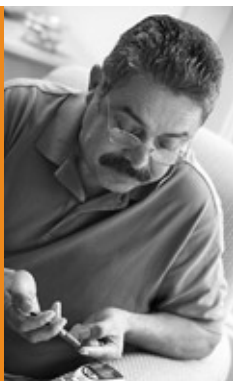
### *Blood test*

The other test is a blood test called A1c (AY-one-see). 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. Usually the goal is for your A1c to be below 7.

## Watch for blood sugar that drops too low

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

**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.



# Learning About Insulin

Insulin helps the body use sugar from the blood for energy. There is always some sugar in the blood. This means the pancreas needs to make small amounts of insulin all through the day. When you eat, your blood sugar goes up. This means the pancreas needs to make extra insulin during meals. When you are more active, your body uses more sugar and needs less insulin.


When you have diabetes, blood sugar stays high. Taking insulin shots is one way to treat it. All insulin used to treat diabetes is made in a lab.

*There are many different kinds of insulin. The kind you may need depends on your activity, eating habits, and how your body responds to insulin. Your doctor or nurse will work with you to match your needs with the kind of insulin that might work well for you.*




# Insulin That Lasts All Through the Day

There are two kinds of insulin that control blood sugar all through the day. They are intermediate-acting and long-acting insulin. Both kinds give a constant, low level of insulin all through the day. Usually this means one or two shots a day.

Insulin that lasts all through the day		
	<i>Generic Name</i>	<i>Brand Name</i>
	<b>Intermediate-acting insulin</b>	
	NPH	Humulin® N Novolin® N
	<b>Long-acting insulin</b>	
	Insulin detemir Insulin glargine	Levemir® Lantus®

# Insulin for Meal Times

After time, one kind of insulin may not be enough to control blood sugar. Your doctor or nurse may add insulin that is used at meal times. There are two kinds of insulin that control blood sugar at meal times. They are fast-acting and short-acting insulin. These kinds of insulin work quickly and last for a short period of time. They cover the high blood sugar from eating a meal. This can mean taking two or more shots a day.

Insulin for meal times		
	<i>Generic Name</i>	<i>Brand Name</i>
	<b>Short-acting insulin</b>	
	Regular	Humulin® R Novolin® R
	<b>Fast-acting insulin</b>	
	Insulin aspart Insulin glulisine Insulin lispro	NovoLog® Apidra® Humalog®

# Premixed Insulin for All Day and Meals

Some people with diabetes need both kinds of insulin. They need insulin that lasts all through the day and insulin for meal times. Premixed insulin combines both kinds of coverage. It gives you quick coverage for a meal plus longer coverage for other times of the day. If you take premixed insulin, you may need fewer shots each day.

There are different types of premixed insulin.

- ▶ **Premixed NPH/regular insulin** is made by combining NPH and regular insulin.
- ▶ **Newer premixed insulin** is the other type of premixed insulin. It is made by combining insulin aspart (NovoLog®) or insulin lispro (Humalog®) with a longer lasting insulin made only for the mix.

## Insulin that covers both (all through the day and meal times)



<i>Generic Name</i>	<i>Brand Name</i>
<b>Premixed NPH/regular insulin</b>	
NPH/regular 70/30	Humulin® 70/30 Novolin® 70/30
NPH/regular 50/50	Humulin® 50/50
<b>Newer premixed insulin</b>	
Insulin aspart 70/30	NovoLog® Mix 70/30
Insulin lispro 75/25	Humalog® Mix75/25
Insulin lispro 50/50	Humalog® Mix50/50

The numbers used to name the premixed insulin tell you the percent of each kind of insulin in the mixture. The amount of longer lasting insulin is written first. For example, a 70/30 mix means 70 percent of the mix is a longer lasting insulin and 30 percent is quick coverage for a meal.

## Comparing Medicines

Research studies have compared newer premixed insulin with other diabetes medicines. This research can help you and your doctor decide whether newer premixed insulin might be a good choice for you. In these charts, a ✓ means research shows the medicine **works better** than the medicine it is compared with.

### Comparing newer premixed insulin and pills for diabetes

Newer premixed insulin can lower blood sugar more than pills for diabetes. Newer premixed insulin is more likely to cause very low blood sugar. It can also cause more weight gain than diabetes pills.

	Pills for diabetes	Newer premixed insulin
<b>Benefits</b>		
<b>Better</b> at lowering A1c.		✓
<b>Better</b> at lowering fasting blood sugar (before eating).		✓
<b>Better</b> at lowering blood sugar after meals.		✓
<b>Side Effects</b>		
<b>Less</b> hypoglycemia (very low blood sugar).	✓	
<b>Less</b> weight gain.	✓	

## Comparing newer premixed insulin and long-acting insulin

Newer premixed insulin can lower A1c and blood sugar after meals more than long-acting insulin. But long-acting insulin is better at lowering blood sugar before eating. Newer premixed insulin is more likely to cause very low blood sugar. It can also cause more weight gain than long-acting insulin.

	Long-acting insulin	Newer premixed insulin
<b>Benefits</b>		
<b>Better</b> at lowering A1c.		✓
<b>Better</b> at lowering fasting blood sugar (before eating).	✓	
<b>Better</b> at lowering blood sugar after meals.		✓
<b>Side Effects</b>		
<b>Less</b> hypoglycemia (very low blood sugar).	✓	
<b>Less</b> weight gain.	✓	

## Comparing newer premixed insulin and premixed NPH/regular insulin

The different types of premixed insulin work about the same. Newer premixed insulin is better at lowering blood sugar after meals.

	Premixed NPH/regular insulin	Newer premixed insulin
<b>Benefits</b>		
<b>Better</b> at lowering A1c.	Work the same.	
<b>Better</b> at lowering fasting blood sugar (before eating).	Work the same.	
<b>Better</b> at lowering blood sugar after meals.		✓
<b>Side Effects</b>		
<b>Less</b> hypoglycemia (very low blood sugar).	Work the same.	
<b>Less</b> weight gain.	Work the same.	

## Questions To Ask Your Doctor

All kinds of insulin help the body control blood sugar. Talk to your doctor or nurse about which kind of insulin will work best for you. Here are a few things to ask about.

### How often do I need to take insulin?

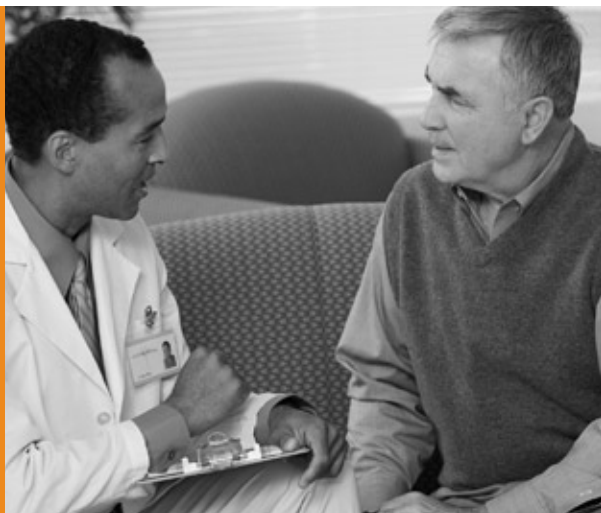
Some kinds of insulin are taken only once a day. Others need to be taken more often or with meals. You may need fewer injections if you can use premixed insulin. Ask your doctor or nurse how often you need to take your insulin.

No matter which insulin you use, be sure to follow the directions included with your medicine.

### Are some kinds of insulin easier to measure and inject?

Some people take insulin for coverage all through the day and insulin at meals. Premixed insulin combines

both kinds in a mix. This mix may make it easier to measure and inject your insulin.



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### Can I use a pen?

To use a syringe, you need to draw up insulin into the syringe. To use a pen, you do not need to draw up insulin. You put a needle on the pen, set the dose with a dial, and give the injection. Most kinds of insulin are available in pens. This option can make it easier to measure and inject insulin. This might be helpful if you have trouble using syringes.

### What about the cost?

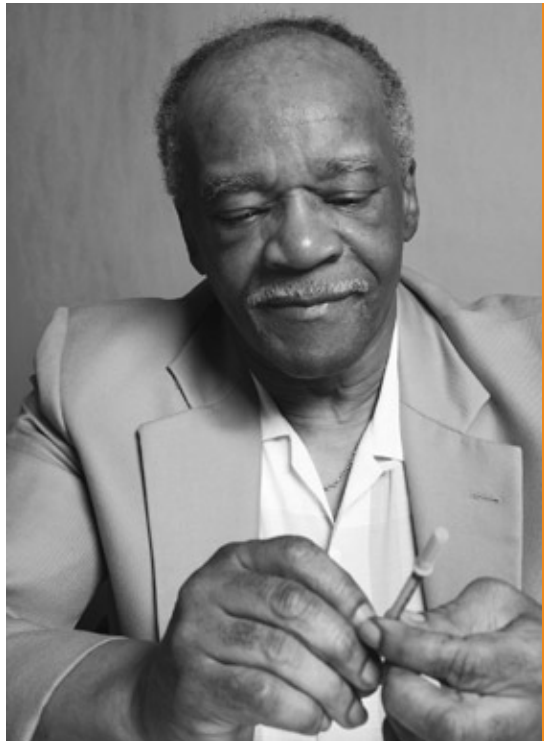
Use the chart on page 12 to compare the prices of different kinds of insulin. If prescriptions are part of your health insurance plan, check with your plan about the cost to you. If you need help paying for insulin, there may be a program for you.

The Partnership for Prescription Assistance can tell you about these programs.

Web site:

**pparx.org**

Phone: 1-888-477-2669



# Price of Insulin

Insulin comes in vials and pens. There are more units of insulin in one package of pens than in one vial.

Generic Name <sup>1</sup>	Brand Name	Price <sup>2</sup>	
		One Vial (1,000 units)	Five-Pack Pens (1,500 units)
<b>COVERS ALL THROUGH THE DAY</b>			
<b>Intermediate-acting insulin</b>			
NPH insulin	Humulin® N	\$45	\$135
	Novolin® N	\$45	\$135
<b>Long-acting insulin</b>			
Insulin detemir	Levemir®	\$95	\$190
Insulin glargine	Lantus®	\$95	\$190
<b>COVERS MEAL TIMES</b>			
<b>Short-acting insulin</b>			
Regular insulin	Humulin® R	\$45	NA
	Novolin® R	\$45	\$135
<b>Fast-acting insulin</b>			
Insulin aspart	NovoLog®	\$105	\$200
Insulin glulisine	Apidra®	\$95	\$180
Insulin lispro	Humalog®	\$105	\$200
<b>COVERS BOTH (all through the day and meal times)</b>			
<b>Premixed NPH/regular insulin</b>			
70% NPH/30% regular insulin	Humulin® 70/30	\$45	\$135
	Novolin® 70/30	\$45	\$135
50% NPH/50% regular insulin	Humulin® 50/50	\$45	NA
<b>Newer premixed insulin</b>			
70% insulin aspart protamine suspension/30% insulin aspart	NovoLog® Mix 70/30	\$105	\$200
75% insulin lispro protamine suspension/25% insulin lispro	Humalog® Mix75/25	\$105	\$200
50% insulin lispro protamine suspension/50% insulin lispro	Humalog® Mix50/50	\$105	\$200

<sup>1</sup> These drugs were included in the research studies.

<sup>2</sup> Average Wholesale Price from *Red Book*, 2008. Price does not include the cost of needles or syringes.

NA = not available in pens.

## For More Information

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For an electronic copy of this guide and materials about comparing treatments and medicines for other conditions, visit this Web site: [www.effectivehealthcare.ahrq.gov](http://www.effectivehealthcare.ahrq.gov)

### For free print copies call:

The AHRQ Publications Clearinghouse  
(800) 358-9295

Ask for AHRQ Publication Number 08(09)-EHC017-A

For more information about diabetes, visit the MedlinePlus Web site: [www.nlm.nih.gov/medlineplus/diabetes.html](http://www.nlm.nih.gov/medlineplus/diabetes.html)

### Source

The information in this guide comes from a detailed review of 45 research reports. The review is called *Comparative Effectiveness, Safety, and Indications of Insulin Analogues in Premixed Formulations for Adults With Type 2 Diabetes* (2008) 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 written by Monica Goei, M.D., Martha Schechtel, R.N., Seth Meyer, M.A., Joe Stewart, B.C.N.S.P., Rachelle Nicolai, B.A., Valerie King, M.D., and David Hickam, M.D., of the Eisenberg Center. People taking insulin for type 2 diabetes helped them develop this guide.

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The photos in this guide are of models and are used for illustrative purposes only.