A GUIDE FOR TEENS

How can a Continuous Glucose Monitor (CGM) Help Me Manage My Diabetes Better?

This guide tells you about Continuous Glucose Monitors (CGM), a way to check your sugars all the time without needing to prick your finger, and how using them can help you manage your diabetes better.

I do not know about the CGM... How can it help me control my diabetes?

Before using a CGM, I would feel like my blood glucose was going low. I would have to do a finger stick to check how low I was. Many times I was much lower than I thought. That can be dangerous. With CGM I can see what is happening right away and prevent lows.

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CGM Companies: Abbott, Dexcom, Metronic, Senseonics

Funding provided by the Leona M. and Harry B. Helmsley Charitable Trust.

Dear Reader

We are a group of adults, children, teens, and parents of children with Type 1 Diabetes. We gave advice on putting this guide together. We also gave advice on other guides you may want to read:

- Is the Insulin Pump Right for Me?
- How Do I Use an Insulin Pump?
- Is the Insulin Pen Right for Me?
- How Can I Manage My Type 1 Diabetes Better?
- Is the Continuous Glucose Monitor Right for Me?
- How Can a Continuous Glucose Monitor Help Me Manage My Diabetes Better?
- How Can a Continuous Glucose Monitor Help and Carb Counting Help Me Manage My Diabetes Better?

Some of us use a continuous glucose monitor (CGM) and some of us do not. Some of us had thought about using CGM. Some had not thought about it until we helped with this guide.

We want to try and help people understand what we have learned from our teachers and from each other. That is why we want to share it with you.

CGMs have been around for many years. Lately, they have become more accurate and easier to use. More people with diabetes use them than ever before. It is a very useful way to check your glucose level. CGMs can also help you manage your diabetes better. Many people like CGM and some do not.

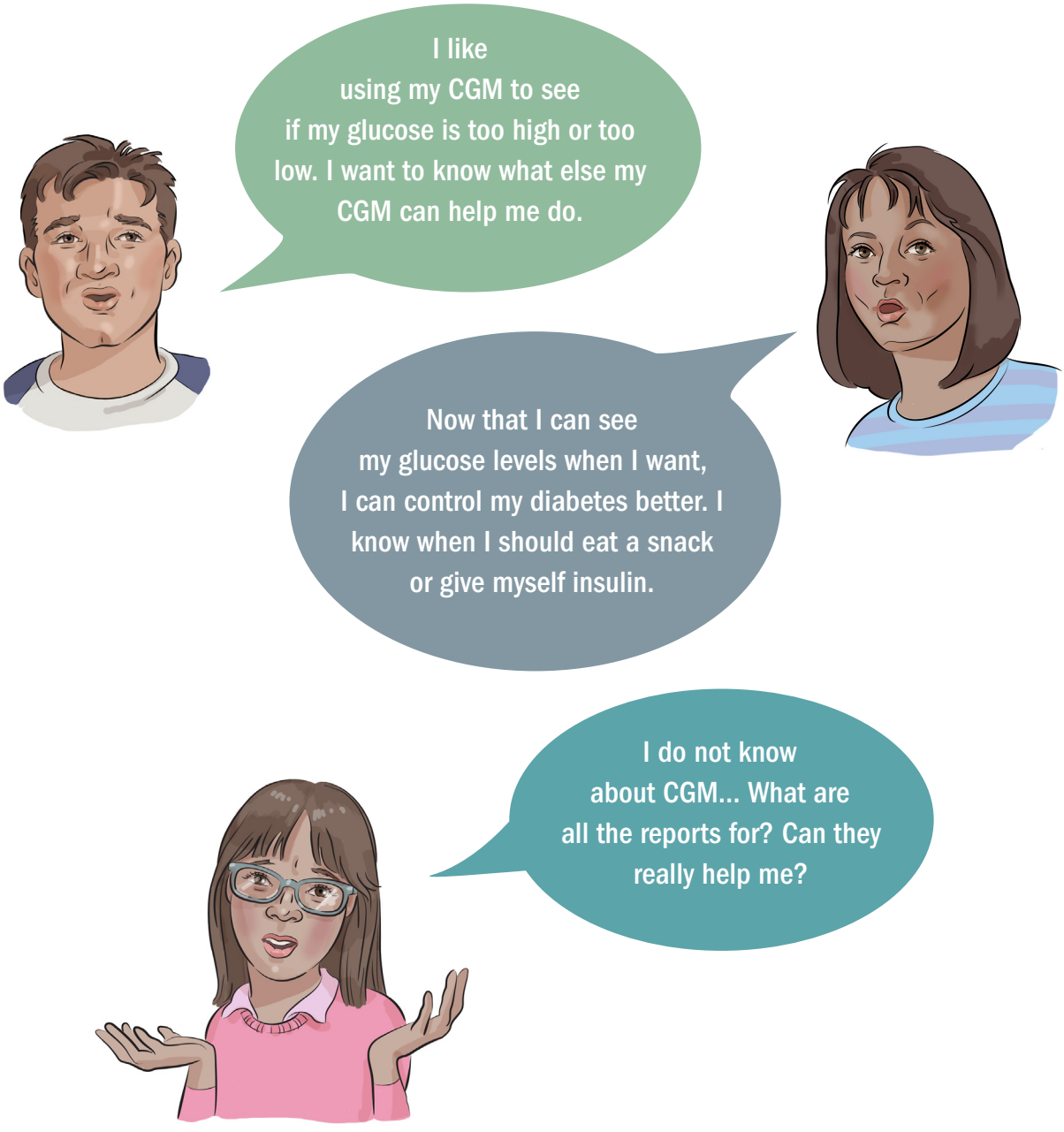
We want to help you figure out how CGM can help you manage your diabetes better.

We also hope that in the future there will be even more ways to help us manage diabetes and one day cure it. In the meantime, we invite you to be curious and explore the CGM.

Let's get started!

HERE IS WHAT VICTORIA HAS TO SAY ABOUT USING A CGM:

"I got my first CGM in 2019 and I love it. It helps me manage my diabetes better. I can see how different food and exercise affect my glucose. It is a tool that gives me information. I can make better decisions on how much insulin to give. I really like that I do not have to do so many finger sticks. I can also share my CGM data with my doctor. The reports I get have helped me. I can see patterns for when my glucose is too high or too low. I like to talk to my doctor about the information in my reports. I feel like I really understand and manage my diabetes better."



Introduction

I am curious to learn more about the CGM.

We are glad you are curious to learn more CGM. It could be right for you to manage your diabetes better.

We want to help you learn about this awesome technology. Using the CGM to manage your diabetes can help improve your glucose control. It can give you more freedom.

Do you have more guides I could read? Yes. You may want to read our other guides:

- Is the Insulin Pump right for Me?
- How Do I Use an Insulin Pump?
- Is the Insulin Pen Right for Me?
- How Can I Manage My Type 1 Diabetes Better?
- Is the Continuous Glucose Monitor Right for Me?
- How Can a Continuous Glucose Monitor Help Me Manage My Diabetes Better?
- How Can a Continuous Glucose Monitor Help and Carb Counting Help Me Manage My Diabetes Better?

I am the one that needs to make choices about how I treat my Type 1 Diabetes.

That is right. This is about your health, your life, and your choice to become the most active member on your diabetes team.

In this guide, we talk about your "team." That is because it often takes many people to help you take care of your diabetes.

The first part of your team is always you. Family members and friends you include in helping you with your diabetes are part of your team. Then you have your doctor. You may also see a diabetes educator, a nurse, nurse practitioner or physician assistant. You may see a dietitian and maybe a social worker or a psychologist. Your pharmacist and eye doctor are part of your team, and anyone else you want to include. These people are part of your diabetes care team. Each can help you take better care of your diabetes.

Thank you for inviting us to join your team!

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SECTION 1 — Continuous Glucose Monitors (CGMs): The Basics

Can you tell me more about glucose level and testing for it?

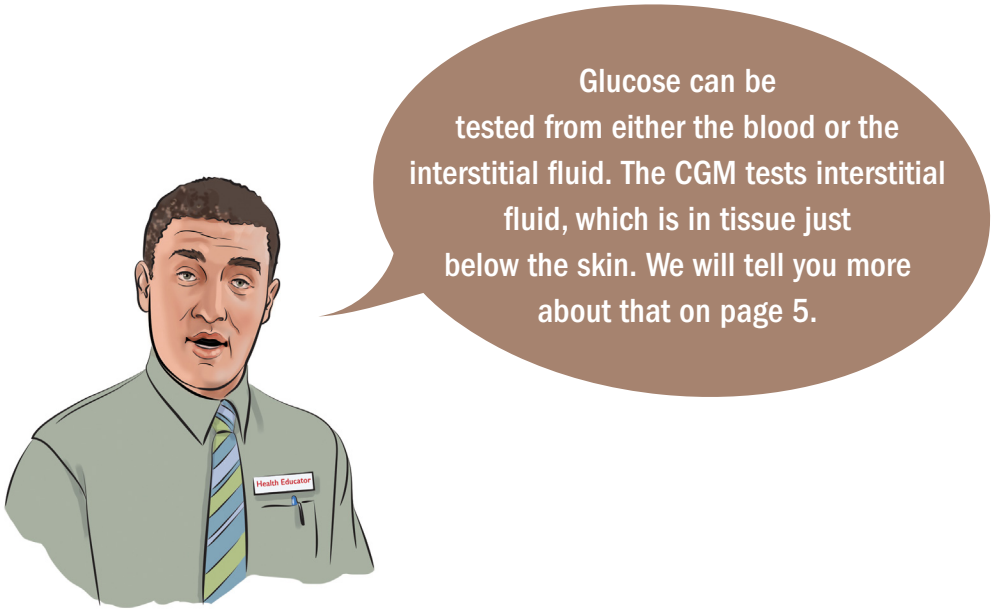
Glucose level means sugar level. In this guide, we call sugar "glucose". People with diabetes have to know what their glucose levels are to help them decide how much insulin to take or how much food to eat.

When someone does not have diabetes, an organ in the body called the pancreas makes insulin for the body. When the person eats it makes more insulin. When the person is not eating, it makes less insulin. The pancreas responds right away to the level of glucose in the blood so it knows how much insulin to make.

When someone has Type 1 Diabetes, the pancreas doesn't make much insulin. So, when someone has Type 1 Diabetes, they need to give insulin with shots or the pump, just like a normal pancreas would do. For a person to know how much insulin to give, they need to know what their glucose level is.

Glucose level means how much glucose is in the blood. In the United States, this level is measured in milligrams per deciliter, or mg/dl. In other countries, it is measured in millimoles, or mmol/l.

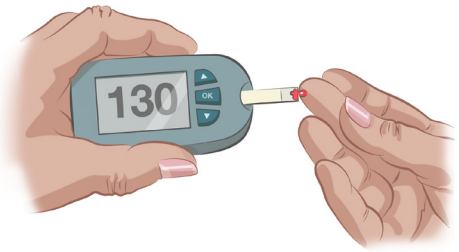
Glucose levels go up and down. The main reason for this has to do with what a person has eaten, or how much insulin is in their body.



A normal range (for someone without diabetes) is about 70 to 100 mg/dl (3.9–5.6 mmol/l) before breakfast and below 140 mg/dl (7.8 mmol/l) after meals. A person with diabetes does not have a normal range because their pancreas does not work. Their body does not make insulin. They must give insulin for the food they eat. If someone has diabetes, they will give more insulin if their glucose levels are high and less if they are low. If a glucose level is too low, a person will eat or drink something to raise their glucose. If a glucose level is too high, a person will give insulin. You must test your glucose level to know how much insulin to give.

What are the ways to test for glucose level? How do they work?

Glucose meter:



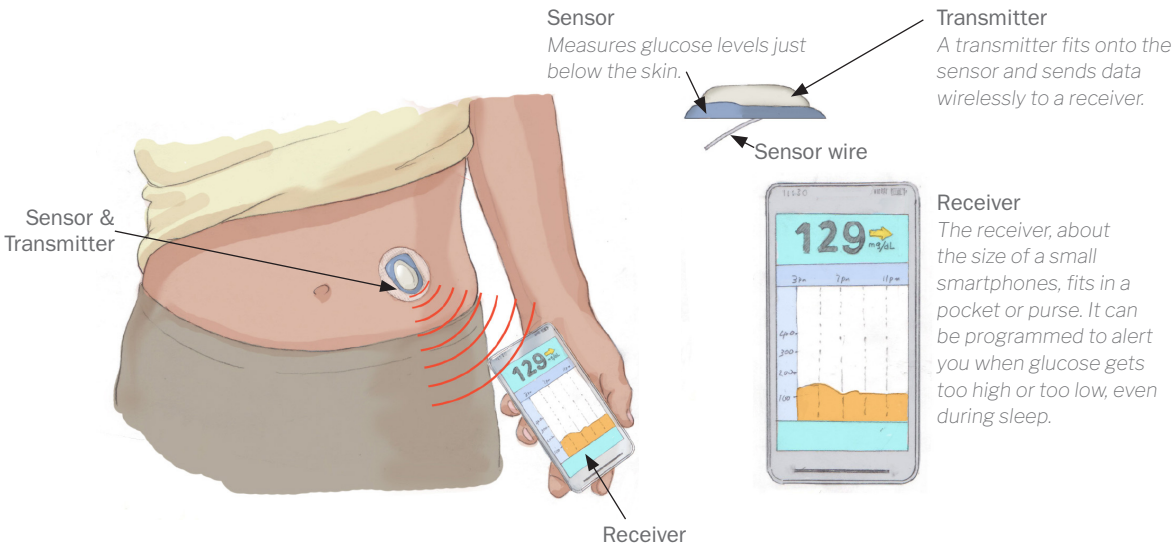
It used to be that the only way to test glucose level was to prick the skin. That is, squeezing some blood out from the finger tip onto a test strip. Then seeing the level on the glucose meter.

The glucose meter gives information on what the glucose level is at that moment the blood is tested. It does not say whether the glucose is going up, going down or staying the same. The glucose meter does not have alarms to alert someone to a level that is too low or too high.

Continuous Glucose Monitor (CGM):

A CGM is a very different way of testing the glucose level. A person puts it on a different part of their body every 6 to 14 days. After 10 to 14 days, a person throws out the one they have been wearing and then puts a new one on their body. There is also one type of CGM that can stay in the body up to 6 months.

The CGM checks the glucose is checked every few minutes. A person can now see their glucose level on a receiver or their smartphone without pricking their finger. And the CGM tells the person if their glucose level is going up, going down or staying the same. A CGM is a much easier way to check glucose levels and it gives a lot more information!



How many CGM types are there?

Some CGMs have three pieces. Others have two pieces. Most CGMs have a short lasting sensor. One has a long lasting sensor. A sensor is the part of a CGM that is under the skin and measures glucose.

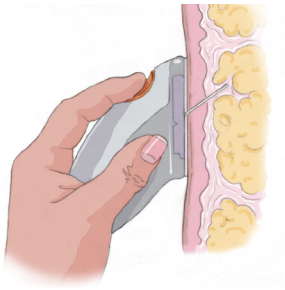
CGM systems change and grow over time. Newer models are coming out all the time. Many become easier to use and wear. Others add new features.

Is there anything that would make me *not* be able to use a CGM?

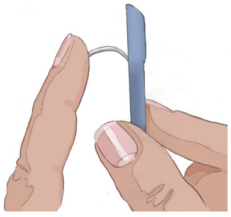
Yes. If you have a severe tape allergy, you most likely will not be able to use a CGM. This is because you need tape to keep parts of the CGM in place.

Can you tell me about the CGM with three pieces and a *short lasting* sensor? And what do the pieces do?

Three piece CGMs have a **sensor**, **transmitter** and **receiver**.

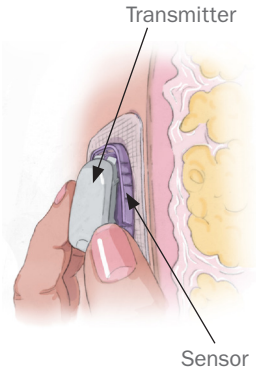


The Sensor goes on the belly or arm, in most cases. It depends on the type of CGM. The sensor comes pre-loaded into a device that injects it under the skin. The device that puts the sensor under the skin is called an inserter. Once under the skin, the inserter is thrown away. The sensor stays in place for 10 to 14 days.



The sensor has a thin wire about a half an inch long that goes under the skin. The wire is attached to and covered by a plastic part. The plastic part of the sensor has tape on the bottom of it so that it sticks to the skin. This sensor part of the CGM is flat and about the size of an adult thumb print. Most CGM, sensors need to be replaced every 6 to 14days.

The sensor tests the glucose level every few minutes. It then changes the information into an electrical signal. This signal goes to the transmitter.



The Transmitter is a small device that fits over the sensor. You attach it to the sensor. When you need to change the sensor, you take off the transmitter. You will be able to reuse the transmitter by placing it on a new sensor. So, do not throw it away!

The transmitter gets the signal from the sensor. It then sends the information to a receiver or a smartphone.

The sensor and transmitter are often taped down together to hold them in place.

The Receiver is the part that gets the signal from the sensor and transmitter so you can see your glucose levels. The receiver that comes with the CGM is about the size of a small smartphone.

There are options for how to get your glucose information. You can choose to use the receiver that comes with the CGM, or you can use your own smartphone. Some people use both the CGM receiver and their smartphone.

Some CGMs can send information some pump receivers. If you use an insulin pump, you can look at the pump receiver to check glucose levels.

You can see many helpful things on the receiver or smartphone screen. The most important thing is that you are able to see your glucose level as a number. You can also see arrows that show if your glucose is going up, going down or staying steady. You can send your glucose levels to the smartphone of a family member or friend if you want to.

If you use a smartphone, you will have to download an app to see your glucose reading. We will talk more about what else you can see on the screen on page 7.

The receiver needs to be close by to receive a transmission. Some devices have a range of 20 feet. Others must be much closer — about 6 feet. You also have to make sure there is not anything between you and the receiver that will block the signal. For instance, it cannot be blocked a wall.

Can you tell me about the CGM with three pieces and a *long lasting* sensor? And what the pieces do?

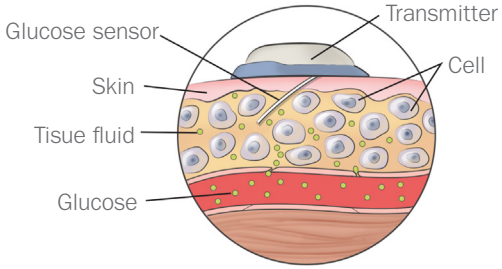
The main difference between systems with a *short lasting* sensor and a *long lasting* sensor is how you place the sensor on the body. The long lasting sensor requires a small surgery to put a sensor under the skin. The sensor stays in place for up to 90 days. There is a transmitter that you have to place on top of the skin. Then the signal is sent to a smartphone.

Can you tell me about the CGM with two pieces?

Some systems have only two pieces. This is because the sensor and transmitter are one single piece. So, you do not have to attach the transmitter to the sensor. When you throw out the sensor, you get rid of the transmitter at the same time. You replace the combo sensor and transmitter every 10 to 14 days, depending on the brand. The sensor and transmitter unit send glucose information to a receiver or smartphone. The receiver for a two piece CGM is called a reader. At the moment, the two piece CGM does not have a way to send information to a pump receiver.

How does a CGM check my glucose?

The sensor sits under the skin. It reads the glucose level in something called the "interstitial fluid". Interstitial fluid surrounds all the cells in the body. Interstitial fluid can also be called glucose fluid.



Will the CGM glucose number be the same as the number I get with a finger stick and glucometer?

The CGM and finger stick readings will not always be the same. The glucose reading from the CGM or finger stick shows you a number just from that moment in time. Glucose moves from the blood vessel into the tissue just below your skin. It takes 5 to 10 minutes for the glucose to move from the blood vessel to the tissue just below the skin. So, the CGM reading is showing what your glucose was 5 to 10 minutes ago.

The difference between the CGM and the finger stick is greater when your glucose is changing quickly. Glucose levels will change quickly right after you eat or give yourself insulin.

If you choose to use a CGM, you can learn how to use the feature that shows if your glucose is going up or down and how fast the glucose is changing. A finger stick reading does not give you all this information.

If I use the CGM, do I still need to check my glucose with a glucose meter?

It depends. Each CGM brand has different rules about checking blood glucose. Some devices require you to do finger sticks once or twice a day to calibrate the CGM. Calibrate means to enter your blood glucose number to help the CGM be more accurate. Others do not require any routine finger sticks. If you have a device that requires a blood glucose check, it will ask you to do it!

But all CGM brands suggest that you carry a glucose meter with you so you can test your fingerstick glucose level if for some reason the CGM number seems off. Also, sometimes the CGM stops working without warning. So it is always good to have a back up meter for glucose testing.

Are all CGMs the same?

No. Different companies make different CGMs. Right now in the United States, 4 companies have CGMs that are approved by the Federal Drug Administration (FDA). Newer and better CGMs are likely to be FDA approved in the future.

Each company makes a device with common parts. But each CGM has different features. Some examples of features are:

- How long a sensor lasts before it has to be changed
- If you have to do a finger stick to calibrate the CGM
- If it is approved for children to wear
- If it has alarms to tell you if your glucose is too high or too low

Here is a list of the CGMs approved in the United States:

COMPANY	CGM NAME	TYPE	APPROVED AGE
Abbott	Freestyle Libre Freestyle Libre 2	2 piece	18 and up 4 years and up
Dexcom	Dexcom G-5 and G6	3 piece	2 years and up
Medtronic	Guardian Connect	3 piece	14 to 75 years old
Sensionics	Eversense	2 piece	18 and up

COMPANY	CGM NAME	ALARMS	CALIBRATE	SHARE WITH OTHERS
Abbott	Freestyle Libre Freestyle Libre 2	Yes Yes	No No	Yes Yes
Dexcom	Dexcom G-5 Dexcom G6	Yes Yes	Yes No	Yes Yes
Medtronic	Guardian Connect	Yes	Yes	Yes
Sensionics	Eversense	Yes	Yes	Yes

What do CGMs look like?

Here are some photos of CGM systems:

FREESTYLE LIBRE DEXCOM G-6 GUARDIAN CONNECT EVERSENSE

CGMs have different features. For more information on the features, see our guide "Is Continuous glucose Monitoring right for Me?"

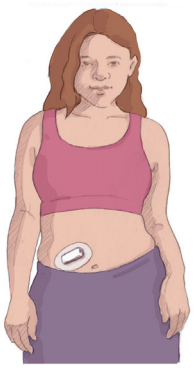
How often do I wear the CGM?

All the time. The CGM sensor and transmitter are attached to your body at all times, even when you are sleeping.

You live your life and do all your activities wearing your CGM.

You keep it on all the time.
This includes:

- When you exercise
- When you take a shower
- When you go swimming
- When you wear a fancy outfit
- When you have sex



Where on my body do I wear the CGM?

Each CGM system has information on where to place the sensor on the body. The approved sites are the best. But people do find other spots that work well for them. People wear them in many places. This includes on the arms, abdomen or lower back and upper buttocks. You need to check your CGM manual to be sure of what the best places are to wear your sensor.

Most common places people attach the sensor is to the abdomen or back of the arm. This is because it is easy to reach the fatty tissue. People attach it above or below the beltline and waistline. It is best to avoid areas where the skin is puffy from putting sensors in the same place a number of times. You will learn where on your own body a sensor is best.

What does "site rotation" mean?

Site rotation means changing the place you put the sensor each time. This is so you do not put it in the same place every time. This is done to keep the skin and part under the skin healthy. If sensor place is not changed, lumps or hard areas can start to form under the skin. A sensor then can't work as well. Check your CGM manual for the best places on your body to put the sensor.

How often should I rotate to a different site?

Your diabetes team will tell you how often to move the sensor from one place to another. Most people need to replace and move, or rotate, the *short term* sensor every 6 to 14 days. There is one *long term* sensor that lasts 90 days.

Sometimes the diabetes team may tell you to rotate the sight more often. They mostly do this if there is any sign the sensor site is not working right. If the sensor falls off before the time to wear it is up, you will need to call the company who makes the sensor to ask for another one.

How do I insert the CGM sensor?

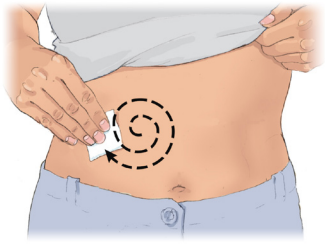
You will learn how to put in the CGM sensors by yourself. This is the case unless you are using the Eversense CGM. Each CGM is a bit different. So you will have to follow your CGM brand instructions. There are videos available at the CGM company websites you can watch.

In general, sensors come with an insertion device that allows you to easily place the sensor. You will have to prepare to insert sensor first.

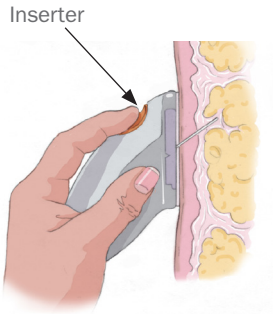
1. Check the sensor to make sure it has not expired.
2. Wash your hands.
3. Follow the instructions on package as to how to peal any covering. There is often a paper cover over the sticky part of the sensor tape. The sticky part will go on the skin.

Here are the basic steps to insert a sensor with 3 piece CGMs:

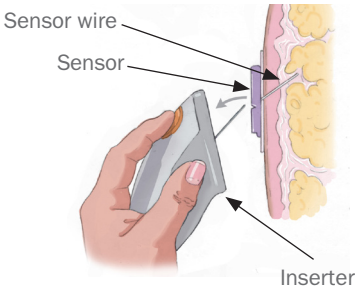
1. Clean your skin.



2. Place the inserter on the skin where you want the sensor to go.
   - **a.** Make sure it is about 3 inches from pumps sites
   - **b.** Avoid boney areas like your ribs
   - **c.** Do not use the same site two times in a row

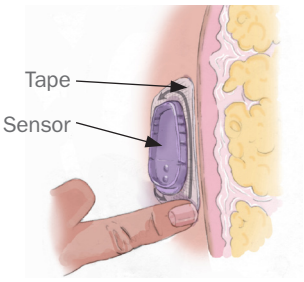


3. Push the button. It will make a popping sound. That lets you know the sensor is being inserted.

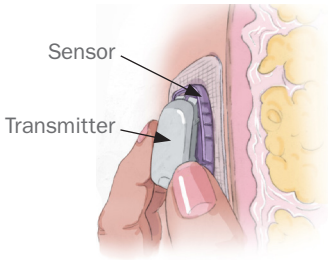


4. Remove the inserter. The sensor will be in place.

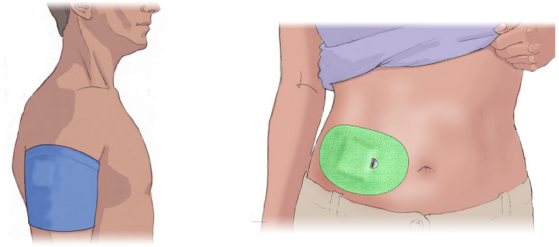
5. Press down on the tape around the sensor to make sure it is well stuck to your skin.



6. Attach the transmitter. Again, each CGM is a bit different. But in most cases you will put it on top of the sensor, press down and snap it in place.



7. Some people use what is called over-tape. This is tape that you place over the sensor and transmitter to keep them in place.



8. Now you are ready to set up the receiver.

Here are the basic steps insert a sensor for 2 piece CGMs:

CGMs with two pieces have the sensor and transmitter together as one piece:

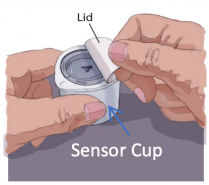
1. Check the single sensor and transmitter to make sure it has not expired.

2. Wash your hands

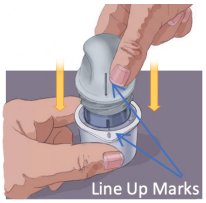
3. Prepare the inserter

a. Follow the instructions on package as to how to place the sensor into the inserter. Open the sensor and inserter package. The next steps usually involve:

i. Peal the lid off the sensor cup

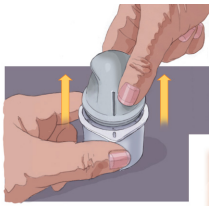


ii. Line up the sensor and inserter mark

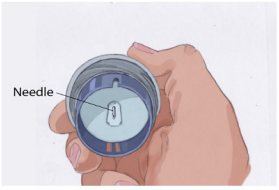


iii. Press down and twisting until you hear a click

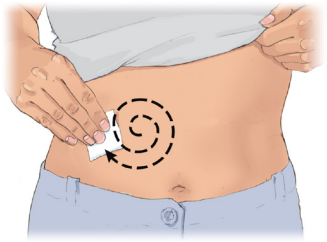
iv. Lift the inserter out of the sensor cup.



v. The sensor is ready to be put on.



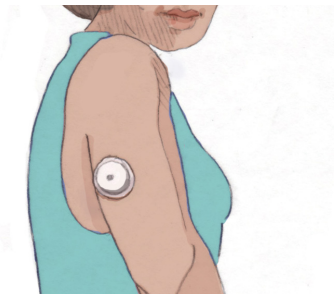
4. Clean your skin.



5. Place the inserter on the skin where you want the sensor to go.

6. Push the button. It will make a popping sound. That lets you know the single sensor and transmitter is being inserted.

7. Remove the inserter. The sensor will be in place.



8. Press down on the tape around the sensor to make sure it is well stuck to your skin.

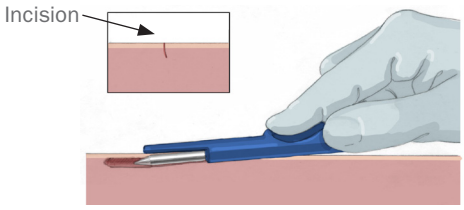
9. Some people use what is called over-tape. This is tape that will be placed over the single sensor and transmitter to keep it in place.

10. Now you are ready to set up the receiver.

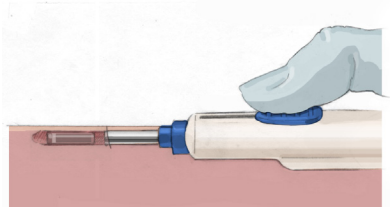
What are the steps for inserting a *long term* CGM?

The Eversense CGM device is the long term one. A trained doctor in a clinic inserts it. It is considered a minor surgery. Once it is inserted, you will set up your receiver. Your doctor will have to remove or replace the sensor after 90 days.

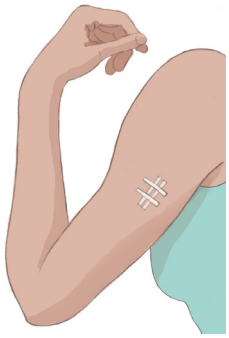
1. The doctor makes incision, or small cut.



2. The doctor creates space under the skin and inserts the sensor.



3. The doctor closes the incision.



How do I set up the receiver or smartphone?

Your CGM system will most likely come with its own receiver. But you may also choose to use your smartphone. Some CGM systems will work with an insulin pump receiver. Setting up the receiver means adding information into the receiver or smartphone. To do this, you start by turning on the receiver or smartphone. If you are using a smart phone, you will have to download the app for the CGM you have.

Each system will have a set of menus to follow. These menus can be set for English or Spanish. The first time you use the receiver or smartphone app you will follow the prompts to set:

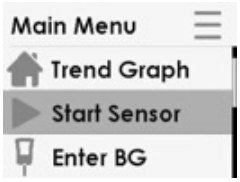
- Date and time
- Target glucose range
- Alarms, in some systems
  - Set the Low Alert alarm to let you know if your glucose is too low
  - Set the High Alert alarm to let you know if your glucose is too high

You may have to reset your receiver if the batteries die. You may also have to reset it if you need to make changes to your target glucose range or alerts.

What do I need to do each time I put in a new sensor?

You will have to do a few things.

Connect or pair the transmitter with the receiver or app on a smartphone. This is done so the transmitter can send glucose data to your receiver or smartphone so you can see the data. Turn on the Bluetooth function on the receiver or smartphone.



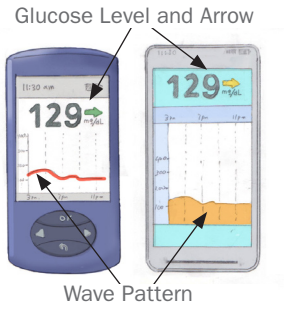
Start or activate your sensor. To do this you may have to enter in a sensor serial number into the receiver or smartphone. Some systems require that you scan the sensor by holding a receiver or smartphone over the single sensor and transmitter.

Calibrate the system in some systems. This means you will need to get a finger stick glucose reading from a glucose meter. You will enter your glucose reading into the receiver or smartphone.

Wait for a warm-up period for the sensor to start sending accurate glucose levels to the transmitter and receiver. How long the warm up period depends on which system you have. It can last anywhere from 1 to 24 hours.

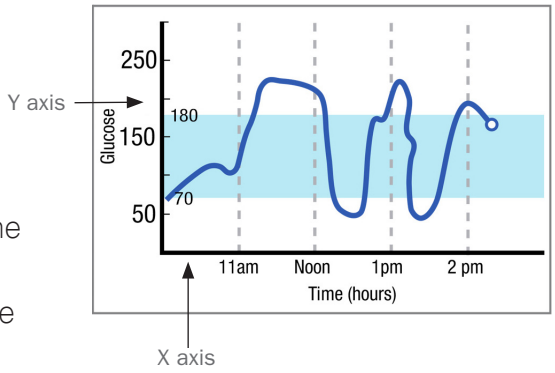
What glucose information can I see on my receiver or smartphone?

The most important information you will be able to see on your receiver screen is your glucose level. You will be able to see this as a number. You will be able to see it as a wave pattern over time with your glucose target range highlighted. And you will see an arrow letting you know if your glucose is going higher or lower.



Tell me more about the lines on the screen. What do those mean?

Every time the CGM reads your glucose level it creates a dot. The dots then connect to make a line. This line shows your glucose over time.



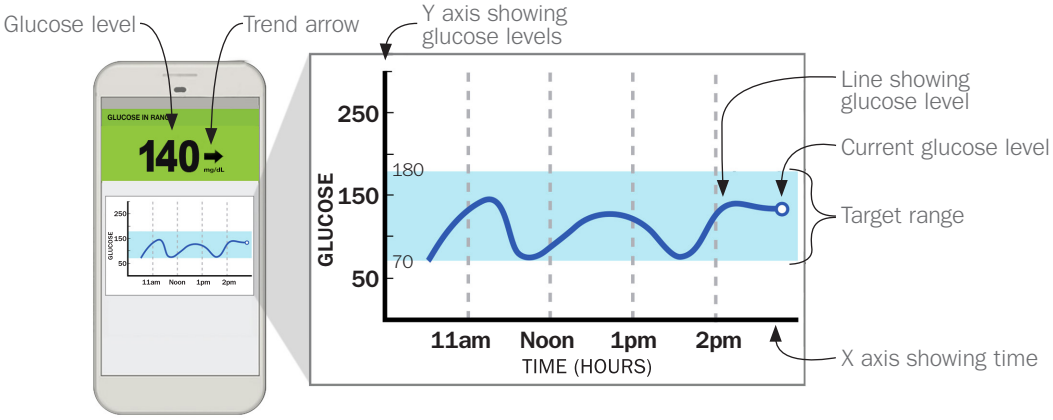
The Y axis is the vertical line of numbers on the left side of the graph. This is your glucose number. **The X** axis is the horizontal line on the graph that is at the bottom of the graph. This is the time of day.

Throughout the day many things will make the line will go up and down. For instance, when you eat, the line will start to go up. When you take insulin, the line will start to go down.

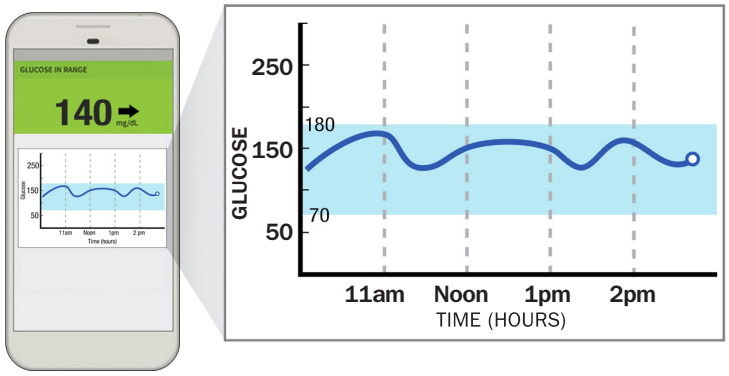
There is a colored area of the chart that shows the best place for your glucose wave to be. This is called the target range. Some people may have a wave right in the target range. Others may have a wave that always seems to be above the target range. And still others may have a wave the often goes below the target range.

A line that drops below the target range is showing low glucose, or hypoglycemia. A line that is above the target range is showing high glucose, or hyperglycemia. Some people may have a flatter looking line and others may have a very wavy line.

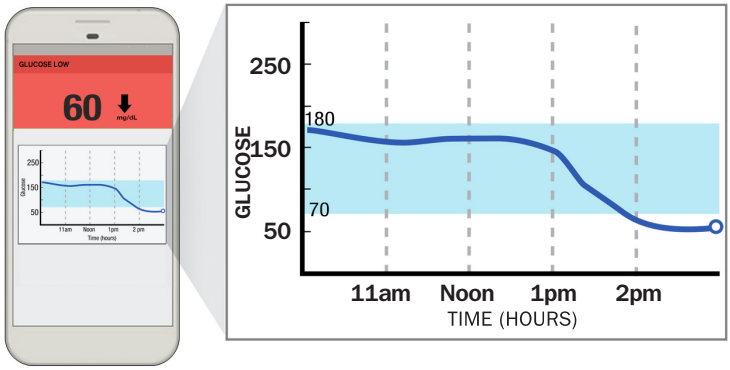
CGM RECEIVER OR SMARTPHONE WINDOW:



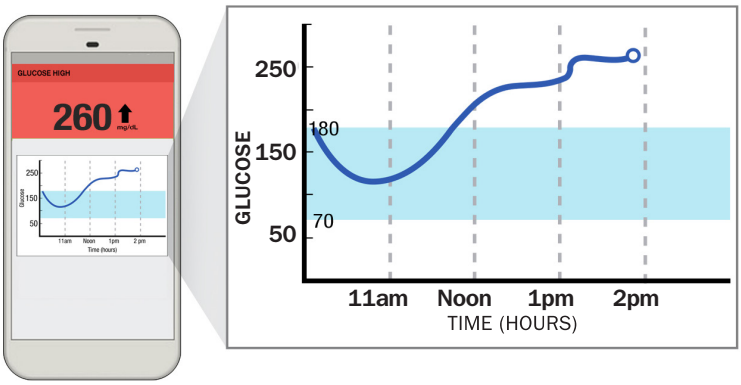
This is an example of a flatter line in the target range:



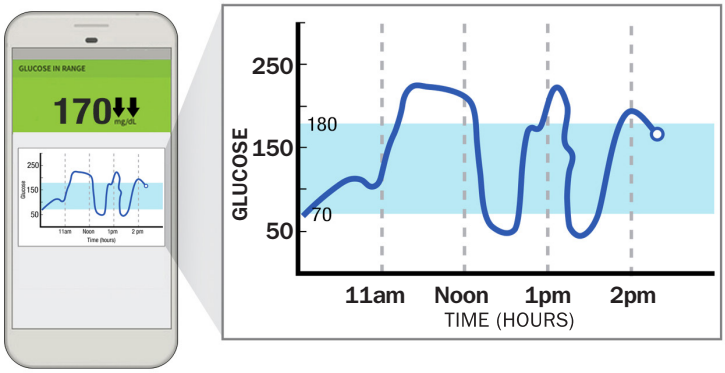
This is an example of a wavy line with low glucose, or hypoglycemia:



This is an example of a wavy line with high glucose, or hyperglycemia:



Here is an example with a wavy line with both high and low glucose:



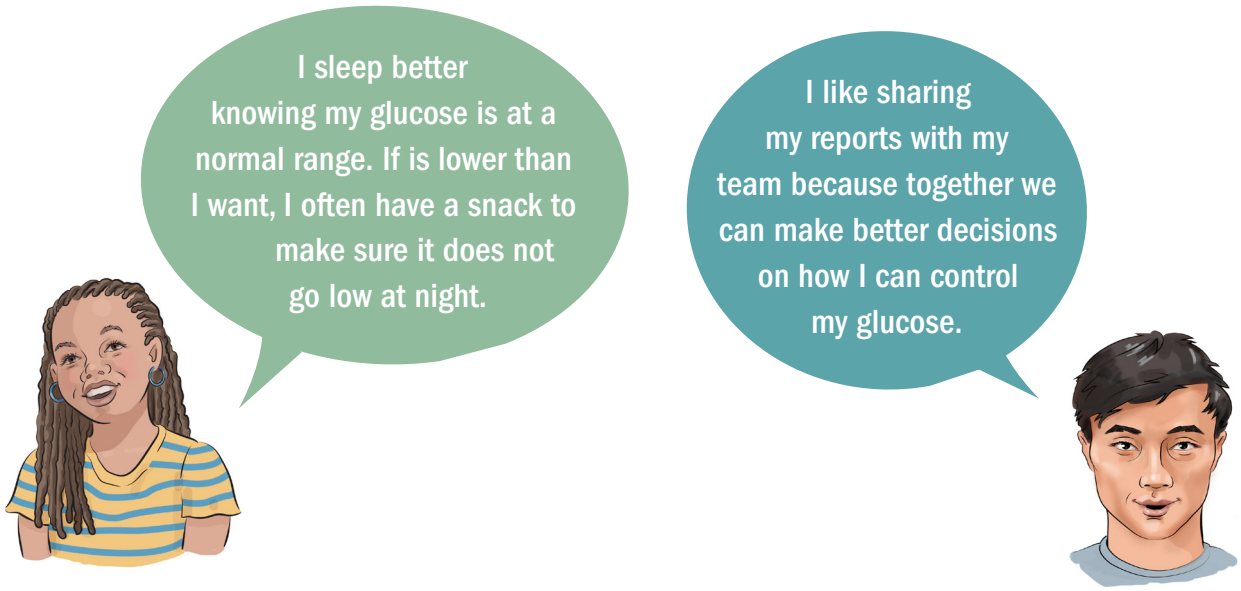
SECTION 2 — How a CGM Can Help Manage Type 1 Diabetes Better

There are many reasons that the CGM can help you manage your diabetes better!

If you decide to get a CGM, be sure to read our guides "How Can Continuous Glucose Monitor Help Me Manage May Diabetes Better?" and "How Can a Continuous Glucose Monitor and Carb Counting Help Me Manage May Diabetes Better?"

Here are some basics on how the CGM can help you manage your diabetes better:

- You can see your glucose level anytime without having to prick your finger.
- You can see how your glucose changes over a few hours or days.
- You can see patterns or trends in what your glucose does over a period of time.
- Seeing glucose levels in real time can help you make more informed decisions throughout the day about how to balance your food, physical activity, and medicines.
- You can share your CGM reports with your diabetes care team to help make diabetes treatment decisions.
- You can share your glucose levels with a family member or friend.
- You can get alarms and alerts, so you know if your glucose levels are going too high or too low.
- Some sensors communicate with insulin pumps and direct them to deliver insulin.



A CGM allows you to see how your glucose is doing *all* of the time. You can see this information on a receiver or your smartphone in real time. So, you can make decisions that will help you adjust how much insulin you need. Your CGM can alert you if your glucose is going too high or too low. With this information, you can better avoid complications from severe glucose lows or highs. You can also download data on your computer, tablet, or smartphone to see patterns and trends in your glucose levels. And you can share this data with your diabetes team. You can print out reports that show what your glucose was doing over a period of time. The reports can show a summary of several days and you can see specific days too. The shared information can help you and your diabetes care team make the best plan for managing your diabetes.

Your CGM can:

- Record dangerously low overnight glucose levels, which often go undetected
- Track high glucose levels between meals
- Show early morning spikes in glucose
- Assess how diet and exercise affect you
- Find out if your treatment plan works on a day-to-day basis
- Show you how often you are meeting your target glucose range
- Show how much your glucose goes up and down throughout the day — this is called your glucose variability

With this information, your diabetes team can:

- Decide how much insulin you should take
- Develop an exercise plan that is right for you
- Suggest the number of meals and snacks you need each day
- Correct the types and doses of medications you are taking

Can the CGM help me lower my A1C?

Yes. A CGM can help you reach your glucose and A1C targets. One way the CGM can help is that it gives you knowledge about what is happening to your glucose all day and all night.

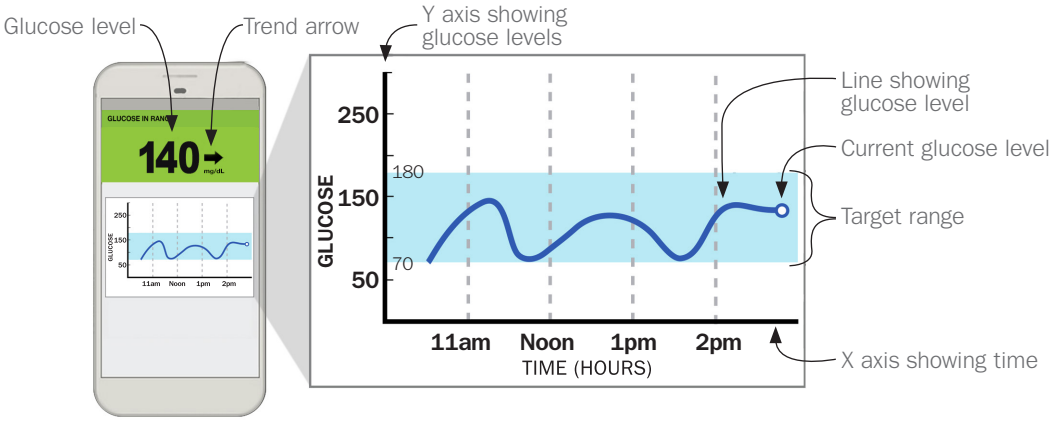
With finger sticks, you only know what is happening right at the time you are checking. Many people with diabetes get tired of checking so often. It is also hard to check when you are busy or want to sleep.

By knowing what your glucose level is, you can adjust your insulin. Or you can eat something to keep your glucose level from being too high or too low. You can set alarms to alert you when your glucose is going too low or too high. This way you do not have to constantly wonder what is happening with your glucose levels. You can also share your CGM reports with your diabetes team and make smarter changes with your medications.

All of these things can help you maintain better glucose control, which can lower your A1C.

Can you tell me more about what is my CGM telling me and what I should do?

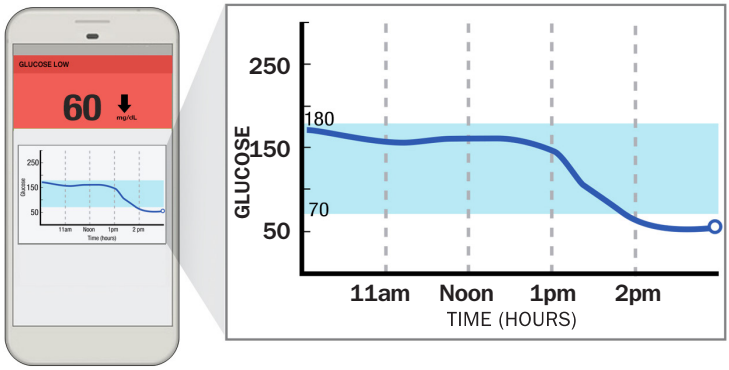
You can look at your glucose level on your smartphone or receiver. It can tell you what your glucose level is right now and if your glucose is on the way up or down. It can tell you if you are high, low or within your target range. With this information, you can make decision on what you should do. When you look at your smartphone or receiver you will see a picture that looks like something like this:



It shows you what your glucose level is right now. Can you find the glucose level 140? It shows if your glucose level has been going up, down or staying flat. Do you see the wavy line? It shows if your glucose level is within your target range. Do you see the blue color block and the numbers 70 and 180? If the wave is inside the colored part it means your glucose is in range. In this picture, the glucose is in the target range of 70–180. It also may tell you what your glucose is likely to do within the next half hour or so. This is done by a trend arrow. Trend means the general direction something is going. Do you see the trend arrow next to the glucose level? In this picture the trend arrow is saying that the glucose is likely to stay the same for about 30 minutes.

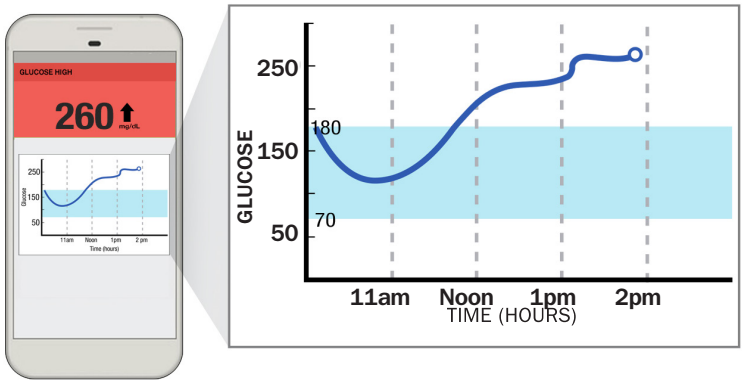
What would my smartphone or receiver look like if I were going low?

Below is an example of low glucose. In this case, the glucose level was in range from 11 am to just before 2 pm. Do you see the line starting to move out of the blue target range color? Do you see the glucose level of 60 with the trend arrow pointing down? This would be the time to eat or drink something to bring your glucose up.

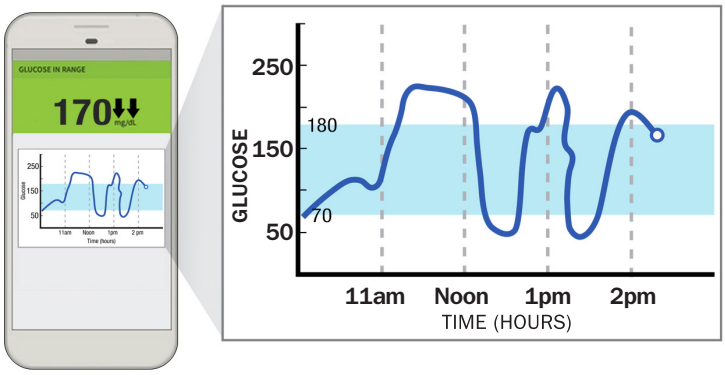


What would my smartphone or receiver look like if I were going high?

Below is an example of high glucose. In this case, the glucose level was in range from 11 am to just before 12 pm. Then the glucose continued to rise. Do you see the line starting to move out of the blue target range color? Do you see the glucose level of 260 with the trend arrow pointing up? This would be the time to give insulin to bring your glucose down.



Earlier you showed an example of glucose going low and high. What does that mean?



In this example, the glucose started in range then was going up at 11 am. By noon, the glucose was about 190 and then started to come down. This pattern happens again about 12:30 and at 2:00 pm. The most likely thing was that the person ate food and when they noticed they were going high gave too much insulin for the amount of food or carbs they ate. Giving too much insulin caused the glucose to fall fast and go very low. In this example, the glucose is 170 and there are 2 trend arrows going down. This shows that the glucose is dropping fast.

Learning how to adjust your food intake and insulin can take time. Carb counting can help too. Once you get the hang of understanding what your CGM is telling you, you can start making informed decisions on how to better manage your diabetes. You can also read our guide, "How Can Carb Counting and CGM Help me Manage My Diabetes Better?" Sharing your CGM reports with your diabetes is also very helpful.

SECTION 3 — What Reports Can a CGM Give Me?

What kind of reports can my CGM give me?

The reports give you and your diabetes care team the tools to help improve how you manage your diabetes. It can take time to learn to read and understand the reports. However, whether you do this yourself or not, your doctor and other diabetes care team members can use the reports to support you in managing your diabetes better. If you learn how to understand the reports, you will be able to look at different CGM report views and if there are ways you can improve your diabetes numbers.

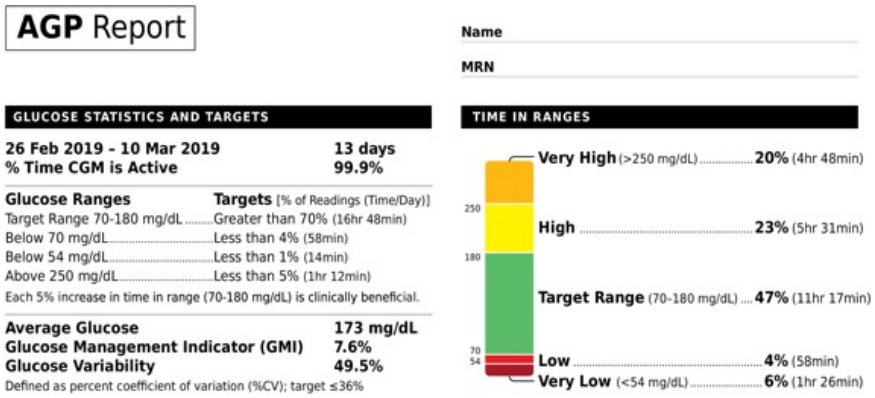
What is the AGP Report?

The AGP Report stands for Ambulatory Glucose Profile Report. Most CGM reports have the same information but look a bit different. Most reports show 4 sections of information:

1. Glucose Statistics and Targets
2. Time in Ranges
3. Ambulatory Glucose Profile
4. Daily Glucose Profiles

What does an AGP Report look like?

Here is an example of what a full AGP report looks like:



AGP Report

Name

MRN

GLUCOSE STATISTICS AND TARGETS

26 Feb 2019 - 10 Mar 2019	**13 days**
% Time CGM is Active	**99.9%**

Glucose Ranges	**Targets** [% of Readings (Time/Day)]
Target Range 70-180 mg/dL	Greater than 70% (16hr 48min)
Below 70 mg/dL	Less than 4% (58min)
Below 54 mg/dL	Less than 1% (14min)
Above 250 mg/dL	Less than 5% (1hr 12min)

Each 5% increase in time in range (70-180 mg/dL) is clinically beneficial.

Average Glucose	**173 mg/dL**
Glucose Management Indicator (GMI)	**7.6%**
Glucose Variability	**49.5%**

Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES

250
180
70
54

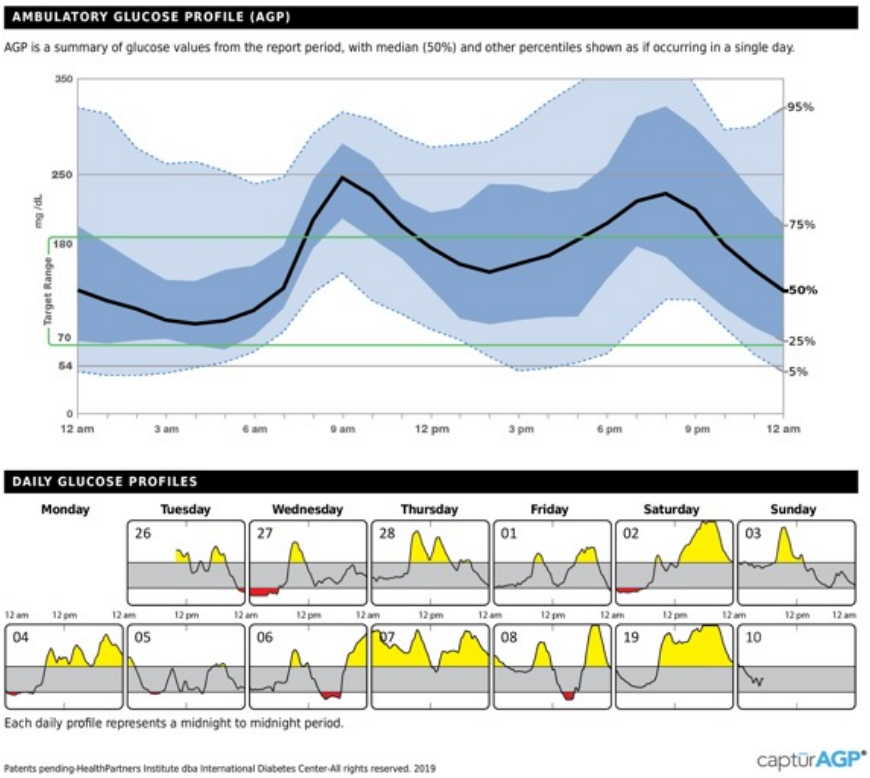
Very High (>250 mg/dL) **20%** (4hr 48min)

High **23%** (5hr 31min)

Target Range (70-180 mg/dL) **47%** (11hr 17min)

Low **4%** (58min)

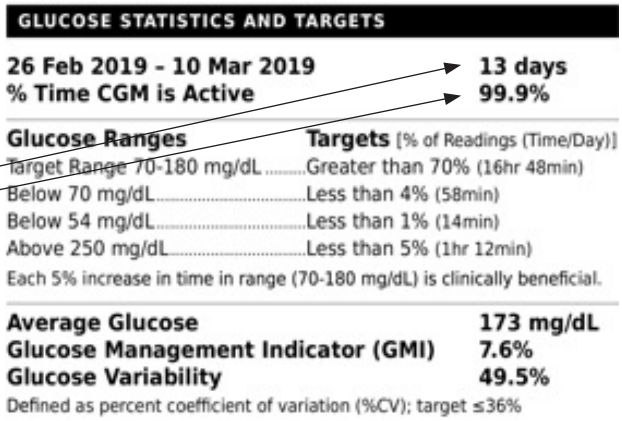
Very Low (<54 mg/dL) **6%** (1hr 26min)



Now lets look at each section closely.

In the Glucose Statistics and Targets section you will first see:

- The dates the CGM was worn
- How many total days it was worn
- % time CGM is active

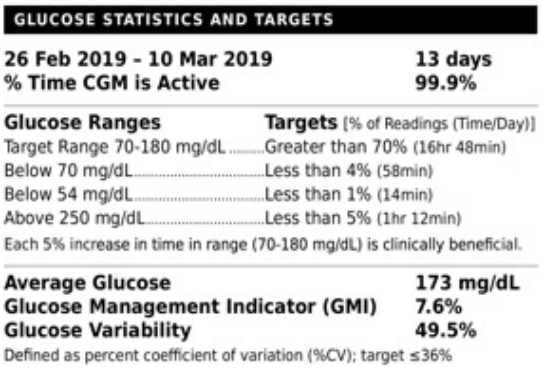


The % time a CGM is active means the number of hours the CGM collected data, divided by number of hours in report. It shows how well the CGM was working. In this example, the CGM was working very well.

In 13 days, this CGM was able to provide all but a few minutes of the possible of 312 hours the CGM was worn. In some cases, the CGM does not collect data all the time. The CGM may not have been working very well. For example if the percent was 50%, that would mean the CGM only collected half of the data it should have. It could also mean you were only wearing it half of the time. Hopefully you will wear it all the time.

What do the Glucose Ranges tell me?

- Glucose ranges show numbers that let you know if your glucose is high, low or just right.
- A common target range is 70-180 mg/dl. Keeping your glucose between 70-180 mg/dl is best.



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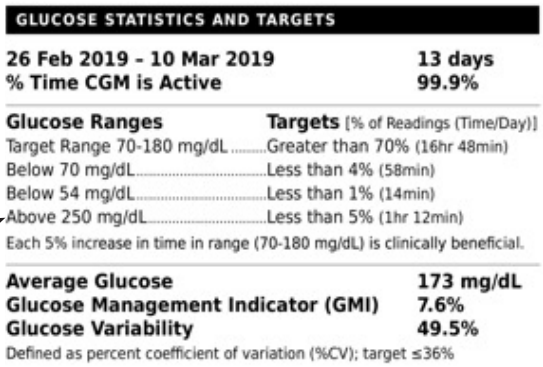
Defined as percent coefficient of variation (%CV); target ≤36%

- When your glucose is below 70 mg/dl, your glucose is low.
- If your glucose is below 54 mg/dl, your glucose is very low.
- If your glucose is above 250 mg/dl, your glucose it much too high.



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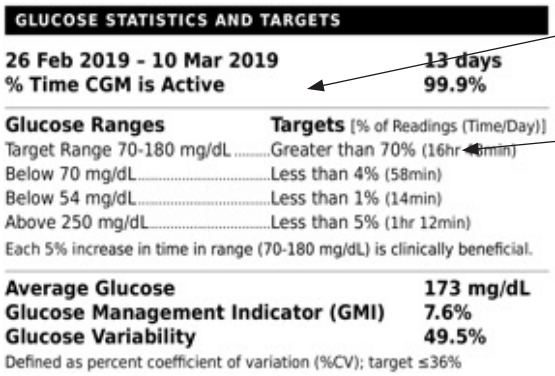
For more information on how to treat high and low glucose, hypoglycemia, and diabetes ketoacidosis (DKA) look at our guide, “How Can I Manage My Diabetes Better?”

What do the Targets tell me?



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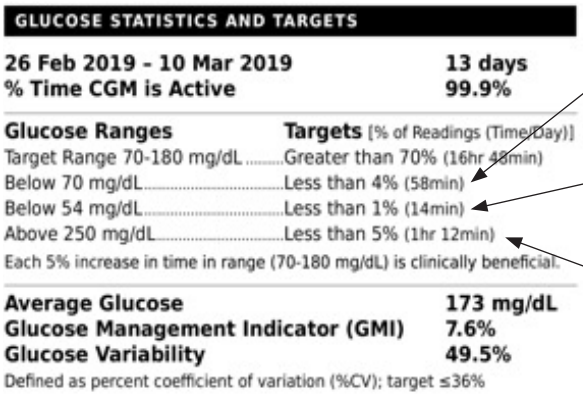
- After each glucose range, is a target. The Target section tells you how often your glucose was in that range.
- In this example, can you see how long the person was in the target range? They were in their target range 70% of the time. What about the other ranges — can you see how many minutes this person was below 70, mg/dl, below 54 mg/dl and above 250 mg/dl?



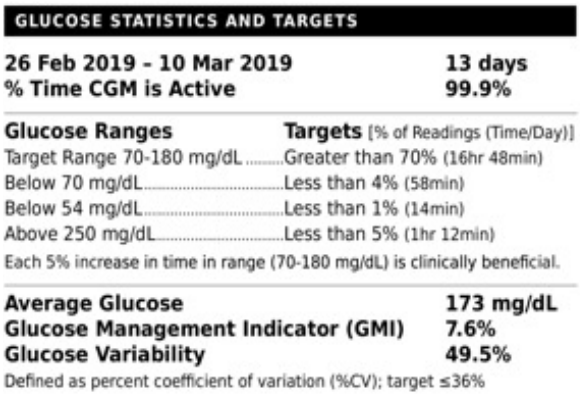
- In this example, the person was below 70, mg/dl for 58 minutes or 4% of the time.
- They were below 54 mg/dl for 14 minutes or 1% of the time.
- They were above 250 mg/dl 1 hour and 12 minutes or 5% of the time.

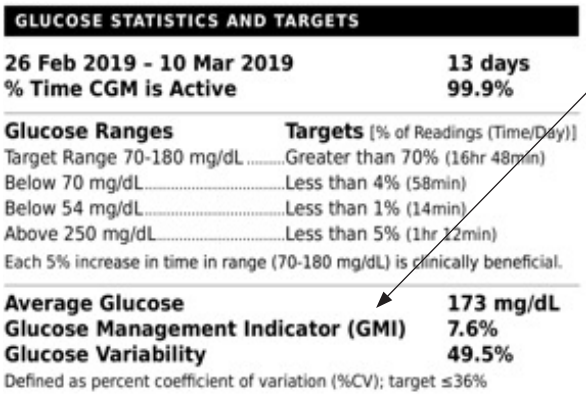
Why is the time in these different ranges important to me?

Knowing your time in the different ranges can help you and your diabetes team make decision on how to manage your diabetes better. Keeping your glucose is the 70-180 mg/dl range is best. The more you can keep your glucose in this range, the better your diabetes health will be. Doing this helps lower the risk for the complications of diabetes. Reducing the time you are low and very low will help you feel better. You want to have very few glucose levels below 54 and not many below 70 mg/dl. Reducing your high glucose can help you feel better. Having few highs with also help you have a better A1c.

What is the average glucose?

This part of the report shows some other interesting pieces of information. Do you see the Average Glucose? The average glucose takes all of the glucose levels from a chosen time frame and divides them by all of the number of readings. The chosen time frame is usually two weeks. The CGM system does lots of math to give you simple numbers to help you understand your diabetes health. It is best for your average glucose to be within the target range.





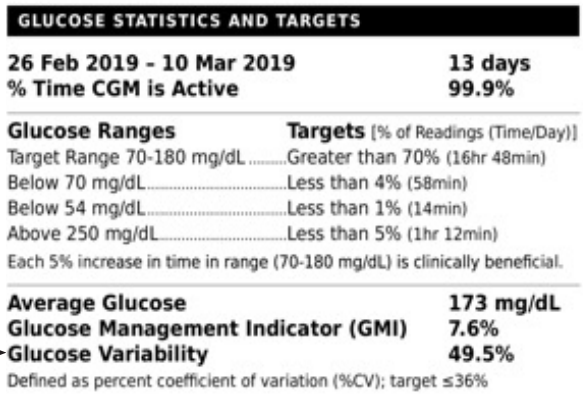
What is the GMI?

The Glucose Management Indicator (GMI) is a calculation that is predicting what your future A1c will be.

When you have blood taken for an A1C test it measures your average glucose over 3 months; the GMI is used to see what your "A1C" is over the past 2 weeks. A recommendation for most people is to have a GMI of less than 7%.

What is Glucose Variability?

The Glucose Variability is used to see how much your glucose levels are bouncing from highs to lows and back again. Some people may have many high and low glucose levels in a day. Others will be even. The goal is to have steady glucose levels with very few ups and downs. High variability means that your glucose line has many ups and down like a roller-coaster and a low variability looks like speed bumps. The goal is to have more speed bump days than roller-coasters. This reports show a glucose variability of 49.5% A variability of less than 36% is considered ideal.

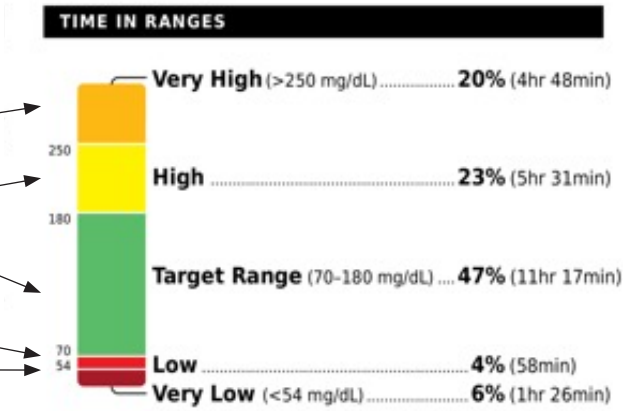


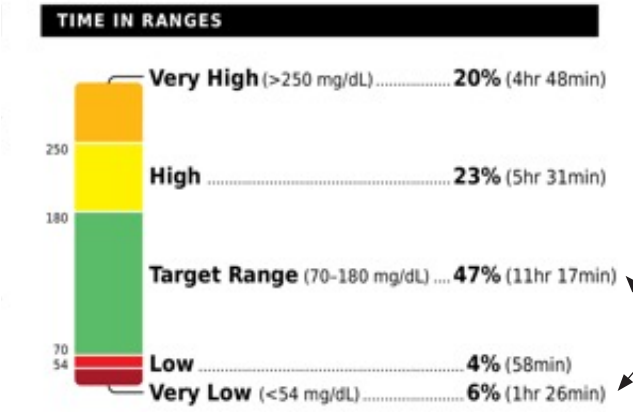
What does the Time in Ranges section tell me?

The Time in Ranges part of the report is another way to look at your glucose level. It is a colorful view. The little numbers are the glucose ranges and the chart is broken up by 5 levels.

The 5 levels of this section are from very high to very low.

- Very High over 250 mg/dl
- High — between 180 and 250 mg/dl
- Target Range — between 70 and 180 mg/dl
- Low — between 54 and 70 mg/dl
- Very Low — less than 54 mg/dl



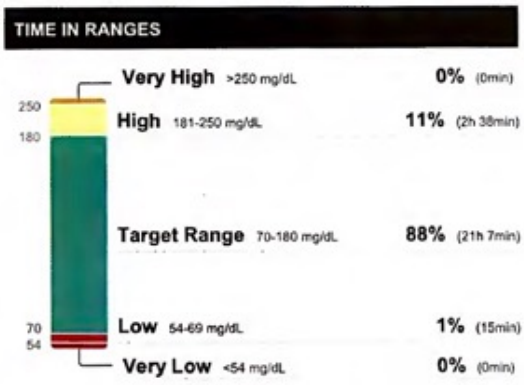


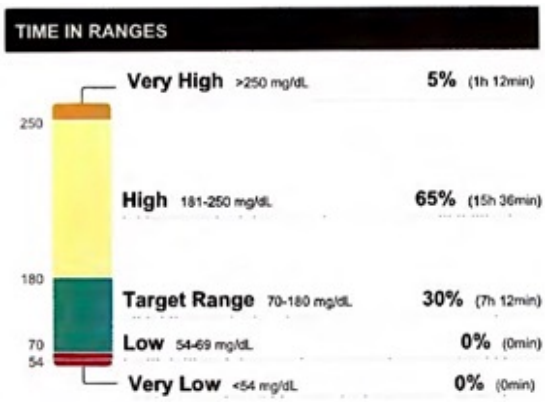
The Time in Ranges report shows a graph by color and shows by percent and hours/minutes your glucose is in a certain range. This picture is the same information as the glucose and target ranges described above.

- Percent in range
- Time in range

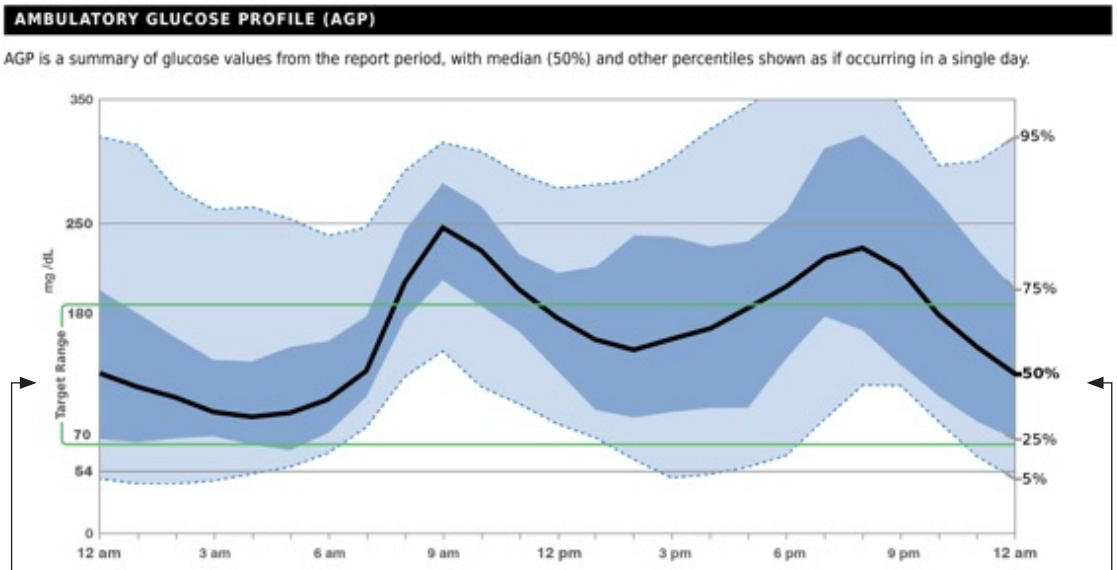
Here are two more Time in Range examples.

- Can you see which person's diabetes was well controlled?
- Can you find the percent time of the person who had a high glucose most of the time?
- Who had a very high glucose level?
- Did either person have a very low glucose level?





What does the graph part of the report tell me?



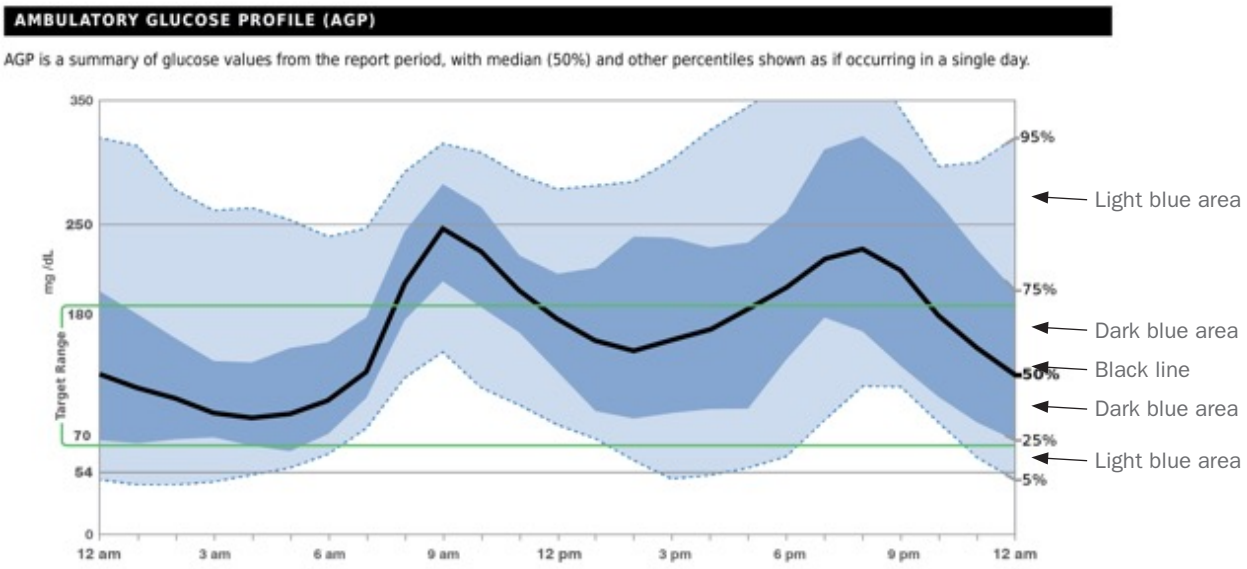
The left side shows the glucose ranges. The bottom line shows you the time of day. The right side shows you the percent of glucose readings. The shaded areas and black line give you a picture of how all of your glucose values for the whole time you wore the CGM would look if all the readings happened in one day instead of many days. It kind of looks like a wave. You want the lines to be in the 70–180 range.

You and your diabetes care team can look at this to:

- See patterns of when you eat.
- See patterns of when you give insulin.
- See when you are most often in or out of your glucose Target Range.
- See patterns of if you might be giving too much or too little insulin for the amount you have eaten by how flat or bumpy your wave is.

By looking at your patterns and other sections of the report, your team might decide to change your target goals. They might change your insulin dose or correction factor to help you manage your diabetes better.

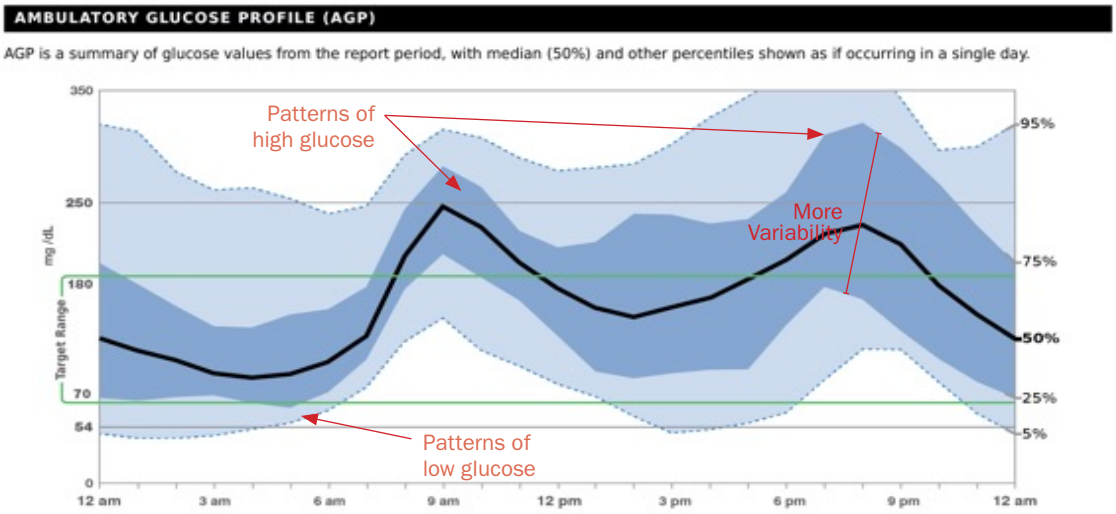
What do the shaded areas and black line mean?



Black line: median (middle) line. This line separates the point where half of the glucose values are above the halfway point and half are below. The goal for this line is to mostly be flat and inside the shaded area. This line is not flat. It also goes very high above the target area. You also want to see this line inside the target range most of the time.

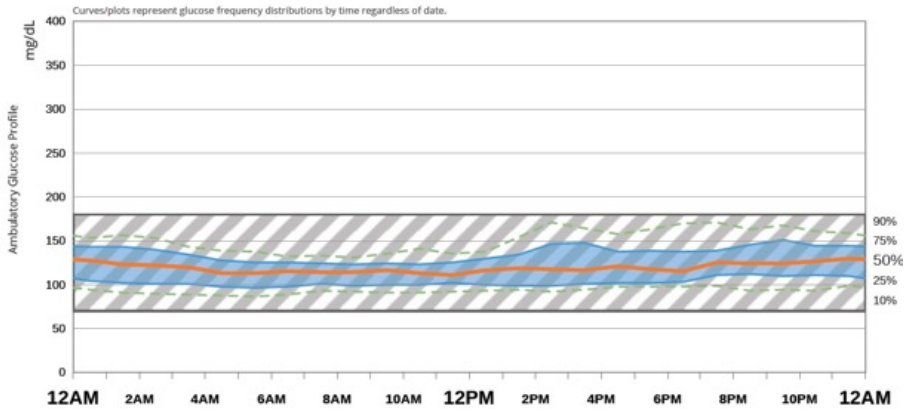
Dark blue: This darker blue shaded area shows where 50% of the glucose values are. The goal is for this space between is narrow or less variability. A wide space shows that there is more variability. Do you see the narrow space and the wider space in the image below?

Light blue: 5% of values are above (95% top line) and 5% are below (5% bottom line). When the dotted blue lines and the light blue shaded area is closer to the dark blue shaded area, the better. This area can show patterns of high and low glucose values.

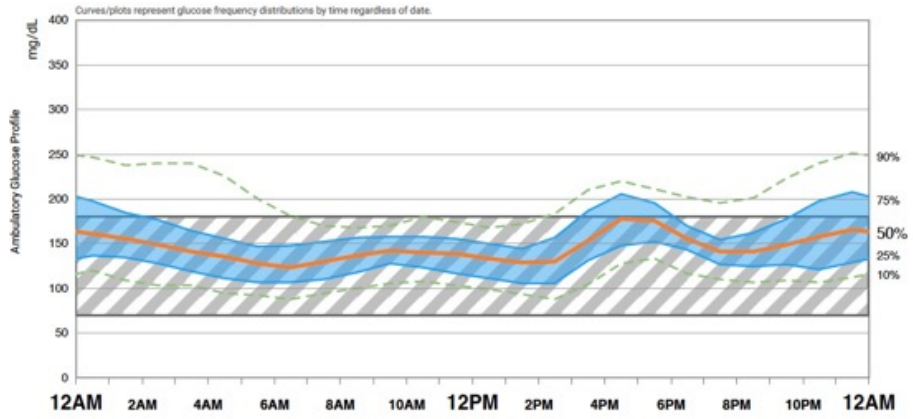


Can I see some APG reports from real people?

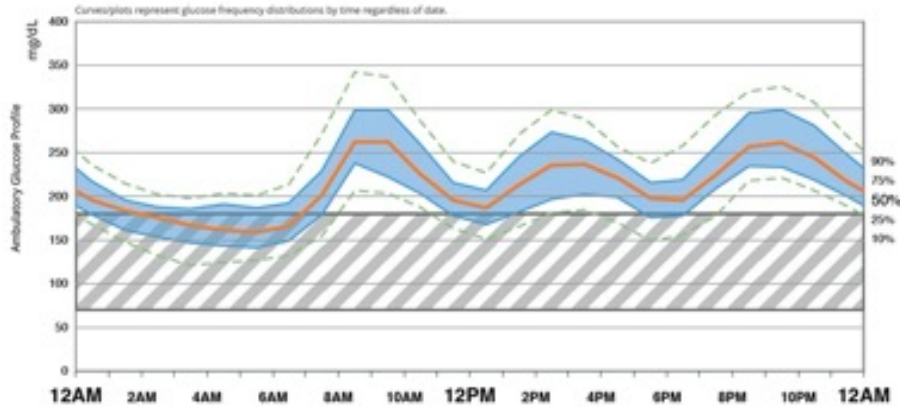
Lets look at three different reports. This report is from someone without diabetes. Look at how flat the line is. The whole wave pattern is between the 70 to 180 target range.



Here is an APG of a person with well controlled diabetes. This line is pretty flat too. Most of the wave is within the 70 to 180 target range.



Here is an APG of a person with not very controlled diabetes. The line is wavy and most of the wave is above the 70-180 target range.

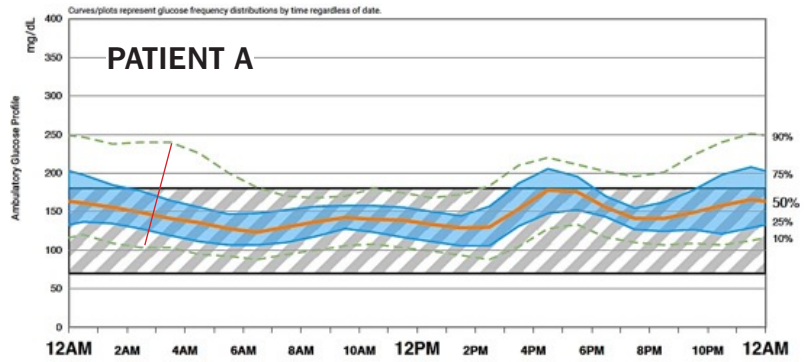


Can you tell me more about glucose variability?

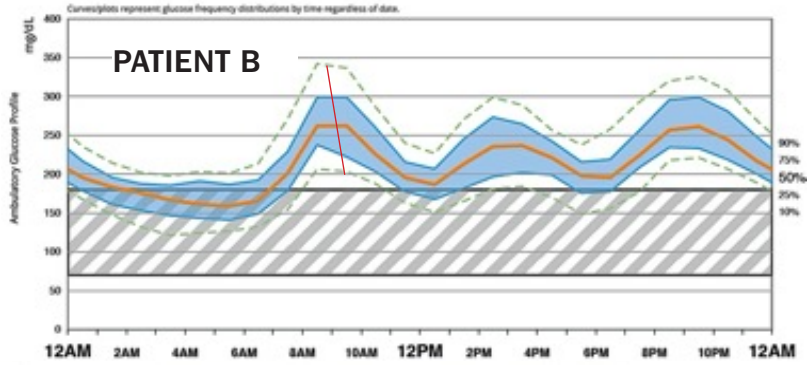
Glucose variability means how much the glucose is bouncing from low to high. These reports give you a nice picture of glucose variability. The images below are from real people.

Please look at the three images below.

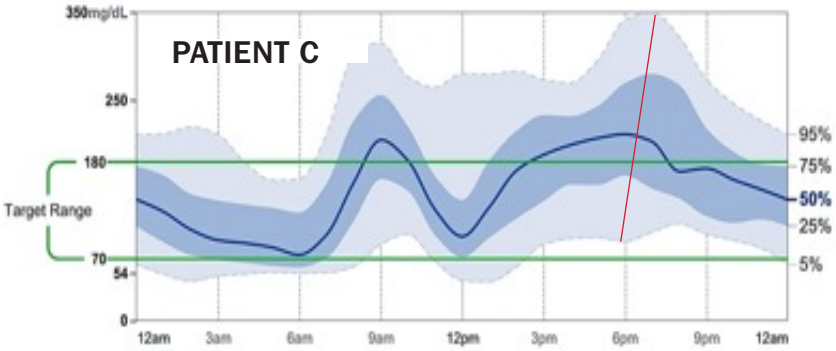
- Which person's lines are flatter?
- Which person has the highest variability? Remember this is how wide the dotted line is from the blue and center line.
- Do any of the people have a period when their glucose value is in their target range?



PATIENT A has a very flat wave pattern with low variability. They are also within their target range a good amount of time. If you saw this person's whole report, you would see they were below their target 4% of the time, over their target 16% of the time and in range 84% of the time. There variability is 28.6%.



PATIENT B is above their target range most of the time. They have the highest glucose levels. Their glucose typically starts climbing in the morning. If you saw this person's whole report, you would see they were below their target 0% of the time, over their target 70% of the time and in range 30% of the time. Their variability is 25.6.



PATIENT C has a pattern of their glucose rising out of range likely after breakfast and coming back down in range before lunch and then rising out of range again. Of the three reports, they have the highest variability. That means that they are bouncing from low to high to low and high again. If you saw this person's whole report, you would see they were below their target 15% of the time, over their target 33% of the time and in range 52% of the time.

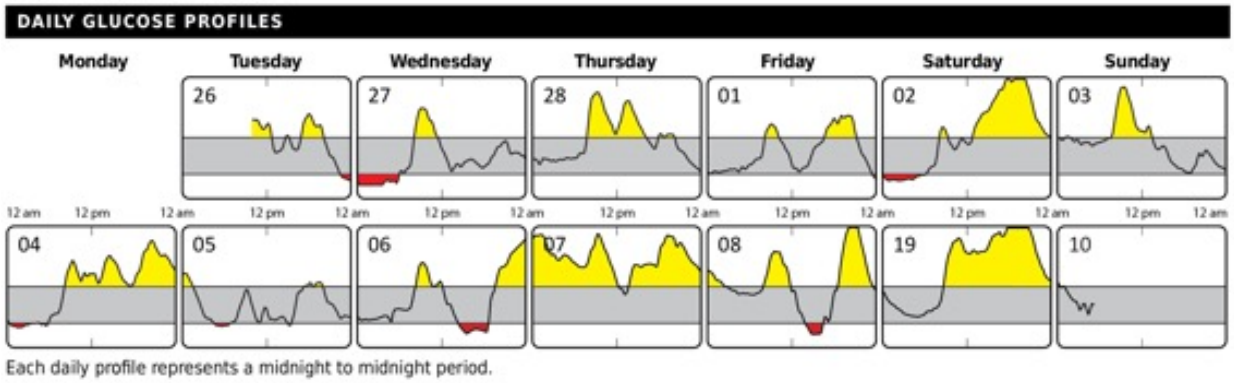
Can you see how Patient C has the widest space from the bottom of their graph to the top? Patient A and B have a much narrower gap. This is shown with the red line.

What do the daily reports tell me?

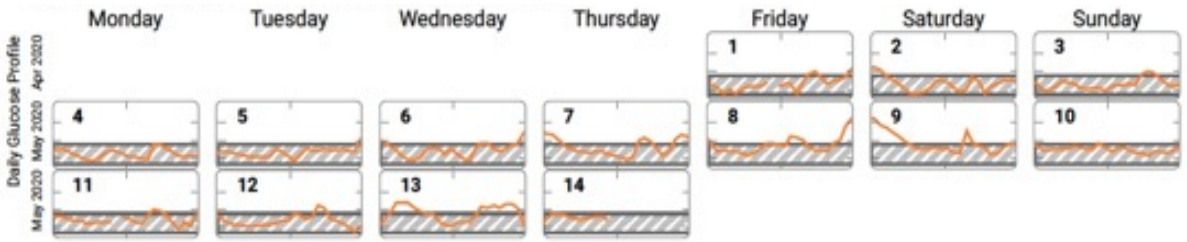
The daily reports are at the bottom of the AGP. This is a way to look at the individual days that go into making up the overall report.

You can look for your best day to discover what you are doing to give you a better time in range. You can look for some problem days to review how to have fewer highs and lows. You can see the effect of exercise, a birthday celebration or late-night snacks. This is a good place in the report to see patterns. Patterns are time periods that look the same over time. For example, are some days of the week more alike than others? Do the mornings always have low glucoses?

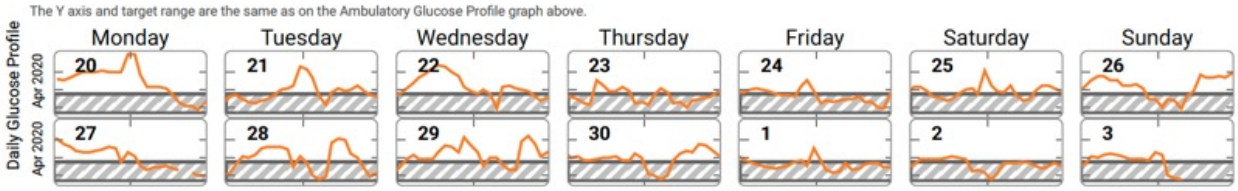
Look at the example below. Can you find Tuesday the 5th? This is the best day for this person. You can tell because the black line is mostly in the grey area. This person has several problem days. They have many days with a high glucose. Do you see all of the yellow colored areas? This is showing where their glucose was above their target range. This person also has days with low glucose. Can you see those red areas? The red show the low glucose.



Look at this daily graph. This person has almost all good days. There are a few days that they went above their target range for a short period of time. Can you find them? There seems to be a pattern on Friday nights into Saturday. Can you see Friday the 1st and Friday the 8th? The glucose is on the rise and starts coming down overnight until the next day.

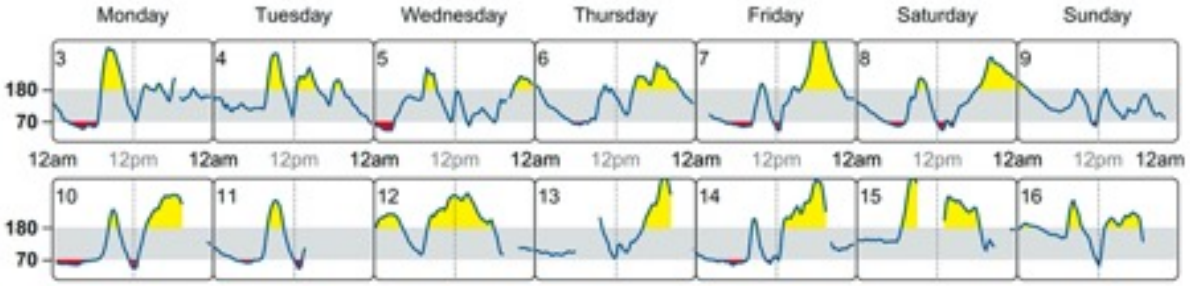


Here is another report. Do you see any patterns? The first part of each week has more ups and downs or variability.



Here is one more daily report. Remember Patient C from the APG report section on page 32.

They had the highest variability. In the report below, you can see each day. You can see how the glucose line shoots up and comes down. Do you see all of the yellow peaks? That is when their glucose is high. Do you see the red areas? That is where the glucose fell too low.



What is the most important information my AGP Report can show me?

The key parts of your report include:

- How many days your CGM was being worn and worked
- An average glucose value
- A prediction of your recent A1C (Glucose Management Indicator — GMI)
- How much your glucose levels are bouncing from highs and lows (Glucose Variability)
- The amount of time you were in your target range
- The amount of time you were below your target range
  - This means when you had low glucose or hypoglycemia
- The amount of time you were above your target range
  - This means when you had high glucose or hyperglycemia
- What glucose patterns you have
  - Patterns of low glucose or hypoglycemia
  - Patterns of high glucose or hyperglycemia
- When you show high glucose variability

Having CGM reports can help provide valuable information to help you meet your goals.

Each person with type 1 diabetes should have their own personal A1C goal and target glucose ranges. Set your A1C goal and target glucose ranges with your diabetes care team.

Your goal will be based on a number of factors. The general A1C target is 7.5% or less for people aged 18 and older and 7% or less for those under 18 year. But these targets vary a lot depending on the person.

You have less risk of long-term complications of diabetes when your glucose levels are closer to normal and in your target range. But, this has to be balanced against the risk of low blood glucose reactions. All of this information can help you manage your diabetes better.

Take time to look at your report. Share your report with your diabetes care team. They can help point out information to help you manage your diabetes better. There are many things that can change your glucose levels (Food, Medications, Sleep, Stress, Hormones, and much more). So just because your glucose was too high or too low more than you want, does not mean you are to blame. The different numbers you see are not grades. The information is not a report card where you pass or fail. It is a tool to help you understand your diabetes better.

Either way, I am committed to taking care of my diabetes.

Congrats for being committed to take good care of your diabetes. We know that it is not always easy to treat type 1 diabetes. We know you can do it well.

Keep up the good work!

APPENDIX 1 — Resources

In this appendix, we offer some resources that may help you. We have the information in this order:

- Organizations
- Carb Counting and Nutrition
- Insulin Pump Companies
- Insulin and Insulin Pens
- Diabetes Supplies and Medications

We have provided internet links. These are US based links so most information is in English. If a site is available in your language, we recommend using that link. To see the information in Spanish or other languages, try Google Translate. It does a pretty good job at changing the information into the language you wish. But, a computer program does this translation so it may not be accurate.

To use Google Translate go to **http://translate.google.com/manager/website/** and follow the step-by-step guide. This is free!

ORGANIZATIONS

AMERICAN ASSOCIATION OF DIABETES EDUCATORS (AADE)

(800) 338-3633
www.aadenet.org

This is a group of diabetes educators. This is their link for patient resources: https://www.diabeteseducator.org/patient-resources. Here they offer information for people with diabetes.

AMERICAN DIABETES ASSOCIATION (ADA)

(800) 342-2383
www.diabetes.org
Spanish link: http://www.diabetes.org/es/?loc=util-header_es

This is the biggest group of people with diabetes and diabetes professionals. It helps people with both Type 1 as well as Type 2 Diabetes. There are local chapters that you can contact for help or to volunteer. They also have an online store to buy books, gifts and other helpful items.

ACADEMY OF NUTRITION AND DIETETICS

(800) 877-1600

www.eatright.org

This is a site for information about food and nutrition.

CHILDREN WITH DIABETES

www.childrenwithdiabetes.com

This started as a group having mostly to do with children with diabetes. Now it includes young adults as well as parents of people with Type 1 Diabetes.

It is a good site to learn about many tools and resources for people with Type 1 Diabetes.

CLINICAL RESEARCH STUDIES WEBSITE

clinicaltrials.gov

This site lists all the clinical research studies that are in process in the United States. You can do a search using the key words "Type 1 Diabetes" if you want to find those research studies.

DIABETES MINE

www.healthline.com/diabetesmine

This is a blog about Type 1 Diabetes. It has been around for many years and is very helpful. A woman who has Type 1 Diabetes started it. It shares many people's experiences and advice.

DIABETES SISTERS

www.diabetessisters.org

This is a group for women with diabetes, mostly Type 1. They share ideas and experiences.

DIABETIC DANICA

www.facebook.com/DiabeticDanica

Danica is a kind young woman with Type 1 Diabetes. She makes YouTube videos about having Type 1 Diabetes and how to use diabetes devices. These videos can be helpful.

DIABTRIBE

www.diatribe.org

Diatribe is a non-profit organization. It evaluates and comments on new approaches and treatments for diabetes, both Type 1 and Type 2.

GLU

www.myglu.org

GLU is the largest interactive on-line network for people with Type 1 Diabetes as well as their care givers and family members. The nonprofit Helmsley Charitable Trust funds it.

It offers excellent advice and information about Type 1 Diabetes. You can also connect with others who have the same questions and concerns about diabetes as you do.

JDRF

www.jdrf.org

This used to be the Juvenile Diabetes Research Foundation. It was started to help do research on Type 1 Diabetes. Now it helps people living with Type 1 Diabetes as well as funds research. There are local JDRF offices that may be helpful to you.

TRIAL NET

www.diabetestrialnet.org

This is a group of researchers who work on preventing and treating early Type 1 Diabetes. Contact your local Trial Net site for screening risk of new onset Type 1 diabetes for yourself or family members.

TUDIABETES

www.tudiabetes.org
Spanish link: http://www.estudiabetes.org

This is a large on-line group of people with both Type 1 and Type 2 Diabetes. They share concerns and ideas in Spanish about living with diabetes.

CARBOHYDRATE (CARB) COUNTING AND NUTRITION RESOURCES

CALORIE KING

www.calorieking.com

This offers information on foods, carbs, calories and more.

CARBS AND CALS

www.carbsandcals.com

This offers books and a $5 App that gives pictures of foods and their carb count.

THE DIABETES CARBOHYDRATE AND FAT GRAM GUIDE

(The American Diabetes Association)

This guide has quick, easy meal planning using carbohydrate and fat gram counts. You can buy it on many shopping websites like Amazon, Barns and Noble and the American Diabetes Association online store. www.store.diabetes.org

THE DOCTOR'S POCKET CALORIE, FAT & CARBOHYDRATE COUNTER

(949) 642-1993

Family Health Publications publish this. You can buy it on many shopping websites like Amazon and Barns and Noble and the calorie king online store at www.calorieking.com.

FIGWEE

www.figwee.com

This is an iPhone App for $2.99 that gives pictures of many different foods along with their carbohydrate count.

NUTRITION IN THE FAST LANE

(Franklin Publishing)
(800) 643-1993
www.fastfoodfacts.com

This book has nutrition information for 60 of the most common restaurants in the United States.

NUTRITION AND DIABETES

(International Diabetes Center)
(888) 637-2675
www.idcpublishing.com

This web site has books for sale in English and Spanish for $3 on nutrition and diabetes.

INSULIN PUMP COMPANIES

These websites give you lots of information about their pumps. They also offer on-line lessons about how to use their pumps.

It can be very useful to look at these sites. You can learn about pumps. You can review how to use the pump you have as well.

ACCU-CHECK PUMPS: ROCHE DIAGNOSTICS

(800) 280-7801
www.accu-checkinsulinpumps.com

This site provides information on the Accu-check Spirit pump.

ANIMAS PUMPS: ANIMAS CORPORATION

(877) 937-7867
www.animas.com

These pumps include the Animas Ping and Animas Vibe.

OMNIPOD PUMPS: INSULET CORPORATION

(800) 591-3455
www.myomnipod.com

This site shares about the Omnipod system. It also gives you the option to try a demo Omnipod pump.

MINIMED PUMPS: MEDTRONICS, INC.

(800) 646-4633
www.medtronicdiabetes.com/home

This is the site for all the MiniMed Medtronic devices.

TSLIM PUMPS: TANDEM DIABETES CARE

(858) 366-6900
www.tandemdiabetes.com

This site describes the features of the TSlim pump.

INSULIN AND INSULIN PENS

SHORT ACTING INSULIN (REGULAR INSULIN) AND INTERMEDIATE ACTING INSULIN (NPH)

These are the oldest and lowest cost types of insulin. They are Regular insulin (short acting) and NPH insulin (intermediate acting insulin).

There are different names for these kinds of insulin including Novolin R, Humulin R, and others. Often these insulins come in vials. But sometimes they come in pens.

www.humulin.com/other-humulin-products.aspx

This offers information on Humulin Regular and NPH insulin as well as 70/30.

Novolin Regular and NPH do not have a website in the U.S. but you can buy them here.

www.diabetesselfmanagement.com/blog/relion-insulin-and-other-products-at-walmart

ReliOn Regular and NPH insulin come in vials. They are part of Walmart's low cost selection of diabetes supplies and products.

RAPID ACTING INSULIN

Apidra (Glulisine) made by Sanofi

www.apidra.com

These come in vials and pens.

Humalog (Lispro) made by Lilly Pharmaceuticals

www.humalog.com/index.aspx

These come in both disposable and refillable pens as well as vials.

Novolog (Aspart) made by Novo Nordisk

www.novolog.com

These come in both disposable and refillable pens as well as vials.

LONG ACTING INSULIN

Biosimilar Glargine

www.basaglar.com

This is a copy of the insulin known as glargine (U100 Lantus). It acts in a similar way and costs somewhat less. It is a long acting basal insulin.

U100 Lantus or Glargine insulin

www.lantus.com

This comes in vials and pens. It is a long acting basal insulin.

U300 Lantus or Glargine insulin

www.toujeo.com

This concentrated Lantus (glargine) insulin acts longer than U100 glargine. It only comes in a pen.

Levemir or Detemir insulin

www.levemir.com

Levemir comes in pens and vials. It is a long acting insulin but it is somewhat shorter acting than Lantus, Degludec or Toujeo.

Tresiba or Degludec insulin

www.tresiba.com

This is the very longest lasting basal insulin. It only comes in pens. It comes in two strengths: U100 and U200.

Glucagon Pens

www.lillyglucagon.com

This is the site for the Lilly brand of glucagon.

www.cornerstones4care.com/tracking/what-to-know/glucagen.html

This is the website for the Glucagon Kit which is the Novo-Nordisk brand of glucagon.

DIABETES SUPPLIES AND MEDICATIONS

CASES FOR INSULIN

www.frioinsulincoolingcase.com

These cases keep insulin cool and are easy to carry.

www.myabetic.com
These are carrying cases for insulin and supplies.

GLUCOSE TABLETS

www.dex4.com

These are one type of glucose tablet on the market. Many pharmacies have their own generic brands. You can look for a type of glucose tablet that you think tastes the best. But be warned, these do not taste like candy.

PEN NEEDLES

www.novonordisk.com/patients/diabetes-care/insulin-pens-and-needles.html

These are insulin pens and needles made by Novo-Nordisk.

PEN NEEDLES AND INSULIN SYRINGES

www.bd.com/diabetes

BD makes many diabetes products. They include syringes, pen needles and insulin infusion sets. BD offers very helpful educational information.

WEBSITE FOR COMPARING THE LOCAL COSTS OF MEDICATIONS

www.GoodRX.com

This is a good free App for finding the best prices for your medications. You enter the medication you are looking for and your location. Then it tells you the cost of it at your nearby pharmacies. It also gives you discount coupons.

APPENDIX 2 — Glossary of Diabetes Terms

In this glossary, we list and define key words that have to do with diabetes. You can use this to look up words you want to learn more about.

A1c

This is also:

- HbA1c
- Hemoglobin A1c
- Glycosylated hemoglobin

It is a blood test. The test can be a finger stick or blood taken from your vein. It tells you what your average blood sugar has been over the past three months. It does this by measuring the percentage of red blood cells in your body that have glucose stuck to them.

In most cases, normal A1c levels are 4% to 5.6%. The goal is to have your A1c as close to normal as possible, without having too many low blood sugar reactions. Your diabetes team will help you figure out what is the best target for you.

Be sure to do this test as often as your diabetes team orders it, about every 3 months.

Antibodies

These are proteins the body makes to protect itself from outside threats. These threats can include bacteria or viruses.

People get type 1 diabetes when their antibodies destroy the body's own beta cells that make insulin.

Aspart

This is the generic name of one kind of rapid-acting insulin. The branded (trade) name for aspart is Novolog. See rapid-acting insulin for more information.

Apidra

This is a branded (trade) drug name of one kind of rapid-acting insulin. The generic name for Apidra is glulisine. See rapid-acting insulin for more information.

Autoimmune disease

This is a disease caused by a problem in the body's immune (infection fighting) system that causes an attack on the body itself, rather than an infection. Type 1 diabetes is this kind of disease.

Basaglar

This is a brand drug name of one kind of basal insulin. The generic name for Basaglar is glargine. This long-acting basal insulin drug comes in one strength written as U100. See basal insulin and long-acting insulin for more information.

Basal insulin

You give this insulin with a shot once or twice a day. In most cases this insulin is only for patients on multiple daily shots. Basal insulin comes in different strengths shown as U100, U200 and U300. There are two types of basal insulin, long-acting insulin and intermediate acting insulin. See long-acting insulin and intermediate acting insulin for more information.

Basal insulins are:

Generic name	Brand name
NPH U100	Humulin (N) or Novolin (N) or ReliOn (N)
Degludec U100	Tresiba U100
Degludec U200	Tresiba U200
Detemir U100	Levemir
Glargine U100	Lantus or Basaglar
Glargine U300	Toujeo

Basal rate

Your body needs insulin on an ongoing basis even when you are not eating. The basal rate is the amount of insulin you need to give by shots or with an insulin pump. When the basal rate or basal insulin dose is set just right, the blood sugar does not go high or low when you are not eating.

For those using a pump, basal rates are in units per hour. You may see units per hour written as units/hour or u/hr. Typical rates are between 0.4 u/hr. and 1.6 u/hr. If you are using shots, you give yourself basal insulin doses in daily units, such as 15 units or 20 units. Your diabetes team will tell you what your basal doses should be.

Beta cells or ß -cells

Beta cells or ß-cells are cells that make insulin.

These cells are in the part of the pancreas called the Islets of Langerhans. See Cells for more information.

Blood glucose (BG) or Blood sugar

Blood glucose is also blood sugar.

This is the main sugar that is in the blood. This sugar is the body's main source of energy.

Bloodstream

The blood flowing through the circulatory system in the living body.

Blood sugar level

This means how much sugar is in the blood.

Blood sugar levels are measured in the U.S. in milligrams per deciliter, or mg/dl. In other countries, in milimoles, or mmol/l.

A normal range (for someone without diabetes) is about 70 to 100 mg/dl (3.9 to 5.6 mmol/L) before breakfast and below 140 mg/dl (7.8 mmol/L) after meals.

Blood sugar meter

This is a small, portable machine. People with diabetes use it to check their blood sugar levels.

After pricking the skin with a lancet, you place a drop of blood on a test strip. The test strip is placed in the machine. Then the meter, or monitor, shows the blood sugar level as a number on the digital display.

Blood sugar monitoring

This means checking your blood sugar level on a regular basis to manage diabetes.

You need a blood sugar meter or blood sugar test strips that change color when a drop of blood touches them. This is so you can check your blood sugar often.

Bolus

This is a burst of short or rapid acting insulin. It acts over a short period.

Most often, a bolus is to offset the blood sugar rise that happens after eating or drinking carbohydrates. It is also a correction dose to bring down a high blood sugar level back to normal.

The insulins for this are:

Generic name	Brand name
Insulin Regular	Humulin (R) or Novolin (R) or ReliOn (R)
Lispro	Humalog
Aspart	NovoLog
Glulisine	Apidra

Cannula

This is a small and flexible tiny piece of tubing. It stays under the skin once you remove the needle from the infusion set of an insulin pump.

Carbohydrate or Carb

Carbohydrates are also called carbs. Carbohydrates are one of the three main parts in foods:

1. Carbs
2. Fats
3. Proteins

They are the most important part of foods to control sugar. Carbohydrates are mainly sugars and starches. They have four calories per gram.

Carb bolus

This is a spurt of insulin that gets sent out quickly in the body to match carbs you are about to eat in a meal or snack. Most people use between 1 unit of rapid acting insulin for each 5 grams of carbs up to 1 unit for each 25 grams of carbs.

Carb counting

This means counting the grams of carbs in any food you eat or liquid you drink. This is a useful way to find out the amount of insulin you need to keep a normal blood sugar.

Carb factor or Carb Ratio or Insulin-to-carb ratio

This is the number of grams of carbs that one unit of insulin covers for a person. This varies from person to person. Your diabetes team will tell you your ratio.

Catheter

This is also pump tubing. Insulin goes through this plastic tube from the pump to the insertion set of a pump.

Cells

Cells are the smallest units of life. They are basic building blocks for all known life forms. Cells make up the parts of your body, like your skin, bones, heart, liver, or lungs. A person has over 10 trillion cells in their body.

Certified diabetes educator (CDE)

This is a health care professional with expertise in diabetes education. Trained and certified.

Continuous subcutaneous insulin infusion (CSII) or Insulin pump

CSII is the formal name for an insulin pump. See Insulin pump for more information.

Coma

This is a sleep-like state where a person is not conscious. Very high or very low blood sugar in people with diabetes can cause a coma.

Continuous glucose monitor (CGM)

A system consisting of a sensor, transmitter and receiver which determines subcutaneous or under the skin glucose levels every 1 to 5 minutes.

Correction bolus

A spurt of short or rapid acting insulin sent out quickly in the body. It is to bring a high blood sugar level back within a person's target range before a meal, after a meal, or at bedtime.

Correction factor or Insulin sensitivity factor

This is the fall in blood sugar level that one unit of insulin will produce. It is set by your diabetes team. It is often in the range of 25 to75 but can be more or less depending on what your body needs.

A correction factor of 50 is used as a starting point. This means that 1 unit of insulin will lower your blood sugar by 50 mg/dl (2.8 mmol/L). For instance, if your correction factor is 50 and your blood sugar is 200 mg/dl (11.1 mmol/L), you expect that giving 1 unit of insulin will lower your sugar by 50 points. Which means that after 1 unit of insulin, the blood sugar will fall from 200 mg/dl (11.1 mmol/L) to 150 mg/dl (8.3 mmol/L).

Dehydration

This is when a person does not have enough water in their body. This can come from drinking too little fluid. It can also come from losing too much body fluid when a person pees or urinates often, sweats, has diarrhea or vomiting.

Delayed-onset hypoglycemia

A drop in blood sugar levels that can happen many hours after intense exercise.

Diabetes team

A group of people who help you take care of your diabetes. You are the most important member of your team. The other people on your team can be:

- Doctor
- Nurse or nurse practitioner or physician assistant
- Diabetes educator
- Dietitian or diabetes educator
- Social worker
- Psychologist
- Eye doctor

These people are part of your diabetes team. Each one of them can help you take better care of your diabetes.

Diabetic coma

This is when a person with diabetes is not conscious and is in a sleep-like state. Very high or very low blood sugar in people with diabetes can cause this.

Diabetic ketoacidosis (DKA) or Ketoacidosis

This is a very serious condition where the body does not have the insulin it needs. This results in dehydration and the buildup of acids in the blood. This needs to be treated in the hospital. It is life-threatening.

Dietitian

A health care professional who tells people about meal planning, carb counting, weight control and diabetes management. A registered dietitian (RD) has more training. Dietitians can also be diabetes educators.

Degludec

This is a generic drug name of one kind of basal insulin. The brand name for degludec is Tresiba. This long-acting basal insulin drug comes in two strengths written as either U100 or U200. See basal insulin and long-acting insulin for more information.

Detemir

This is a generic drug name of one kind of basal insulin. The brand name for detemir is Levemir. This long-acting basal insulin drug comes in one strength written as U100. See basal insulin and long-acting insulin for more information.

Endocrinologist

A doctor with the title MD or DO trained to treat diseases related to glandular problems. This includes diabetes.

Exchange lists

These lists are one of the ways for people with diabetes can plan meals. The lists have different types of food and show the amount carbs, proteins and fats in a serving size. Knowing this information helps you know how much insulin you will need if you eat that food.

Extended bolus

The insulin pump sends out a bolus over a fixed period set by the patient. For example, the pump could be set to give the bolus dose over 2 or 3 hours instead of right away. In most cases, the pump gives the bolus right away. This is a way to give insulin over a longer period, which is good for foods that the body absorbs more slowly, such as foods with a lot of fat in them.

Fasting

This means not eating food or drinking any fluids except water.

Fasting plasma glucose (FPG) test

A lab test that people take after fasting for 8 to 10 hours. In most cases, people fast overnight and take the FPG test in the morning.

An FPG level of less than 100 mg/dl (5.6 mmol/L) is normal. A level of 100 to 125 mg/dl (5.6 to 6.9 mmol/L) means prediabetes. A level of 126 mg/dl (7.0 mmol/L) or more means a person likely has diabetes. When a level is over 126 mg/dl (7.0 mmol/L), there will be more tests to confirm if the person has diabetes

Fats

Fats are one of the three main parts of foods along with carbohydrates and protein. Fats occur alone as liquids or solids. This includes oils and margarines. They also can be a part of other foods.

Fats come from animals, veggies, nuts or seeds. Fats have 9 calories per gram.

Fiber

A kind of carb that passes through the digestive system intact. It does not raise blood sugar levels. It comes from plants.

Fiber adds bulk to your diet. It is very important for keeping your intestines healthy.

Food bolus

A dose of insulin that a person with diabetes takes before meals or snacks. This is to cover the expected rise in blood sugar from the food. Often, food boluses match the amount of carbohydrates in the food.

Glargine

This is a generic drug name of one kind of basal insulin. The brand name for glargine is Lantus or Basaglar or Toujeo. This long-acting basal insulin drug comes in two strengths written as either U100 or U300. See basal insulin and long-acting insulin for more information.

Glucagon—the hormone

This is a hormone. The alpha cells make it in the Islet of Langerhans in the pancreas. This hormone raises blood sugar levels. The opposite hormone to insulin that lowers blood sugar levels. In people without diabetes, the glucagon and insulin work together, to keep blood sugars normal. In people with diabetes, not enough glucagon is made to keep the blood sugars normal so they can fall too low.

Glucagon—the medication

Glucagon is given as a shot to help raise your blood sugar level. It is something that another person would give you if you were having a low blood sugar reaction and were not able to eat or drink sugar to bring it back up. The shot raises the blood sugar quickly. It does this by releasing sugar that is stored in the liver.

Glucagon emergency kit

A kit that has glucagon and a syringe. It is used to treat severe low blood sugar. Glucagon is a hormone that quickly increases blood sugar.

You need a prescription to get glucagon. It is a shot that someone else must give you. You should always have a glucagon kit at home, just in case. Be sure the one you have is not expired.

Glucose

A simple sugar that is in the blood. The body uses glucose for energy.

Glucose tablets

These are tablets that you chew and swallow. They are made of pure glucose. People take them to treat low blood sugar.

Glulisine

This is a generic drug name of one kind of rapid-acting insulin. The trade name for glulisine is Aprida. See rapid-acting insulin for more information.

Glycemic index (GI)

This is a method to classify foods, most of all carbs. The Index is based on how much the blood sugar level goes up after eating the certain food.

Glycogen

When you eat, carbohydrates they turn into a form of sugar called glycogen. This is a storage form of glucose in your liver and muscles. The glycogen is stored in your liver and muscles. When you have a low blood sugar, fast, or exercise, the glycogen turns into glucose and is release into the blood stream when you need it.

Gram

This is a small unit of weight in the metric system. People with diabetes use grams to weigh food.

Hormone

This is a chemical substance made by a gland or tissue. The blood carries it to other cells in the body. There, the hormone attaches to cells and causes them to do a certain job. For instance, when insulin attaches to a muscle cell it lets sugar go inside the cell. This is described as a "lock and key" effect. The hormone is the key and the cell is the lock. When the hormone insulin attaches to the cell, it opens the door and let's sugar inside.

Insulin and glucagon are hormones.

Humulin [N]

This is a brand drug name of one kind of intermediate-acting insulin. The generic name for Humulin [N] is NPH. See intermediate-acting insulin for more information. It is a cloudy insulin.

Humulin [R]

This is a brand drug name of one kind of short-acting insulin. The generic name for Humulin [R] is Insulin Regular. See short-acting insulin for more information.

Humalog

This is a brand drug name of one kind of rapid-acting insulin. The generic name for Humalog is lispro. See rapid-acting insulin for more information.

Hyperglycemia or High blood sugar

This is when a person has a higher than normal level of sugar in the blood. In most cases, this means a blood sugar level of more than 180 mg/dl (10.0 mmol/L).

Hypoglycemia or Low blood sugar or Insulin reaction

This is when a person has a lower than normal sugar level in the blood. In most cases, this means a blood sugar level of less than 70 mg/dl (3.9 mmol/L).

Symptoms can vary. They can include feeling confused, nervous, shaky, drowsy or moody. They can also include sweating, headaches or numbness in the arms and hands.

If it is not treated, severe low blood sugar can cause loss of consciousness, convulsions, or even death.

Infusion set

This is part of an insulin pump. This set transfers insulin from the pump through an infusion line to below the skin. The set includes the tubing, tubing connector, insertion set, cannula and adhesive.

Infusion site or Insertion site

This is the area on the body where someone who uses an insulin pump inserts the cannula or needle.

Injection or Shot

This is when someone inserts liquid medication or nutrients into the body with a syringe. A person with diabetes injects insulin just under the skin, into what is subcutaneous tissue. Subcutaneous means below the skin.

Injection sites

These are places on the body where people most often inject insulin.

Injection site rotation and Infusion site rotation

The place you change on the body where you inject insulin or put the infusion sites. When you rotate, it prevents lipodystrophy. This means an abnormal build-up of fat under the skin.

Insertion set

The part of the infusion set that a person inserts through the skin. It may be a thin or a large metal needle. When the person removes the needle, it leaves a small Teflon catheter or cannula under the skin.

Insulin

This is a hormone made by beta cells in the Islet of Langerhans in the pancreas. The body sends out insulin when blood sugar levels go up, for instance after eating a meal. Its job is to lower blood sugar levels to normal.

Insulin lets sugar go into cells. Sugar gives your cells the energy to live. Without insulin, the sugar stays on the outside of the cells and goes up to very high levels in the blood. Without insulin, you would die because your cells would have no energy to live.

When your body cannot make its own insulin, there are different types for insulin drugs you can take. Your diabetes team will figure out the best insulin for you. The table below explains about the different types of insulin. You can also look up the types and names of insulin in this glossary for more information.

Generic Name (Brand Names)	**Onset —** Time for insulin to reach blood-stream	**Peak —** Period when insulin is most effective	**Duration** – How long the insulin works
RAPID-ACTING INSULIN			
Lispro (Humalog)	About 15 to 30 minutes	About 30 to 90 minutes	About 3 to 5 hours
Aspart (Novolog)	About 15 to 30 minutes	About 30 to 90 minutes	About 3 to 5 hours
Glulisine (Apidra)	About 15 to 30 minutes	About 30 to 90 minutes	About 3 to5 hours
SHORT-ACTING INSULIN			
Insulin Regular [R] (Humulin [R], Novolin [R] or ReliOn [R]	About 30 minutes to 1 hour	About 2 to 5 hours	About 5 to 8 hours
INTERMEDIATE-ACTING INSULIN AND CALLED A BASAL INSULIN			
NPH [N] (Humulin [N], Novolin [N] or ReliOn [N]	About 1 to 2 hours	About 4 to 12 hours	About 18 to 24 hours
LONG-ACTING INSULIN AND CALLED A BASAL INSULIN			
U100 Glargine (Basaglar or Lantus)	About 1 to 1 and a half hours	Maybe slight peak at 12 hours in some people; no peak time in others	About 20 to 24 hours
U300 glargine (Toujeo)	About 1 to 1 and a half hours	No peak	About 28 to 36 hours
Detemir (Levemir)	About 1to 2 hours	About 6 to 8 hours	Up to 24 hours
Degludec (Tresiba)	About 30 to 90 minutes	No peak time	About 42 hours
PRE-MIXED INSULIN			
	About 30 minutes	About 2 to 4 hours	About 14 to 24 hours
50% NPH/50% regular insulin Humulin 50/50	About 30 minutes	About 2 to 5 hours	About 8 to 24 hours
70% long acting/30% rapid acting insulin Novolog 70/30	About 10 to 20 minutes	About 1 to 4 hours	Up to 24 hours
75% long acting/25% rapid acting insulin Humalog mix 75/25	About 15 minutes	About 30 minutes to 2 and a half hours	About 16 to 20 hours

Insulin adjustments

A change in the amount of insulin a person with diabetes takes. Based on factors like meal planning, activity levels and blood sugar levels.

Insulin pen

A device that injects insulin. It looks like a pen for writing.

There are two kinds of insulin pens:

1. Prefilled pen with insulin that is disposable
2. Reusable pen that holds replaceable cartridges of insulin

To inject the insulin under the skin, you need to screw on a needle to the top of the pen.

Insulin pump

This is a small machine about the size of a small cellphone. It is computerized. You can program it to deliver a constant amount of basal insulin and give a bolus of insulin for a meal or high blood sugar. It takes the place of insulin shots.

A pump sends out fast-acting insulin through a plastic catheter, or tube. A Teflon infusion set or a small metal needle connects to the tube. You insert the set or small needle through the skin. The body gradually absorbs the insulin into the bloodstream.

Insulin Regular

This is a generic drug name of one kind of short-acting insulin. The brand name for insulin Regular is Humulin [R], Novolin [R], or ReliOn [R]. See short-acting insulin for more information.

Insulin sensitivity

This is a term to describe how the body reacts to insulin. Everyone reacts differently whether your body is making its own insulin or you must get insulin by shots or a pump. If a person is sensitive to insulin, it means that a smaller amount will lower the level of sugar in the blood. If a person is not sensitive to insulin it means she or he will need more insulin to lower the level of sugar in the blood. When a person needs more insulin to lower blood sugar, they are more resistant to insulin.

Insulin-to-carb ratio

A formula you use to match the dose of insulin to the amount of carbs you eat and drink.

Intermediate-acting insulin

This is a type of basal insulin. It controls blood sugar for about half the day or overnight. This insulin starts working in about 1 to 2 hours. It works best in your body at 4 to 12 hours and then starts fading. How it works is different for each person.

NPH is the generic name of the drug. Humulin [N], Novolin [N], or ReliOn [N] are brand names.

This insulin looks cloudy. You can mix it with regular or rapid-acting insulin in a syringe. See basal insulin, regular insulin and rapid-acting insulin for more information.

Islets of Langerhans

Small islands of cells scattered throughout the pancreas that make hormones. They have beta-cells, which make insulin and alpha cells which make glucagon. Other cells include delta cells, PP cells and Epsilon cells which make other hormones.

Ketoacidosis—See Diabetic ketoacidosis

Ketones

The body releases these acids when body fat breaks down.

Ketones can build up to dangerous levels in the absence of insulin. This is because the body is not able to break down sugar as fuel.

A urine or a blood test can measure them. A urine dip stick is usually used.

Lancet

A spring-loaded device that you use to prick the skin with a small needle. You do this to get a drop of blood to check your blood sugar.

Lipodystrophy

This is when the fat tissue below the skin becomes swollen, hard or forms dimples. It also limits the body from absorbing insulin if you inject in that area.

Giving yourself many shots into the same area of skin or putting the pump cannula in the same site time after time often causes this.

Lantus

This is a brand drug name of one kind of basal insulin. The generic name for Lantus is glargine. This long-acting basal insulin drug comes in one strength written as U100. See basal insulin and long-acting insulin for more information.

Levemir

This is a brand drug name of one kind of basal insulin. The generic name for Levemir is detemir. This long-acting basal insulin drug comes in one strength written as U100. See basal insulin and long-acting insulin for more information.

Lispro

This is a generic drug name of one kind of rapid-acting insulin. The brand name for lispro is Humalog. See rapid-acting insulin for more information.

Long-acting insulin

This type of basal insulin controls blood sugar consistently for an entire day or longer. After injecting, it begins working many hours and can stay in the bloodstream up to 42 hours. How long it works can be different for different people. It may start weakening a few hours earlier for some, while it may work a few hours longer for others. It comes in different strengths shown as U100, U200 and U300.

See basal insulin to learn more.

Long-acting insulins are:

Generic name	Brand name
Degludec U100	Tresiba U100
Degludec U200	Tresiba U200
Detemir U100	Levemir
Glargine U100	Lantus or Basaglar
Glargine U300	Toujeo

Medical insurance or health insurance

This is a plan that a person signs up for that pays for some or all the costs of medical and surgical care. These plans differ from state to state. Sometimes people must buy their own insurance. Other times they get it from their job or the government. Government plans include Medicare and Medicaid. In some states, the plan may have its own name. For instance, in California it is Medi-Cal.

Multiple daily injections (MDI)

This is a schedule where you give yourself many insulin shots each day. In most cases, you use a long-acting insulin along with shots of rapid-acting insulin before each meal or snack. Some people also use intermediate-acting insulin. See long-acting, intermediate-acting and rapid-acting insulin for more information.

Novolin [N]

This is a brand drug name of one kind of intermediate-acting insulin. The generic name for Novolin [N] is NPH. See intermediate-acting insulin for more information. It is a cloudy insulin.

Novolin [R]

This is a brand drug name of one kind of short-acting insulin. The generic name for Novolin [R] is Insulin Regular. See short-acting insulin for more information.

NPH

This is a generic drug name of an intermediate-acting insulin. The brand names for NPH are Humulin [N], Novolin [N] or ReliOn [N]. See intermediate-acting insulin for more information.

Occlusion

The infusion set or infusion site clogs or blocks. This can stop or slow insulin delivery.

In most cases, an occlusion happens when the cannula gets pinched, kinked or dislodged. The cannula blocks when insulin crystals form.

An occlusion can be partial. That means it only reduces, but does not stop the flow of insulin. Or it can be complete. That means no insulin gets through the tubing.

Pancreas

This gland is near the stomach. It is deep in the center of the body. It releases insulin and other hormones. It also releases digestive enzymes.

Pharmacist

This health care professional prepares and gives medicine to people. She or he also gives information on medicines.

Pre-mixed insulin

In most cases, people with diabetes take these two or three times a day before a meal. They are insulins where a shorter and longer acting insulin mixed. In most cases, they look cloudy. The numbers after the name describe how much long-acting and short-acting insulin is in the mix. They have many names, including:

- Humulin 70/30 (70% long acting/30% short acting insulin)
- Novolin 70/30 (70% long acting/30% short acting insulin)
- Novolog 70/30 (70% long acting/30% rapid acting insulin)
- Humulin 50/50 (50% long acting/50% short acting insulin)
- Humalog mix 75/25 (75% long acting/25% rapid acting insulin)

Proteins

These are one of the three main parts of foods along with carbohydrates and fats. Proteins are made of amino acids. Foods like milk, meat, fish, and eggs have protein.

The body burns proteins more slowly than fats or carbohydrates. There are four calories per gram of protein.

Rapid-acting insulin

If you give yourself shots, you will give both long-acting insulin and short or rapid-acting insulin. The rapid-acting insulin covers insulin needs for meals. You give yourself a shot at the same time you eat.

If you use a pump, you only use rapid acting insulin. The pump gives out rapid-acting insulin in small amounts on an ongoing basis. You also program your pump to give you a bolus of insulin for meals. See long acting insulin and bolus for more information.

Rapid acting insulins are:

Generic name	Brand name
Lispro	Humalog
Aspart	Novolog
Glulisine	Apidra

Reservoir, syringe, cartridge

This container holds the fast-acting insulin inside a pump.

Self-management

In diabetes, this means the ongoing process of managing diabetes. It includes when you:

- Plan meals
- Plan physical activity
- Check blood sugar
- Take diabetes medicines
- Handle diabetes when you are sick
- Handle low and high blood sugar
- Manage your diabetes on trips

People with diabetes design their own self-management treatment plan. They do this with the support of their diabetes team. This includes doctors, nurses, dietitians, pharmacists and others.

Sensitivity factor

This is the amount that a single unit of insulin lowers the blood sugar level in a person. Often this is first set at 50. But based on how a person reacts to insulin it can change.

A lower number, such as 25, means that the person is less sensitive to insulin. A higher number, such as 75, means that the person is more sensitive to insulin.

Sharps container

This is a container where you get rid of used needles and syringes. It is often made of hard plastic so that needles cannot poke through.

Self-monitoring of blood glucose (SMBG)

This is when you check your blood sugar with a blood sugar meter.

Short-acting insulin

Short-acting insulin covers insulin needs for meals. You give yourself a shot about 30 minutes before you eat. Short-acting insulin brand names are Humulin [R], Novolin [R] or ReliOn [R]. The generic name is regular insulin.

Starch

This is a type of complex carbohydrate. Some examples are bread, pasta and rice.

Sugar

A kind of carbohydrate that most often has a sweet taste. This includes glucose, fructose and sucrose. In the diabetes world, the word sugar is often used instead of glucose. Blood glucose and blood sugar mean the same thing.

Sugar alcohol

This is a sugar substitute. It has simple sugars with an alcohol molecule attached to them. This lowers the calorie content. It also delays the effect on blood sugar levels.

Syringe

This is a device used to inject medication or other liquids into body tissues. The syringe for insulin has a hollow plastic tube with a plunger inside. It also has a needle on the end.

Team management

This is an approach to treat diabetes where a team provides medical care. See Diabetes team for more information.

Total daily dose (TDD)

The total amount of insulin a person uses in a day. It means adding all the insulin doses: faster and slower acting insulin together. You use the TDD to help figure out the basal rate, carb factor and correction factor.

Tresiba

This is a brand drug name of one kind of basal insulin. The generic name for Tresiba is degludec. This long-acting basal insulin drug comes in two strengths written as either U100 or U200. See basal insulin and long-acting insulin for more information.

Toujeo

This is a brand drug name of one kind of basal insulin. The generic name for Toujeo is glargine. This long-acting basal insulin drug comes in one strength written as U300. See basal insulin and long-acting insulin for more information.

Type 1 Diabetes

In Type 1 Diabetes, the pancreas makes little or no insulin. This is because the beta cells in the body that make insulin are destroyed.

It is an autoimmune disease. This is caused by a defect where the body's internal defense system attacks a part of the body itself.

Most often, this type of diabetes appears suddenly. It is more common in people younger than 30. But it can appear at any age.

The ways to treat it are:

- Give daily insulin shots or use an insulin pump
- Count carbohydrates
- Exercise regularly
- Self-monitor blood sugar levels each day through finger sticks or by using a continuous glucose monitoring (CGM).

Units of insulin

This is the basic measure of insulin. U-100 insulin means 100 units of insulin per milliliter (mL) or cubic centimeter (cc) of solution.

It is a way to describe the concentration of insulin. In the United States, there are U100, U200, U300 and U500 insulins.