

Pocket Guide

Continuous Glucose Monitoring

Connecting the Dots



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Getting Started

Welcome!

If you have diabetes or are caring for someone with diabetes and want more information on glucose data, this guide is for you.



Who Might Benefit from a Continuous Glucose Monitoring system (CGM)?

- People with type 1 diabetes taking insulin via injections or pumps
- People with type 2 diabetes taking insulin via injections or pumps and/or have frequent episodes of very low blood glucose
- People who have trouble recognizing the symptoms of low blood glucose (hypoglycemia unawareness)
- People who often have wide glucose fluctuations
- People who would like to have more information or improve their daily glucose numbers

A CGM Can Help You:

- Understand glucose trends so you can better manage eating, exercise and medication
- Provide more comfort at night and managing hypoglycemia
- Understand importance of taking medication and the timing of medication

BGM or CGM

You are likely familiar with the most common way to check blood glucose levels: blood glucose monitoring (BGM) using a blood glucose monitor.

A blood glucose monitor measures the amount of glucose in a drop of blood, usually taken from a finger. This process is commonly known as a “fingerstick.” Fingersticks may need to be done several times a day. The results show whether blood glucose is in range at the time performed. This glucose value is often used to make decisions about how to modify diet, activity, insulin, or the dosages of other medications.





Blood Glucose Monitors (BGMs)

BGMs are a tried and true way for people with diabetes to measure blood glucose in a **single moment in time**. This requires a **fingerstick** using a test strip and BGM to understand glucose management.

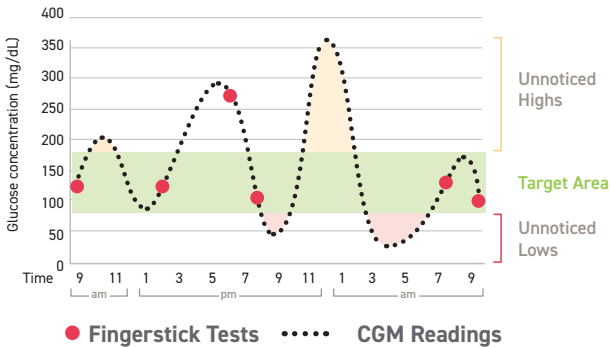


Glucose meters can be uploaded to a computer and generate reports. More detailed insights require more fingersticks throughout the day and sometimes at night to help manage your diabetes. Glucose meters and strips are inexpensive and usually covered by insurance.

Continuous Glucose Monitoring Systems (CGM)

CGM is a newer way for people with diabetes to **continuously measure glucose** day and night. Most CGMs do this by self-insertion of a tiny sensor that **you wear for up to 14 days**. They come with an easy-to-use inserter and the sensors have build-in adhesive to help it stick to your skin. Some CGMs last longer but require the sensor to be placed under the skin by a trained professional. CGMs **require little to no fingersticks** but do require you to have the receiver/reader or a smart phone nearby.

CGMs **connect the dots** traditional BGMs leave unconnected. Reports provide **detailed insights on trends** for day-to-day decisions and for discussions with your provider. CGMs can also **automatically collect and share** glucose data with a person of your choice and can **predict dangerous highs and lows** before they happen to help you stay in target.



Things to Consider

1. CGM provides more information.

A blood glucose meter gives you a snapshot in time, telling you exactly where your blood glucose is at that moment. It does not connect the dots of where it has been or where it is going. CGM can give you more of the story, showing you current directions, predictive directions, and trends over time.

2. Like the caboose trails behind the train engine, CGM readings are slightly behind blood glucose readings.

Sensor glucose results may be slightly behind blood glucose readings—that is, a sensor glucose reading tells you what your glucose was about a few minutes earlier. This should not generally affect your ability to use sensor glucose to make decisions about your treatment, but it's good to know in situations when glucose can change rapidly, such as during exercise or just after taking a dose of insulin to correct a high glucose reading.

3. You will likely still need fingersticks.

Some CGM systems need to be calibrated to maintain their accurate results. For this, fingerstick readings are needed. You may be advised to do fingersticks on certain other occasions, such as when your sensor is warming up (usually for two hours after insertion), your sensor readings are low or high, if you have symptoms of low or high blood glucose, or if you suspect readings are off for some reason.

About CGM

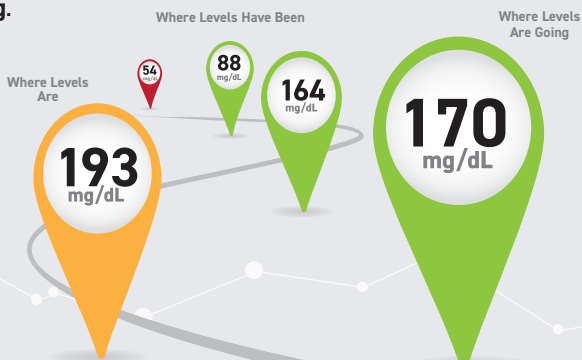
Learning About CGM

It is likely that you've heard the term CGM but may not be sure what it's all about. Let's break down what you need to know.

A continuous glucose monitoring system (CGM) is a device that allows for constant monitoring of blood glucose (sugar) levels. CGM gives you, as a person with diabetes (or a person caring for someone with diabetes), an easy, at-a-glance way to access your blood glucose (sugar) levels 24 hours a day.

As many people with diabetes know, checking blood glucose (sugar) is a critical piece of diabetes management. CGM systems have been shown to help people keep glucose levels stable, reducing episodes of both low blood glucose (hypoglycemia) and high blood glucose (hyperglycemia), and decreasing the risk of complications from diabetes.

Unlike traditional blood glucose meters that give you blood glucose results for one moment in time, CGM tells you where your current glucose levels **are**, where they've **been**, and what direction they are **going**.





How CGM Works

Most of us are familiar with traditional glucometers, which require a drop of blood from under the skin or from a fingerstick. CGM continuously checks the glucose level in the thin layer of fluid that surrounds the body's cells under the skin, even while you sleep.

The components of the CGM system work seamlessly to provide the information you need. Most CGM systems include a sensor, transmitter, and receiver that work together to capture glucose data. Other CGM systems require a reader that you use to scan the sensor at least every eight hours so data is not lost. A smartphone app can be also used to scan the sensor so you do not need to carry an additional device.

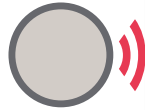
THE SENSOR:

This is a tiny water-resistant device that measures interstitial fluid glucose levels almost continuously and sits partially beneath the skin. Some sensors are the size of an eyelash and are implanted completely beneath the skin under a doctor's supervision. The sensor lasts for a period of time (which varies depending on the system) before needing to be replaced.



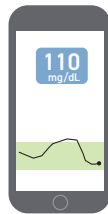
THE TRANSMITTER:

This is a rechargeable or replaceable water-resistant transmitter that sends data wirelessly from the sensor to the receiver or a compatible smart device. It transmits automatically or only when you scan the sensor. The glucose information is transmitted painlessly and can be transmitted through clothing. The transmitter may be separate or can be built in with the sensor.



THE RECEIVER OR READER:

This is a rechargeable stand-alone device about the size of a cell phone or smaller, or it can be an app on your smartphone. The information is displayed as a graph, continuously updated with new glucose data. The information on the screen also includes trend arrows that show the direction glucose is heading and reports that show current and past data. All of this information can help you and your healthcare provider make management decisions.



Connecting the Dots with Data

CGM systems connect the dots between glucose readings, providing current and historical data by capturing hundreds of glucose readings a day.

The data are presented with clear visuals to help better understand the direction your glucose levels are trending and connect the dots with predictions about what the numbers mean for you. These give you and your healthcare providers information that can be used to determine better ways to manage your diabetes.

A New Look at Diabetes Data

In addition to collecting detailed information about your glucose numbers, a CGM system also lets you add notes about food, exercise, medicines, illness, and stress—anything that may affect your glucose levels. Your input with these day-to-day factors helps you put your glucose levels in context and empowers you as an active participant in your diabetes management. All the data from your CGM—both your glucose readings and any notes—can be downloaded as files or linked remotely to your provider's office for review, a mobile app, or computer. This information lets you and your healthcare provider see trends over time and helps in discussing setting ideal and realistic targets and goals.

Measuring Success: A1C and Time-in-Range

Understanding your glucose data is one of the keys to improving your diabetes management. Most people with diabetes have a blood test called a hemoglobin A1C (or simply A1C) once every three to six months. The results correspond with your average blood glucose over the past two to three months and offer a "big picture" sense of how well blood glucose (sugar) is being managed. But the A1C test does not capture how much time blood glucose is above or below your target range.

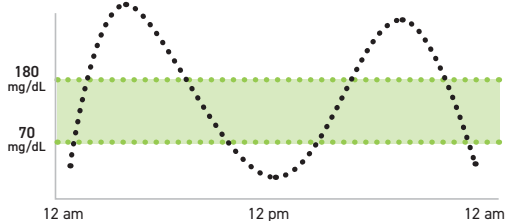
CGM offers a new way to measure how well you are hitting your targets. Your time-in-range (TIR) refers to the percentage of time that your blood sugar is within a specified target range. This target range can vary but for most people this is between 70 and 180 mg/dL. Having information about what percent of your readings are below, in, and above your target range helps your provider collaborate with you to decide any changes in medication or lifestyle to help you reach your goals. In general, an ideal TIR is >70%.

These details can be helpful in assessing or adjusting your treatment plan.

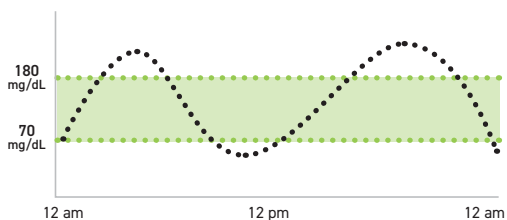
Setting Time-in-Range Goals

Time-in-range or target ranges are planned with your healthcare provider. It is recommended for most people with diabetes to target blood glucose levels between 70 and 180 mg/dL. This can vary in certain circumstances, such as during pregnancy (where tighter control is preferred) or in very young children or older individuals (when targets may be increased to avoid hypoglycemia). The recommended goal for time-in-range is 16.8 hours of the day (70%) or longer. This corresponds with the American Diabetes Association's recommended goal that hemoglobin A1C be 7% or lower.

50% TIME IN RANGE



70% TIME IN RANGE



Seeing Trends Clearly

CGM systems give you a number for each reading and provide visual feedback as well. They can alert you when your glucose levels are rising or falling so that you can take action before you develop symptoms or require treatment. This can help to prevent dangerous blood glucose levels instead of simply reacting to them.

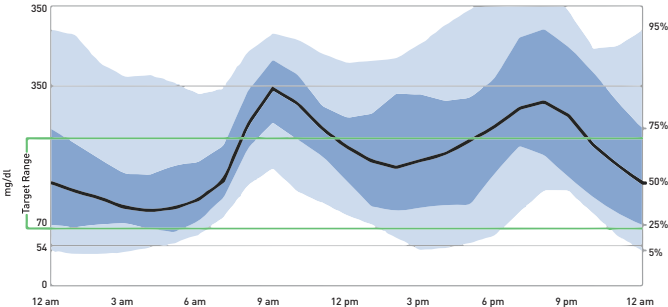
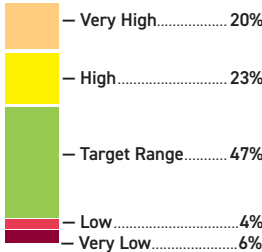
Trend arrows tell you, at a glance, whether your glucose is rising or falling and how quickly it's changing. In addition, CGM analysis software can produce graphs, which give you more details about your numbers and help compare your current reading to previous ones. This can help show the effects of certain food, medicine, stress, and exercise on your glucose levels and can help you make decisions about your treatment plan.



CGM Reports

All CGM systems produce standardized reports also known as an ambulatory glucose profile. This information includes statistics, summaries, and graphs that show your time-in-range and glucose patterns, and help you translate your numbers into an overview for easy and quick interpretation.

Sample report image on a tablet:



Getting Alerts

Many CGMs provide an audible beep or vibratory alarm to alert you when you need to take action to correct your glucose level. Alerts may happen when your glucose result is:

- Above your target range
- Below your target range
- Predicted to go low soon
- Signal loss



Predictive alerts provide a warning about potentially high or low blood glucose (sugar) allowing you to take action before it becomes an emergency.

Some CGM systems allow you to turn the alert on or off. Always check with your provider about using the alert on your system.

A Day in the Life with CGM

Meg, a 32-year-old school psychologist, uses her CGM system to manage her diabetes, improve her health and quality of life and make decisions about food, insulin, and exercise throughout the day. She uses the trend arrows from CGM to help with these predictive decisions. The trend arrows help her see where her blood glucose has been and where it is going.



Before breakfast



Meg sees: Her fasting glucose is within the range advised by current guidelines of 70-180 mg/dL, although it is a little higher than her normal readings. The trend arrow shows her glucose is stable, indicating that the reading is not a cause for concern. Meg decides to have a high protein breakfast, since her glucose is normal but higher than usual. She takes her usual dose of insulin.



After breakfast (Two hours after beginning breakfast)



Meg sees: Her glucose is within range for two hours after a meal (less than 180 mg/dL), and the trend arrow shows that her glucose is falling slowly. Meg does nothing because her glucose is currently in range. She knows glucose normally rises after a meal, but then begins to fall as more time passes after eating.



Before lunch



Meg sees: Her glucose is high, and the trend arrow indicates it is rising slowly. Since her glucose is high and increasing, she takes enough insulin to cover the meal and a correction.*



After lunch *(Two hours after beginning lunch)*



Meg sees: Her glucose is high, but the trend arrow shows that it is falling significantly. Meg's reading is higher than the recommended range for 2 hours after beginning a meal, but she does not take a correction dose of insulin, since her glucose is falling. If she took a correction dose, the result could be "insulin stacking"—or an overcorrection—that might bring on low blood sugar. Meg decides to check her CGM reading again in 30 minutes since the trend arrow indicates her glucose may be falling rapidly.



Before exercise



Meg sees: Her pre-exercise glucose is in range, but the trend arrow indicates it is falling slowly. Since she knows exercise can dramatically reduce her glucose levels, she decides to have a serving of fruit with 15 grams of carbohydrates before beginning her daily 30-minute walk. Meg also takes a snack with her and resolves to check her CGM system during her walk to make sure her glucose does not get too low (below 70 mg/dL). If her CGM system indicates low glucose, or she gets an alert indicating hypoglycemia, she will have a quick-acting carbohydrate snack (with 30 grams of carbs), such as a juice box.



Before dinner



Meg sees: Her glucose is within range but falling significantly 30 minutes after exercise. Since she plans to have dinner right away, she will reduce her usual pre-meal insulin dose to keep her glucose levels in range. She will also check her levels carefully 30 minutes and 1-2 hours after she eats.



Before bed



Meg sees: Her glucose is in the low normal range and is falling slowly, so she decides to have a snack with yogurt and fruit before going to bed. She also makes sure she has turned on her CGM system alert for hypoglycemia, since she knows falling glucose at night can be dangerous.

Living with a CGM System

Patient Stories and Insights

A summary of interviews carried out by the
Hormone Health Network.





Jonathan - A 31-year-old medical fellow with diabetes mellitus type 1 (T1D) for 20 years. Has been using CGM for 6.5 years.

“There’s a lot of stereotypes about what people with diabetes can and can’t do. But I don’t let diabetes limit me and CGM helps that.”

I love being so active but keeping up with my diabetes can be tough when I’m on the move. Before CGM, I was testing 8-10 times every day and still not catching all the highs and lows. Now, I can keep living life with more confidence in what I’m doing. I’m still not perfect with my diabetes, even with CGM, but I have a confidence and freedom that I didn’t have before.

Mila - A 30-year-old entrepreneur with type 2 (T2D) for over 4 years. Has been a CGM system for 8 months.

“CGM has brought my family together, I wish I had it sooner.”

I did not want to stop my life to constantly check with fingersticks, and thought, there has to be a better way. I reached out to someone on social media who told me about their positive experience with CGM. Once I switched, my life changed— it was less work, less manual calculations, less testing, and a lot more confidence! I was even able to convenience my mom who struggled with undermanaged diabetes to switch as well, now our family is able to support each other in a more caring way. Using CGM has changed my life, I only wish I had it sooner.



Melissa - A 47-year-old with diabetes mellitus type 1 (T1D) for 37 years. Has been using CGM for 6-8 years.

“CGM makes life with diabetes easier; it gives me back some normalcy in my chaotic life.”

When I started using CGM, I loved that I could look down at any moment and see the bigger picture of what's going on without having to get a meter out and compare numbers. CGM made diabetes less of a focal point in my life—less irritating. The reports also help me make little changes like when I saw nighttime highs and realized I had to cut out the late-night snacking. Or like unexpected lows I kept getting a couple hours after playing tennis. I share the CGM data with my husband even while he's deployed. One night, he saw I was low and called to check on me all the way from Jordan. Amazing!



Joe - An 86-year-old former barber with diabetes mellitus type 2 (T2D) for 15 years. Has been using CGM for 6 months along with insulin and oral medication.

“I feel safer with CGM; it lets me be independent. I don't have to always do fingersticks to know what's going on (important as a clarinet player).”

I've only been using CGM for six months now and I'm still learning about the trend arrows, but it's really easy for me to use and helps me decide what to do and what not to do. Now I can make better choices about when and what food I eat and whether I need some juice before I go out on a walk or bike ride. I don't get lows like I used to and I'm not afraid to eat. I can tell my family what's going on much easier without so many fingersticks. I just feel safer with CGM.



Diana - A 48-year-old nurse with diabetes mellitus type 1 (T1D) for 38 years. Has been using CGM for 8 years.

“Diabetes is so tedious. CGM that makes it a little easier. Try it once and see what happens. You won’t be locked into it.”

When my doctor suggested CGM, I thought, “why not give it a try”. That’s when CGM became my reminder in the background giving me that extra piece of information I needed to keep on track. The trend arrows are great to know what’s going on in the moment and the reports help me adjust my insulin with my doctor. I wish I had CGM sooner. My advice if you’re curious, try it once and see what happens. You won’t be locked in and it might be the extra info you’re looking for.



Liz - A 29-year-old researcher and health coach with diabetes mellitus type 2 (T2D) for over 6 years. Has been using a CGM system for 8 months

“I feel like I let myself and my body down, but my persistence help me find peace of mind with CGM”

My diabetes was discovered by mistake. I passed out after a workout and thought it was dehydration. Once diagnosed, I struggled to manage my blood glucose and the medications made me sick. I feel like I let myself down and my body down. My brother suggested using a CGM system. The difference with managing my diabetes using a CGM has been night and day– as a scientist I love the graphs and data CGM provides. I recommend to anyone considering CGM– Find out all your options, ask questions, see what works best for you.



Anne - A 38-year-old dance instructor with diabetes mellitus type 1 (T1D) for 22 years. Has been using CGM for 5 years.

"I felt like I was already in control, but I wish I knew how much better it could be with CGM."

I've had T1D for over 20 years but have only been using CGM for about four years now and it's been a complete game-changer. The constant monitoring helps me stay in control. The trend arrows and trend reports are also super helpful. At first, I didn't try CGM because I felt like I was already in control and didn't want something attached to me all the time. But now, I can't imagine not having it and I wish I knew how much better it could be with CGM.



Tiana - A 25-year-old dietitian with diabetes mellitus type 1 (T1D) for 4 years. Has been using CGM for 3 years.

"I'm much more in control of my diabetes than having my diabetes in control me."

For the first year of having diabetes, I really just wanted it to go away. I felt like having something connected was going to be a constant reminder of diabetes and I hated fingersticks because I was having to check so many times a day. Now I look at my blood glucose using the CGM data on my phone. Now, I get a lot more data and understand a lot more of what's going on than I get from A1C. I just feel more in control with CGM, more time in range and on track.



Randy - A 43-year-old with a career in the service industry with diabetes mellitus type 1 (T1D) for 38 years. Has been using CGM for 1.5 years.

“With diabetes, you have to think about what’s going on all day every day. With CGM, I don’t have to think as much and that’s a good thing.”

When I got the chance to try CGM, I did. It’s been a wonder tool so far to help with tweak basals and carb ratios and to really level things out for me. Seeing the trends in my path during the day helps me see where I’m going before I get there so I get ahead of the problems. That makes life with diabetes easier and that means more time with my son and less time trying to figure out what’s going on.

Michele - A 57-year-old genealogy researcher with diabetes mellitus type 1 (T1D) for 53 years. Has been using CGM for 2 years.

“I’ve had diabetes for over 50 years. I’ve been mostly in control but as I get older with my diabetes, I’ve been wanting to fine-tune my control to avoid complications.”

I’ve always felt I had decent control. But as I get older with my diabetes, I’ve been wanting to fine-tune my control more and more. Long-term complications are on my mind and I want to have the best control possible to avoid them. CGM has been a great tool to fine-tune what I do. CGM helps me spend less time with swinging blood sugars. I also get to see the big picture of what’s going on. CGM catches those things I would have missed otherwise.

Start the Conversation

CGM provides a whole new way to monitor and manage glucose. However, keep in mind that CGM won't cure your diabetes or directly solve problems with glucose fluctuations without thoughtful interpretation and consideration.



Considering CGM?

Things to Think About

CGM is only a tool to help you and your team see more clearly what adjustments should be made to your diabetes medications and/or insulin regimen.

Use the device reference chart and consider the answers to the questions below to assess your needs. Be ready to discuss the answers with your healthcare provider during your next visit.

Assess Your Needs

- Are you tired of multiple fingersticks every day?
- Is my current approach to glucose control working?
 - Have I had frequent episodes and/or severe low blood glucose?
 - Do I have stress or worry about low or fluctuating blood glucose levels?
 - Would additional alarms or alerts about my blood glucose levels be helpful?
- Am I able to maintain glucose control at mealtimes and during exercise?
- What is my comfort level with technology?
- How could using CGM improve my control or quality of life?
- What costs are associated with using CGM?
 - Does my insurance cover this?
 - Does my insurance have a “preferred system”?

You're in Charge of Your Future!

Hopefully by now, we have boosted your confidence and understanding of CGM. We know connecting the dots about what is best can be overwhelming; talk with your healthcare team about CGM and the options that you have. Here are some questions to get your started:

- Would CGM give me information I can use to manage my diabetes better?
- What system or systems might be best for me?
- Can a CGM system help me reach my glucose targets?
- How would using a CGM system change how I manage my insulin at mealtime, bedtime, and during exercise?
- How do I share the data from my CGM device with my healthcare team?
- Are there medicines I need to avoid when using CGM?
- Does my physician offer samples of any of the CGM systems that I can try?
- Is there training available on how to use the system?



Acknowledgments

The Endocrine Society and its affiliate, Hormone Health Network, is a global community of physicians and scientists dedicated to accelerating scientific breakthroughs and improving patient health and well-being.

The information provided in this guide does not replace the advice of a trained medical professional. For personalized diabetes treatment information, please consult with your healthcare provider.

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Connecting the dots through collaboration

