

# Continuous Glucose Monitoring:

What is CGM, How Does it Work, and Which Device is Right for Me?



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## What is a continuous glucose monitor?

Continuous glucose monitors (CGMs) measure the body's glucose levels in real-time by sensing the glucose present in tissue fluid, also known as interstitial fluid. CGMs are particularly useful after meals and overnight, as they can alert you when glucose levels drop below or rise above a predetermined threshold. CGMs provide a good way to monitor Time in Range, or the percentage of time a person spends with glucose levels in their target range.

## BGM vs. CGM

While a blood glucose meter (BGM) provides a measure of your blood sugar level at a specific moment in time (with the prick of a finger), CGMs typically provide an updated glucose level every one to five minutes – that's at least 288 times per day!

Think of a BGM as a single photo, or a blood sugar “snap shot.” CGM, on the other hand, is like a video, providing a constant stream of glucose levels, trends, and overnight data.



## Exercising with a CGM Device

There can be a difference between your CGM readings and BGM measurements due to what we call a “lag.” Changes in glucose levels in the blood are not seen as quickly in the interstitial fluid. At rest, the interstitial glucose lags about five minutes behind the blood glucose; in situations when glucose changes rapidly, such as during exercise, lag time can increase up to 24 minutes. This means that your CGM readings aren’t always going to be accurate during exercise.



## How do CGM devices work?

A CGM can either be transcutaneous (meaning it goes through your skin) or implanted under the skin. Continuous glucose monitoring devices require three basic parts:

### Sensor

Monitors real-time glucose levels under your skin. Inserted under the skin, sensors are normally worn for 7-14 days, depending on the device. Implanted sensors last longer, up to 90 days.

### Transmitter

Sits on top of the sensor and sends glucose data to a smartphone app or receiver. In transcutaneous systems, the sensor and transmitter are connected as one small, on-body device. Some transmitters are reusable for several months and others are disposable with the sensor. In implanted systems, the transmitter is attached to the skin and can be removed without harming the sensor below the skin.

### Smartphone App or Receiver

Displays your real-time glucose level, whether blood glucose is trending up or down, and your glucose history. Most CGM devices offer smartphone apps for viewing data. Some CGMs automatically send your glucose readings to the app or receiver in real time, while other CGMs need to be “scanned” with your phone or reader to access the glucose data.

CGMs have a variety of features that differ by brand and model, including the amount of time the CGM needs to “warm up” before glucose readings are accurate, how long you can wear the device before replacing it, and various alarms that alert you to highs and lows. More below.

## Do CGMs Hurt?

CGM devices include a tiny needle for insertion, which may feel like a sting or pinch when put in place. CGMs have advanced needle technology to ensure an easy insertion, and most people do not experience pain.

For some people, CGM insertion or the adhesive can irritate the skin. The good news is that you can prevent tissue damage by rotating your CGM insertion site, and there are several strategies and products you can try to avoid skin irritation. Talk with your healthcare professional if this is a concern for you.



## Personal CGM vs. Professional CGM

The CGMs that we just described are called **personal CGMs** – they are personal devices that a person with diabetes uses for a long period of time. They are available as real-time CGMs, where the data can be continuously viewed, or as intermittently-scanned CGMs, where information is recorded all of the time, but you need to scan the sensor to view the data.

Another type of CGM is called **professional CGM**. Professional CGMs are given to someone with diabetes by their healthcare team for a short session (usually 1-2 weeks) to better understand that person's glucose levels. After the wear period, the person will review the data with their healthcare professional. This can provide insights that inform the person's diabetes treatment, and it can help healthcare professionals recommend therapy and lifestyle recommendations that lead to better glucose management.

Some professional CGMs have a real-time mode, meaning that the user can see their glucose levels while wearing the device. Other professional CGMs have a “blinded” mode. Blinded CGM means that you cannot look at their glucose values on-demand; instead, all of your glucose data is stored and shared with your healthcare professional. If you get a blinded professional CGM, your healthcare team will analyze the data and discuss it with you once your wear period is complete.

While long-term, real-time CGM is most effective for day-to-day diabetes management, especially for insulin users, professional CGM can be an important tool for people who are not using personal CGM. Periodic use of CGM can help people find patterns and learn the effects of food and physical activity on glucose levels, even for those not taking any diabetes medications.

## How will a CGM Device Improve my Health and Diabetes Management?

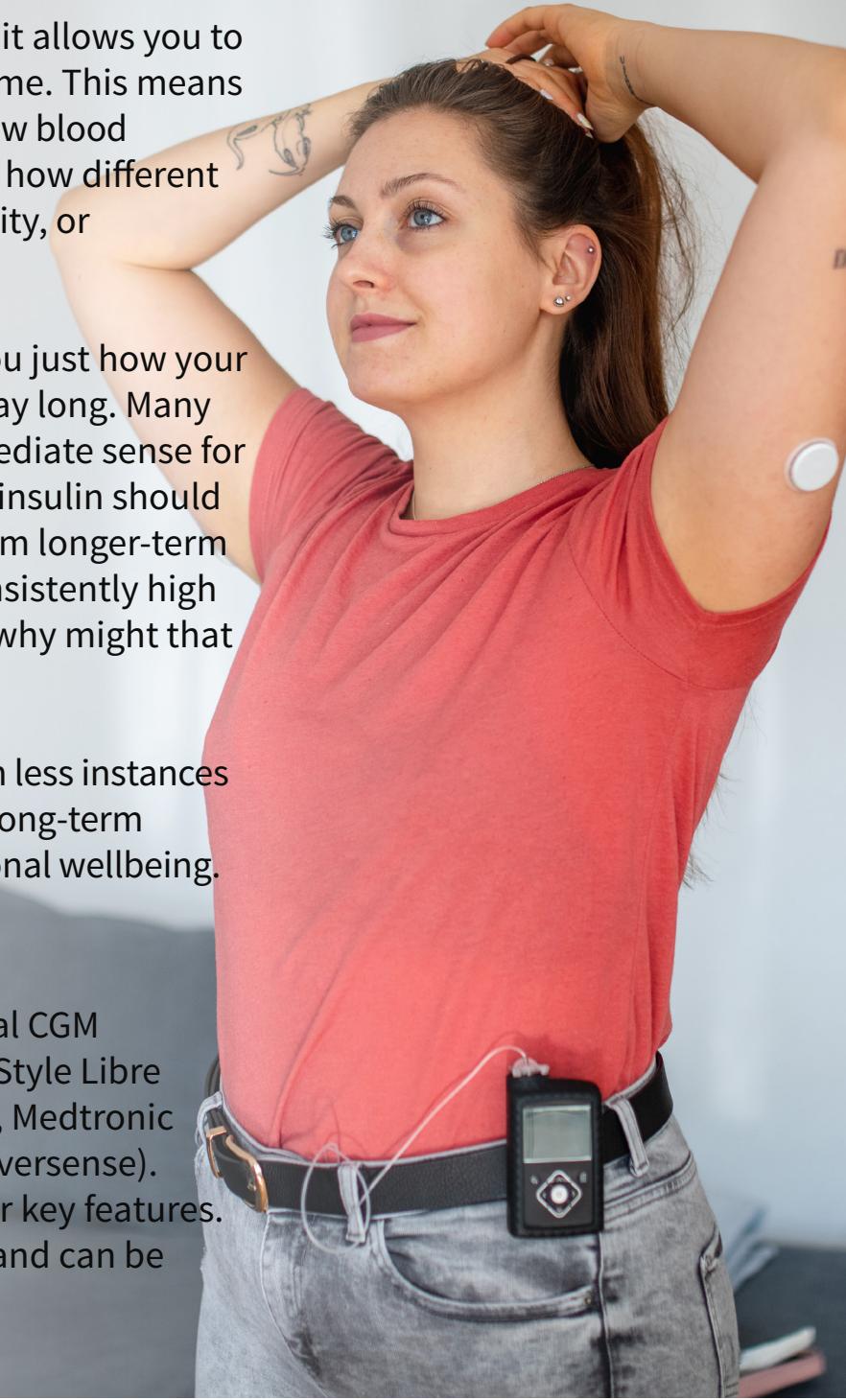
The most important part of CGM is that it allows you to respond to your glucose levels in real time. This means that you can prevent and treat high or low blood sugar levels early on, and you can learn how different behaviors – such as food, physical activity, or medication – affect your glucose levels.

The CGM is the ultimate tool to show you just how your behavior affects your blood sugar, all day long. Many people think of glucose data in an immediate sense for guiding therapy decisions: “How much insulin should I take right now?” But it also helps inform longer-term patterns: “My blood sugar has been consistently high after breakfast for the past two weeks; why might that be, and what can be done about it?”

Stable glucose levels are associated with less instances of severe high & low blood sugar, fewer long-term health complications, and better emotional wellbeing.

## How to Choose a CGM Device

Currently, four companies have personal CGM devices on the US market: Abbott (FreeStyle Libre and Freestyle Libre 2), Dexcom (the G6), Medtronic (Guardian Sensor 3), and Senseonics (Eversense). The table below compares some of their key features. Pricing varies with insurance coverage and can be provided by the company.



	<b>Freestyle Libre 14-Day</b> 	<b>Freestyle Libre 2</b> 	<b>Dexcom G6</b> 	<b>Medtronic Guardian Sensor 3</b> 	<b>Senseonics Eversense</b> 
<b>Fingerstick Calibration</b>	0 Factory Calibrated	0 Factory Calibrated	0 Factory Calibrated	2/day minimum	2/day minimum
<b>Labeling</b>	Replaces fingersticks for treatment decisions,	Replaces fingersticks for treatment decisions,	Replaces fingersticks for treatment decisions,	Replaces fingerstick confirmation	Replaces fingersticks for treatment decisions, Requires 2 fingerstick calibrations/day
<b>Age</b>	18+ Years	4+ Years	2+ Years	7+ Years (670G) 14+ Years (Guardian Connect)	18+ Years
<b>Medicare Coverage</b>	Yes	Not known	Yes	No	Yes
<b>Warmup</b>	1 Hour	1 Hour	2 Hours	2 Hours	24 hours after implantation
<b>Wear Length</b>	14 Days	14 Days	10 Days	7 Days	90 Days
<b>Alarms for Lows, Highs</b>	None in US – must scan sensor to see glucose.	Yes	Yes	Yes	Yes
<b>Data Display</b>	Reader, Android and iPhone apps (FreeStyle Libre Link)	Reader (mobile app not yet available in US)	Receiver, Android and iPhone apps, smartwatches, Tandem t:slim X2 pump	630G or 670G pump, Guardian Connect Android and iPhone apps	Android and iPhone apps
<b>On-Body Form and Transmitter Design</b>	~2 stacked quarters, one-press insertion Fully disposable transmitter integrated with sensor patch	~2 stacked quarters, one-press insertion Fully disposable transmitter integrated with sensor patch	Eraser-sized transmitter, one-button inserter Three-month use transmitter separate from sensor	~2 stacked quarters (clamshell), one-button inserter Rechargeable transmitter separate from sensor	Sensor inserted by a healthcare professional Rechargeable, watchface-sized transmitter separate from sensor

While any CGM can help improve your diabetes management, there are some differences between the currently available systems that you may want to consider or talk about with your healthcare team. Specifically, ask your healthcare professional about how alarms may be able to alert you to times of hyperglycemia or hypoglycemia, what it means if you have to calibrate your CGM, and how to use your CGM with smart insulin pens, mobile apps, or even insulin

## How to Get Started with a CGM Device

Once you've received a CGM, it's helpful to establish CGM goals, set glucose targets, make a plan for responding to glucose readings, and decide with whom you want to share your data. Talk with your healthcare team about your goals – are you using CGM to prevent hypoglycemia using its alert system? Or are you trying to learn how your daily behaviors impact glucose management?

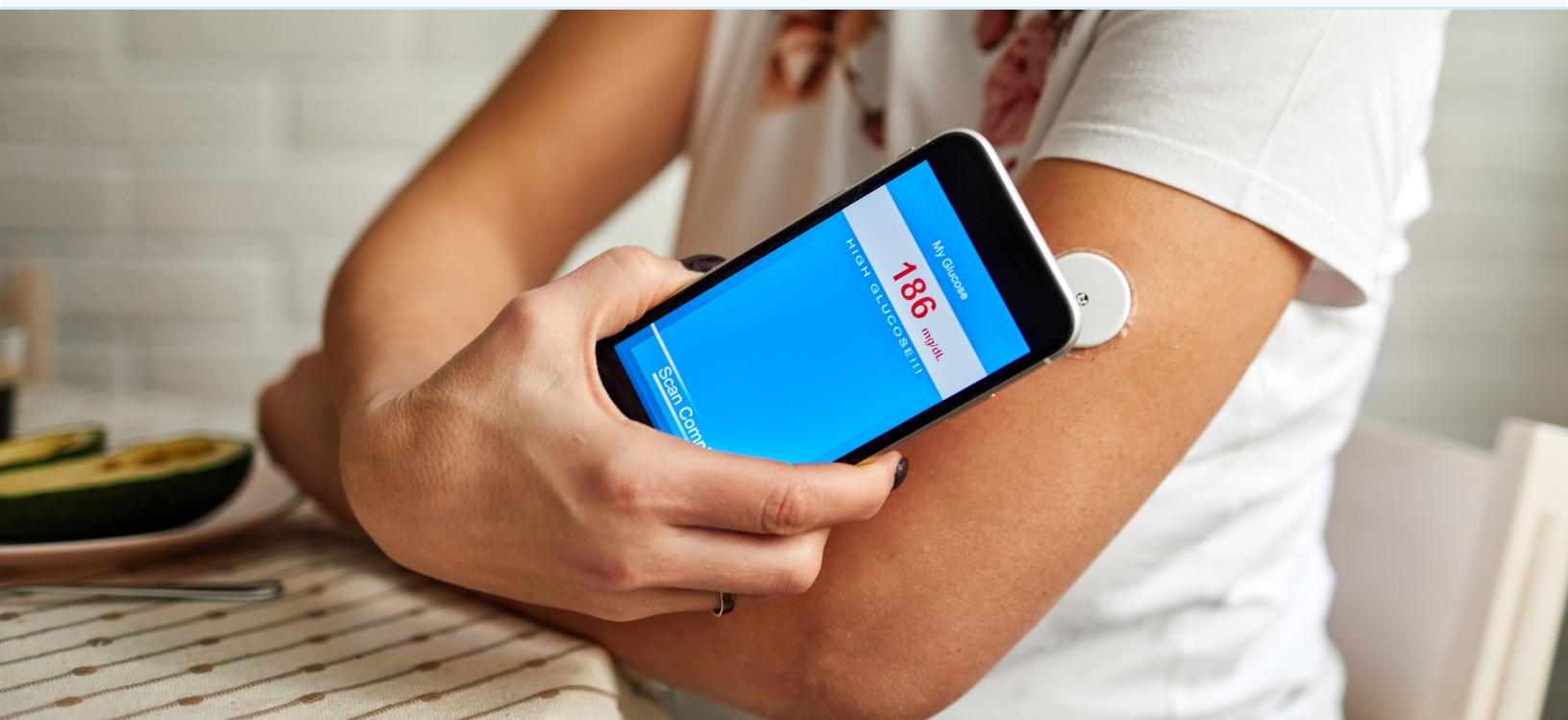
## Know your Glucose Targets and Make a Response Plan

Knowing your target glucose range is important for responding to your real-time glucose values. For most people with diabetes the target range is 70-180mg/dl. Make a plan that incorporates glucose trend arrows from your CGM to help you prevent big spikes out of range and know how you'll respond to hyperglycemia and hypoglycemia. Here are some prompts for you to discuss with your healthcare team:

- What is my glucose target when I wake up and before meals?
- What should my glucose level be two hours after a meal? If it is above that value, what actions should I take to bring my glucose levels down?
- What is my glucose target before bed?
- What high glucose level should I try to avoid? What should I do if my glucose gets that high?
- What low glucose level should I try to avoid? What should I do if my glucose gets that low? What should I do if my glucose levels are trending down?

## Can I Share my CGM Data with Others?

Remote monitoring allows for a person's real-time glucose levels or past CGM data to be shared with others. Remote monitoring can be used to give peace of mind to loved ones. For example, a traveling spouse can share their CGM data with care-partners, or a child at a sleepover can share their glucose levels with family. People also use remote monitoring to send updates directly to their healthcare professional. This sharing function is now available for most CGM devices.



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