

## RCH Diabetes Clinical Information on Continuous glucose monitoring (CGM)



There is currently a lot of attention and marketing activity around the use of CGM (continuous glucose monitoring) in diabetes management. There are currently two systems available in Australia- the Medtronic iPro and the Animas Dexcom. Abbott is also about to release the FreeStyle Libre systems which is not a CGM but has some similar benefits.

For more information on the Freestyle Libre please visit their website ([www.freestylelibre.com.au](http://www.freestylelibre.com.au)). Please note that this device is currently used in Europe for children, but is not TGA approved in Australia for use in children under the age 18 years. We are hopeful that this may change in the future.

### **What is CGM?**

CGM is a small button like device that sits against the skin and records subcutaneous tissue (not blood!) glucose. Tissue glucose levels and blood glucose levels are not always the same. When you use the current CGM devices under optimal conditions the CGM glucose is usually within a 10-13% range of the actual blood glucose level. For example, if the blood glucose level is 4.0 mmol/l, the CGM reading might be anywhere between 3.6-4.4 mmol/l. When the blood glucose level is rising or falling quickly, the CGM values may not be as accurate and might lag behind for several minutes.

Both the Animas Dexcom and the Medtronic iPro systems require calibrating. This is done by fingerpricks and testing blood glucose on a meter as you have always done. The amount of times that this needs to be done can vary between 2-4 BGLs per day depending on the system that you are using. The CGM does not replace blood glucose testing.

Tissue glucose readings are taken by the CGM every 10 seconds and averaged out over 5 minutes. It is the 5 minutely average reading that is recorded and displayed

CGM sensors vary in terms of how long they last. Under ideal conditions they will last between 5-13 days depending on the brand. Some people find that electrodes can last longer than this, though the accuracy of the sensors is not guaranteed by the manufacturers once the sensor is used beyond its stipulated life. Similarly, users may find that occasionally sensors do not last the full amount of time that is stated. This can be for a variety of reasons including “wear and tear” by people with active lifestyles. The CGM sensor is considered to be the disposable component of CGM. They are expensive and costs are currently not covered by either the NDSS or health insurers.

The transmitter devices (the part that sends the electrical signal and data to a receiver) have lives of between 2-3 months to 1 year depending on the brand. The full kits (transmitter, receiver and sensors) will cost about \$2000 – \$7500 per year, again depending on the brand. This cost is not currently covered by the NDSS or private health insurance.

Tissue glucose levels that have been measured by the CGM can be seen in ‘real-time’ either on a purchased receiver, a mobile phone or on an insulin pump depending upon the specific device. Displays include the current glucose level and a graph of previous glucose levels over several hours (glucose trends). One of the most useful features is a read-out of whether the glucose level is rising or falling. Alarms can be activated to alert users if glucose levels are above or below predefined target levels.

For more information on both the Medtronic iPro and the Animas Dexcom CGM systems, please visit the appropriate website.

<https://www.medtronic-diabetes.com.au/> or <http://amsldiabetes.com.au/>

## Will CGM improve my diabetes control?

The short answer is yes, no and maybe.

CGM devices have become much more accurate over recent years and they measure tissue glucose extremely well. But does this translate to better diabetes control?

Studies performed on CGMs have shown a variety of results. These range from no benefit to only a small benefit in reducing a patient's HbA1c, reducing hypoglycaemia and improving quality of life. Individuals anecdotally report a variety of responses in relation to wearability, comfort and functionality.

One of the reasons behind these conflicting results is because people use CGMs for a variety of situations. Some patients use CGM with injections, some use it with insulin pumps and others use it linked to the pump where it has limited control over the delivery of insulin in certain situations.

Studies show that the amount of time the CGM is in use is critical. To gain any benefit in reducing HbA1c, CGM devices need to be used more than 70-80% of the time (i.e. > 5 days per week). Research suggests that for a variety of reasons most adolescents are unwilling to wear CGM more than 40% of the time.

The motivation of the user has shown to also significantly affect the benefits of wearing a CGM. If the aim is simply to avoid hypoglycaemia and not to improve metabolic control then HbA1c levels may worsen.

Finally, for some, CGM provides too much information. Adolescents in particular and some parents find the constant feedback from CGM overwhelming, causing them to switch off and ignore readouts and alarms, particularly if the CGM readings give false-alarms.

It is important to understand that regardless of how the insulin is delivered, it is difficult to respond to CGM in real time by varying your insulin doses. Once insulin has been injected it cannot be removed. Rapid-acting insulin that has been delivered under the skin will take an hour or so to reach maximal effect and 3-5 hours to wear off. Although pumps deliver smaller doses of insulin more frequently, the principle remains the same. In short, subcutaneous insulin whether delivered by injection or pump cannot switch on and off like it does in the pancreas of people without diabetes.

Research is currently underway into CGM as part of a "closed loop" systems. This will *predict* where a blood glucose level is heading and inform a pump ahead of time about how much insulin to deliver. Being able to change insulin delivery *ahead of time* rather than in *real time* is what most clinicians think will ultimately prove to be the best use of CGM. Whilst this research is ongoing, our ability to respond to CGM in real time remains limited. We can treat hypoglycaemia with hypo-food and respond to sustained hyperglycaemia with a small extra dose of insulin. Looking at patterns of blood glucose that might be consistent over a few days may also be useful in terms of adjusting insulin doses.

## What should I do?

Currently it appears that the benefits of CGM depend heavily on the needs of an individual patient and family and their particular situation. Depending on your needs and situation, CGM may or may not be of benefit to you. Given the significant financial commitment that CGM requires it would be best to discuss the pros and cons of CGM for you/your child with your treating doctor.