

Diabetes at Camp: Continuous Glucose Monitors & Integrated Insulin Pumps

Module 9 of 12

Special thanks to the team below and everyone who contributed to this work.

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Objectives

At the end of this module, the participant should be able to:

- Identify the types of Continuous Glucose Monitor (CGM) systems campers may be wearing
- List the devices that require calibration and define the timing of the calibration for each device
- Explain how to use the data from the CGM to determine the action required to enhance the safety and well-being of the camper



Continuous Glucose Monitors (CGM)

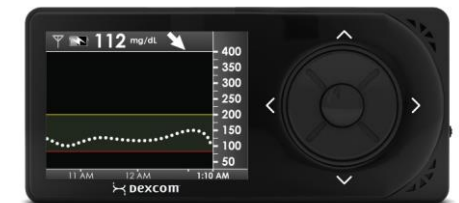
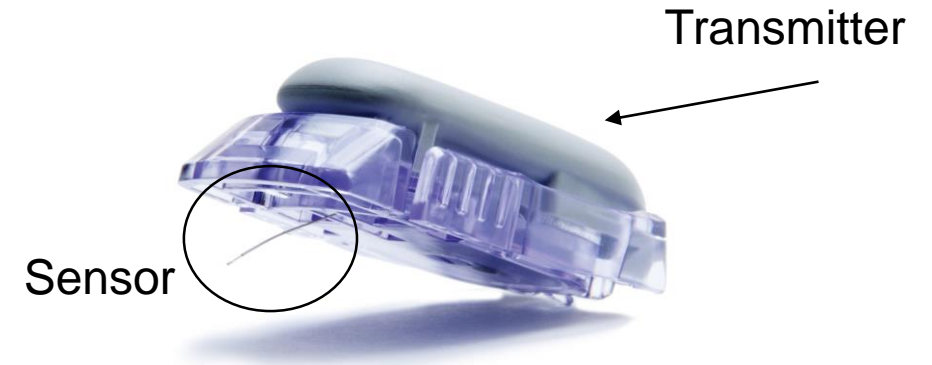
Devices on the Market

1. Dexcom G4
2. Dexcom G5
3. Dexcom G6
4. FreeStyle Libre 14-day system
5. Medtronic Guardian Connect
6. Senseonics, Eversense CGM System



What are the CGM Components?

- A **sensor** is a small filament that is inserted under the skin
- An **insertion device** contains the sensor and the device is easily inserted under the skin with one button push
- The **transmitter** is either part of the sensor (FreeStyle Libre) or “snapped” onto the sensor after insertion (Guardian and Dexcom)
- A **receiver** is the device that data can be interpreted from immediately. The receiver can be a separate device, part of the insulin pump, or information can be pushed to a smart phone device.



Receiver

Insertion Device

What do CGMs do?

- The transmitter sends the interstitial glucose values (vs blood glucose) to a receiver.
- This data is incredibly helpful and should be utilized!
- It provides all the information missing between finger stick checks – like watching a moving picture of glucose values.



WARNING!

- Sensors have become very accurate – even more so than some glucometers
- **HOWEVER** - If the data on the screen does **NOT** match the individuals symptoms, a finger stick should be done and compared with the sensor data to confirm
- Interstitial glucose is similar to blood glucose, but may follow blood glucose by up to 10 minutes when BG is rising or falling



CGM Options

CGM Brand	Calibration required?	How often should you calibrate?	Can you dose insulin off of the sensor reading?	Can you take Tylenol?	How often should the sensor be changed?	How long is the warm-up period*?
Dexcom G5	Yes	Every 12 hours	Yes	No	7 days	2 hours
Dexcom G6	No	None	Yes	Yes	10 days	2 hours
Medtronic guardian	Yes	Every 12 hours, accuracy improves if 4 times daily	No	No	7 days	2 hours
Medtronic Enlite (discontinued)	Yes	Every 12 hours, accuracy improves if 4 times daily	No	No	6 days	2 hours
Freestyle Libre Flash	No	None	Yes	Yes	14 days (depending on shipping date)	1 hour

*warm-up period is the amount of time the device takes to create a stable interstitial reading before calibrating and calculating sensor reading. During this time the device is not providing blood glucose readings.

Integrated CGM (iCGM) Technology

Devices on the Market

1. Dexcom G4 integrated into the Animas pump (CGM information only, pump discontinued)
2. Dexcom G4, G5 or G6 integrated into the Tandem pump (CGM information only)
3. Dexcom G5 or G6 integrated into the Tandem T:slim X2 with Basal-IQ (suspend before low)
4. Medtronic Enlite integrated 530G (suspend on low, discontinued products)
5. Medtronic Guardian integrated 630G pumps (suspend on low)
6. Medtronic Guardian integrated with 670 G – hybrid pump (basal adjustment based on CGM data)

1



2



3



4



5



6



Medtronic Family of CGM Integrated Pumps

Medtronic 530G, 630G, and 670G (manual mode only) can be programmed to suspend on low based on the user's blood glucose reaching a preset low value.

This can be **VERY** helpful for the prevention of low blood glucose values, particularly overnight.

If there is no human intervention, the pump will stay off for 2 hours to allow for a return of blood glucose to a safe range. An alarm will sound prior to the suspend and during the time it is suspended based on the setting.



More Features of the Medtronic 670G

Medtronic 670G is responding to the sensor values every 5 minutes when in auto mode – altering the BASAL rate as needed to maintain a target BG of 120 mg/dL or 150 mg/dL if set to that.

The Medtronic 670G also makes a recommendation for correctional insulin which must be accepted or rejected and **CANNOT** be altered.



Tandem Basal IQ Integrated Pump

- Integrated with the Dexcom G5 or G6
- Suspends prior to low (predictive low blood glucose suspend) which can be particularly helpful overnight
- Returns to preset basal rate as sensor values climb
- Can suspend for up to 2 hours as needed, then returns to preset basal for 30 minutes and suspends again if needed
- When does it suspend?
 - If blood glucose is currently 70 mg/dL or lower
 - If blood glucose is predicted to be <80 mg/dL in 30 minutes
- Basal rates are preset and not changing based on sensor data



How can the Data be Useful?



- On all receivers there is a glucose number in “real time”
- The receiver indicates the trend of the present glucose
- There is also a graph showing the recent past glucose readings (3, 6, 12 or 24 hours)

How can the Data be Used?

- If a child recently had a low blood glucose that was treated – viewing the screen would note present value and trending arrow to indicate recovery from the hypoglycemic episode.
- This is true of hyperglycemia as well and could inform the staff if the bolus delivered to reduce hyperglycemia is effective.
- If hyperglycemia persists after a bolus, the pump infusion set should be changed.

Alarms

Dexcom & Medtronic Systems	Freestyle Libre
<ul style="list-style-type: none">• Audio alarms can be set to warn of impending and/or low glucose values.• The low alerts can be programmed by the individual.• The sound can be individualized to be off, on vibrate or varying intensities.	<ul style="list-style-type: none">• The FreesStyle Libre CGMs do not have a receiver that automatically tracks blood glucose levels. The user must manually initiate checking blood glucose levels. There are NO alarms with this system.

Summary

- There are presently 4 brands of CGMs available FreeStyle, Medtronic, Dexcom, Senseonics
- Dexcom G5, Senseonics and Medtronic systems must be calibrated every 12 hours.
- Dexcom G6 and FreeStyle Libre do **not** require calibration.
- If a child recently had a low blood glucose that was treated – viewing the screen would note present value and trending arrow to note the recovery from the hypoglycemic or hyperglycemic episode. You can also dose directly off the data from the FreeStyle or Dexcom G5/G6 depending on the policy at your facility

Looking Ahead!

- CGMs are getting more accurate and more commonly worn by individuals with type 1 diabetes
- There will continue to be great strides in the accuracy and integration into insulin pumps as the goal is a fully integrated pump and CGM
- Keep up and keep informed!



Assessment

1. Jack is wearing a Dexcom CGM G6. He is sitting down to a lunch of spaghetti and has calculated his carbohydrates to be 84 grams and his blood glucose is 195 mg/dL.

- A. He must check his blood glucose with a finger stick prior to verify his CGM reading prior to giving a correction dose
- B. He may proceed using his sensor data to deliver his correction along with his carbohydrate dose
- C. He should wait to deliver the correction dose until he sees the impact of the meal on his blood glucose values
- D. He should calibrate his sensor prior to eating his meal and then dose appropriately

Assessment

2. Which of the following sensor(s) requires calibration every 12 hours?

- A. Dexcom G5
- B. Freestyle Libre
- C. Medtronic Guardian
- D. Sensionics Eversense
- E. Both A and C

3. Which receiver must be “swiped” across the transmitter to obtain the glucose reading?

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- B. Medtronic Guardian
- C. Freestyle Libre
- D. Medtronic Enlite

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