

# Introduction to Continuous Glucose Monitoring - The role of CGM in Diabetes Care

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## Disclosures to Participants

### **Notice of Requirements for Successful Completion:**

Learners must participate in the full activity and complete the evaluation in order to claim continuing education credit/hours.

### **Presenter has No - Conflicts of Interest/Financial Relationships Disclosures:**

**Ashley Littleton**

### **Disclosure of Relevant Financial Relationships and Mechanism to Identify and Mitigate**

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**Off-label Use: None**

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# Objectives

- A) IDENTIFY PATIENT WHO MAY BENEFIT FROM CGM.
- B) IDENTIFY ADCES RESOURCES FOR CGM (DANA TECH)
- C) IDENTIFY CGM'S THAT ARE AVAILABLE IN WYOMING.

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# Disclosures

Product Trainer for

Medtronic

Omnipod

Tandem



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## CGM Glossary

- ▶ **Adjunctive Indication** - A continuous glucose monitor, or CGM, that cannot be used to make treatment decisions. A stand-alone home blood glucose monitor result should be used to make treatment decisions in this case.
- ▶ **Calibration** - Some CGM systems require fingerstick blood glucose (BG) meter readings in order to generate accurate sensor interstitial glucose readings. The BG meter reading is entered into the device and used for scheduled calibrations or as needed. Calibrations with blood glucose readings are used to ensure that the glucose sensor maintains its accuracy over time. When systems are factory calibrated, fingerstick calibration is not recommended.
- ▶ **Coefficient of Variation** - The Coefficient of Variation (%CV) is calculated by dividing the glucose Standard Deviation by the mean glucose. The %CV is a standardized measure that assesses the magnitude of glucose variability. The larger the %CV, the larger the variability in CGM readings.
- ▶ **Contraindication** - A condition or circumstance in which a person should not use the device.
- ▶ **Intermittently-Scanned CGM** - This device requires the wearer to swipe the receiver/reader/smartphone over the sensor to obtain glucose data.
- ▶ **Interstitial Glucose Level** - The glucose found in the fluid surrounding the cells in the tissue.

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## CGM Glossary

- ▶ **Glucose Management Indicator** - Glucose management indicator (GMI) approximates the laboratory A1C level expected based on average glucose measured using continuous glucose monitoring (CGM) values. The average glucose is most accurate when based on 14 days of CGM data. Differences between GMI and laboratory A1C may reflect differences among an individual's red blood cell lifespan, how glucose binds to hemoglobin, or due to a recent fluctuation in glucose control. Clinical Reference: Bergenstal, RM, et al. Glucose Management Indicator (GMI): A New Term for Estimating A1C From Continuous Glucose Monitoring. *Diabetes Care*. 2018 Nov;41(11):2275-2280.
- ▶ **Integrated Continuous Glucose Monitor (icgm)** - An iCGM is intended to automatically measure glucose in bodily fluids continuously and to link the CGM to other medical devices used to manage diabetes such as insulin dosing systems, insulin pumps and other digital devices.
- ▶ **Lag Time** - Refers to CGM sensor interstitial glucose readings lagging behind fingerstick blood glucose readings. This occurs because the interstitial fluid glucose that the CGM sensor measures tends to lag behind the fingerstick glucose that the blood glucose meter reads, especially when the glucose level is rapidly changing. The lag time can be up to 15 minutes but is typically less.

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## CGM Glossary

- ▶ Non-adjunctive Indication - A CGM that can be used to make treatment decisions without the need for a stand-alone home blood glucose monitor to confirm blood glucose results.
- ▶ Personal CGM - A CGM device owned and used by a person with diabetes, continuously or intermittently. Persons with diabetes and supporting individuals (i.e., parents) use the information in real time to make diabetes management decisions.
- ▶ Professional CGM - Clinic-based and clinic-owned CGM devices that are placed on the patient in the provider's office and used on a short-term basis and returned following specified monitoring period. Data may be blinded or visible to the device wearer.
- ▶ Real-time CGM - A device that automatically transmits glucose data to a receiver or compatible smartphone.
- ▶ Receiver or Reader - The receiver (reader) or compatible smart device receives glucose data from the transmitter and displays current levels, historical trends in levels, and arrows to show direction that glucose is heading.

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## CGM Glossary

- ▶ Sensor - A glucose sensor is the part of a continuous glucose monitoring (CGM) system that is inserted under the skin and measures interstitial glucose levels.
- ▶ Smart Transmitter - A reusable device worn externally over an inserted sensor that powers the sensor and sends glucose information to the mobile device for display in an app (currently Eversense® specific).
- ▶ Standalone Device - A CGM that transfers information directly to a receiver and does not need another connected device to provide the glucose data.
- ▶ Standard Deviation - The extent of glucose readings that are above and below the mean. A measure of variation.
- ▶ Time in Range (TIR) - The percentage of time that glucose levels are within a specified glucose range (target, above or below).
- ▶ Transmitter - A small, reusable or disposable transmitter connected to the sensor allows the system to send real-time glucose readings wirelessly to another device that displays the glucose data.
- ▶ Trend Arrows - Trend arrows indicate the direction the glucose is heading and allows anticipatory changes to be made to prevent hyper/hypoglycemia.
- ▶ Warm-up Time - The amount of time it takes for the sensor to calibrate after it is placed under the skin, before the data can be transmitted to the receiver. The warm-up time varies for different devices. During the warm-up time, the person with diabetes must check a fingerstick blood glucose for treatment decisions.

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## Terminology

Direct from DANATECH – Association of Diabetes Care and Education Specialists Technology Platform

[https://www.adces.org/danatech/glucose-monitoring/continuous-glucose-monitors-\(cgm\)/cgm-101/cgms-role-in-diabetes-management](https://www.adces.org/danatech/glucose-monitoring/continuous-glucose-monitors-(cgm)/cgm-101/cgms-role-in-diabetes-management)

[Home](#) / [Glucose Monitoring](#) / [Continuous Glucose Monitors \(CGM\)](#) / [CGM 101](#) / [CGM's Role in Diabetes Management](#)

### THE ROLE OF CGM IN DIABETES MANAGEMENT



**CGM: What is it? Who is for? How help?**

Written by ADCEs staff, updated  
Abstract:

[Download the PDF: CGM's Role in Diabetes Management](#)

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## Clinical Considerations for CGM

- ▶ Insulin for treatment of their diabetes
- ▶ Can tolerate the CGM adhesive and is willing to wear an on-body device
- ▶ Desires more comprehensive information about their glucose values and trends
- ▶ Is at risk for severe hypoglycemia or has hypoglycemia unawareness

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## CGM in Management

### Young Life

Unable to articulate feelings/symptoms

Wildly variable intake / physical activity

Frequent hypoglycemia in this population

Follow abilities – invaluable to family

### Young Adults

Desiring more independence

Ability to monitor effects of:

Meds

Food

Activity

Sex

Alcohol

### Older Adults

Monitor effects of:

Meds

Foods

Reduce Hypoglycemia Risk

Follow abilities – also for family members monitoring loved ones

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## Appropriate Times of Use

### Pregnancy / Gestational Diabetes

Improve general glucose targets

Changing food choices

Improving medication delivery

### Newly Dx Type 2

Monitoring effect in real time

Changing food choices

Improving medication delivery

### People taking insulin

Reducing risk or fear of hypoglycemia

Improve hyperglycemia with treatment

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## Personal CGMs



### Features

**Duration**

**Warm Up**

**Share**

**Calibration**

**Age**

**Accuracy**

**Medicare**

**Pump**

### Dexcom G6

10 days

2 hours

Yes

No – but can

2 years and older

Overall 9% MARD

Yes

Omnipod 5 / t:slim pumps / Beta

### Dexcom G7

10 days

30 minutes

Yes

No – but can

2 years and older

Overall 8.2% MARD

Yes

Omnipod 5 / t:slim

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## Personal CGMs



### Features

**Duration**

**Warm Up**

**Share**

**Calibration**

**Age**

**Accuracy**

**Medicare**

**Pump**

### Libre 2

14 days

1 hour

Yes

No

4 years and older

Overall 9.2% MARD over 14 days

Yes

None

### Libre 2+

15 days

1 hour

Yes

No

2 years and older

Overall 8.2% MARD over 14 days

Yes

t:slim

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## Personal CGMs



### Features

**Duration**

**Warm Up**

**Share**

**Calibration**

**Age**

**Accuracy**

**Medicare**

**Pump**

### Libre 3

14 days

1 hour

Yes

No

4 years and older

MARD of 7.9% overall

Yes

None

### Guardian Connect

7 days

Up to 2 hours

Yes

No

Indicated for 14 years to 75 years

Overall 9% MARD for the arm,  
10.5% MARD for the abdomen

Yes

InPen

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## Personal CGMs



### Features

**Duration**

**Warm Up**

**Share**

**Calibration**

**Age**

**Accuracy**

**Medicare**

**Blinded / Unblinded**

### Dexcom G6 Pro

10 days

2 hours

Yes

No

Indicated for 2 years and older

Overall 9% MARD

Yes

Both

### Libre Pro

14 days

1 hours

No

No

Indicated for 14 years to 75 years

FreeStyle Libre Pro system has a  
MARD of 12.3% over 14 days without  
fingerstick calibration.

No

Blinded

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# Personal CGMs



## Features

- Duration**
- Warm Up**
- Share**
- Calibration**
- Age**
- Accuracy**
- Medicare**
- Pump**

## Eversense

180 Days  
 24 Hours  
 Yes  
 Yes, twice daily through day 21, then primarily once daily for the remaining 159 days of sensor wear.  
 Indicated for 18 years and over  
 MARD 8.5% in the PROMISE Study  
 Yes  
 No

## Libre 14 Day

14 days  
 1 hours  
 Yes  
 No  
 Indicated for 18 years and over  
 Overall 9.4% MARD over 14 days  
 Yes  
 No – No alarm feature

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## Potential Advantages

See "more of the picture".

Potentially reduce severe hypoglycemia

See how lifestyle affects glucose levels

Ability to adjust insulin / medications based on actual data



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## Potential Disadvantages

Cost

Alarm Fatigue

Skin Irritation



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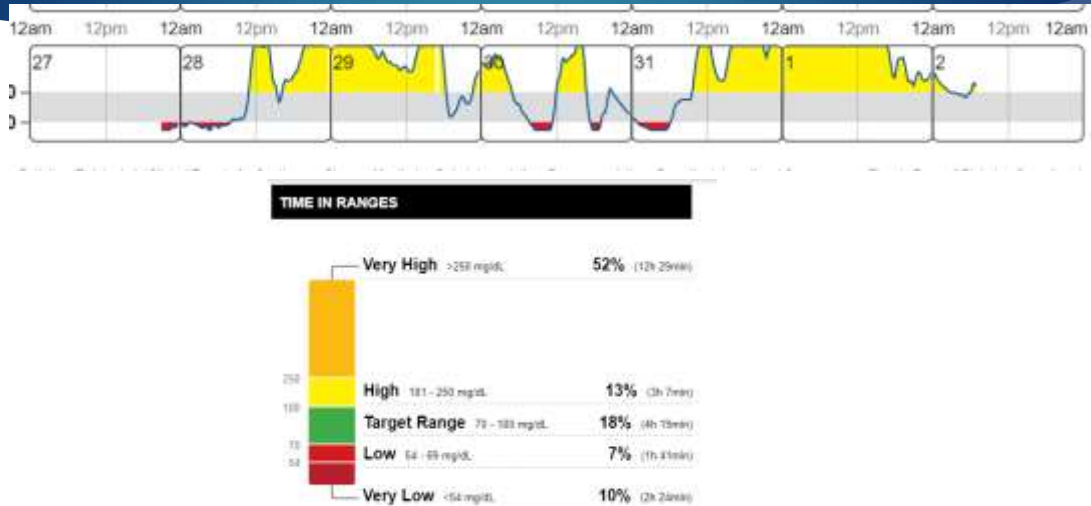
## Case Study 1

- ▶ SA – 50 yo male (at the time of this report)
- ▶ Type 1, NSTEMI 2019, CKD Stage 4
- ▶ At the time of the report, MDI
  - ▶ (this is a pro report)
- ▶ A1C 11.21 3/09/2020
- ▶ What would you do for this patient?

GLUCOSE STATISTICS AND TARGETS	
August 27, 2020 - September 2, 2020	
7 Days	
Time CGM Active: 100%	
Range and Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges	Targets % of Readings (Time in Range)
Target Range 70-180 mg/dL	Greater than 70% (10h 46min)
Below 70 mg/dL	Less than 4% (58min)
Below 54 mg/dL	Less than 1% (14min)
Above 180 mg/dL	Less than 25% (6h)
Above 250 mg/dL	Less than 5% (1h 12min)
<small>Each 5% increase in time in range (70-180 mg/dL) is clinically beneficial.</small>	
<b>Average Glucose</b>	<b>265 mg/dL</b>
<b>Glucose Management Indicator (GMI)</b>	<b>9.6%</b>
<b>Glucose Variability</b>	<b>58.6%</b>
<small>Defined as percent coefficient of variation (%CV); target &lt;36%</small>	

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## Case Study 1 continued



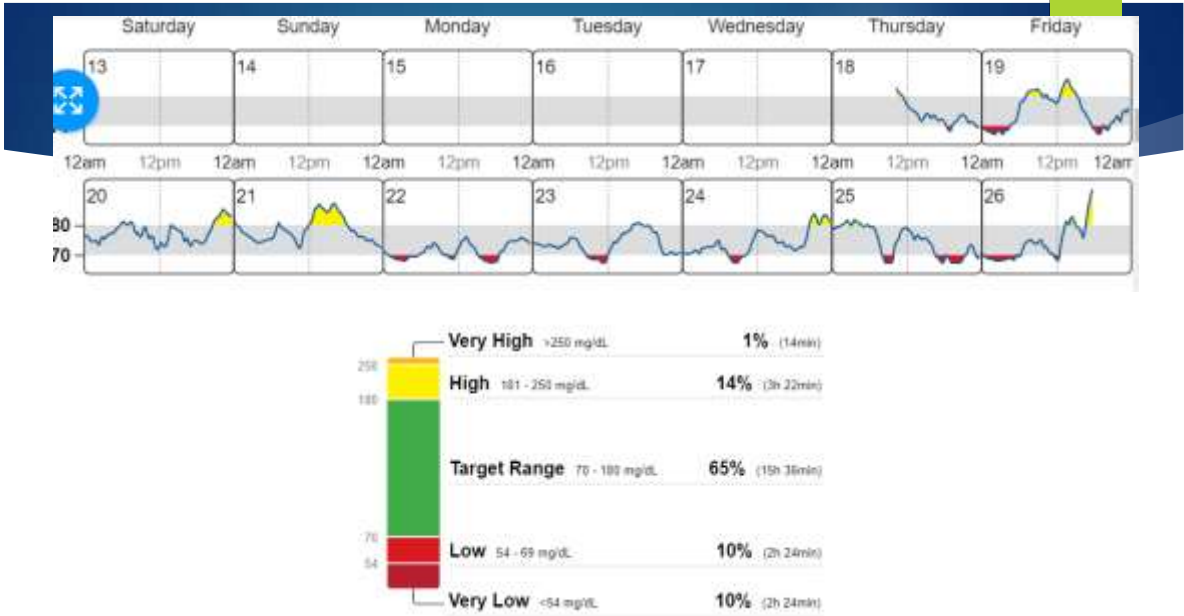
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## Case Study 2

- ▶ JP – 37 yo female (time of report 33 yo)
- ▶ Freestyle Libre Pro report June 2020
- ▶ A1C 5/21/20 – 8.72
- ▶ MDI
  - ▶ 50 units degludec daily
  - ▶ 10 units aspart TID
- ▶ Treated as Type 2 for 3ish years then was diagnosed with Type 1 at age 27
- ▶ Did not want “anything attached to her”
- ▶ Did not want to learn carb counting

Glucose Management Report	
June 18, 2020 - June 26, 2020	9 Days
Time CGM Active:	100%
Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges	Targets % of Readings (Time/Day)
Target Range 70-180 mg/dL	Greater than 70% (16h 48min)
Below 70 mg/dL	Less than 4% (58min)
Below 54 mg/dL	Less than 1% (14min)
Above 180 mg/dL	Less than 25% (6h)
Above 250 mg/dL	Less than 5% (1h 52min)
Each 5% increase in time in range (70-180 mg/dL) is clinically beneficial	
<b>Average Glucose</b>	121 mg/dL
<b>Glucose Management Indicator (GMI)</b>	6.2%
<b>Glucose Variability</b>	43.6%
Defined as percent coefficient of variation (%CV); target <36%	

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## Case Study 3

- ▶ 51 yo male
  - ▶ Dry mouth, frequent urination, HA, fatigue 2.5 years noted retinopathy on eye exam, not seen primary in 20 years
  - ▶ A1C 2/26/24 – 13.2%
- ▶ Started metformin ER 500, increased to 500 mg BID on 3/6
- ▶ Added semaglutide 0.5 mg on 3/6
- ▶ Visit with dietitian, CDCES on 3/15
- ▶ Started on Libre 3

GLUCOSE STATISTICS AND TARGETS															
February 20, 2024 - March 4, 2024	14 Days														
Time CGM Active:	53%														
<table border="1"> <thead> <tr> <th>Ranges And Targets For</th> <th>Type 1 or Type 2 Diabetes</th> </tr> </thead> <tbody> <tr> <td>Glucose Ranges</td> <td>Targets % of Readings (Time/Day)</td> </tr> <tr> <td>Target Range 70-180 mg/dL</td> <td>Greater than 70% (19h 46min)</td> </tr> <tr> <td>Below 70 mg/dL</td> <td>Less than 4% (58min)</td> </tr> <tr> <td>Below 54 mg/dL</td> <td>Less than 1% (14min)</td> </tr> <tr> <td>Above 180 mg/dL</td> <td>Less than 25% (8h)</td> </tr> <tr> <td>Above 250 mg/dL</td> <td>Less than 5% (1h 12min)</td> </tr> </tbody> </table>	Ranges And Targets For	Type 1 or Type 2 Diabetes	Glucose Ranges	Targets % of Readings (Time/Day)	Target Range 70-180 mg/dL	Greater than 70% (19h 46min)	Below 70 mg/dL	Less than 4% (58min)	Below 54 mg/dL	Less than 1% (14min)	Above 180 mg/dL	Less than 25% (8h)	Above 250 mg/dL	Less than 5% (1h 12min)	
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Below 70 mg/dL	Less than 4% (58min)														
Below 54 mg/dL	Less than 1% (14min)														
Above 180 mg/dL	Less than 25% (8h)														
Above 250 mg/dL	Less than 5% (1h 12min)														
Average Glucose	281 mg/dL														
Glucose Management Indicator (GMI)	10.0%														
Glucose Variability	19.0%														
Defined as percent coefficient of variation (%CV); target ≤36%															

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# Case Study 3 – March 4<sup>th</sup> report



### TIME IN RANGES



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# Case Study 3 – April 8<sup>th</sup> report

### GLUCOSE STATISTICS AND TARGETS

<b>March 26, 2024 - April 8, 2024</b>	<b>14 Days</b>
<b>Time CGM Active:</b>	<b>98%</b>
<b>Ranges And Targets For</b>	<b>Type 1 or Type 2 Diabetes</b>
<b>Glucose Ranges</b>	<b>Targets % of Readings (Time/Day)</b>
Target Range 70-180 mg/dL	Greater than 70% (10h 48min)
Below 70 mg/dL	Less than 4% (56min)
Below 54 mg/dL	Less than 1% (14min)
Above 180 mg/dL	Less than 25% (3h)
Above 250 mg/dL	Less than 5% (1h 12min)
<small>Each 1% increase in time in range (70-180 mg/dL) is clinically beneficial.</small>	
<b>Average Glucose</b>	<b>119 mg/dL</b>
<b>Glucose Management Indicator (GMI)</b>	<b>6.2%</b>
<b>Glucose Variability</b>	<b>14.8%</b>
<small>Defined as percent coefficient of variation (CV) target &lt;36%</small>	

### TIME IN RANGES



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## References

- ▶ [https://www.adces.org/danatech/glucose-monitoring/continuous-glucose-monitors-\(cgm\)/cgm-101/cgm-glossary](https://www.adces.org/danatech/glucose-monitoring/continuous-glucose-monitors-(cgm)/cgm-101/cgm-glossary)
- ▶ The Role in Continuous Glucose Monitors (CGM) in Diabetes Management publication (2021)
- ▶ [https://www.adces.org/danatech/glucose-monitoring/continuous-glucose-monitors-\(cgm\)/cgms-in-professional-practice](https://www.adces.org/danatech/glucose-monitoring/continuous-glucose-monitors-(cgm)/cgms-in-professional-practice)
- ▶ The Diabetes Care and Education Specialist's Role in Continuous Glucose Monitoring Updated by the Professional Practice Committee March 2021

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- ▶ [https://www.adces.org/danatech/glucose-monitoring/continuous-glucose-monitors-\(cgm\)/view-compare-cgms/product-detail/freestyle-libre-2-plus-sensor](https://www.adces.org/danatech/glucose-monitoring/continuous-glucose-monitors-(cgm)/view-compare-cgms/product-detail/freestyle-libre-2-plus-sensor)
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- ▶ [https://www.adces.org/danatech/glucose-monitoring/continuous-glucose-monitors-\(cgm\)/view-compare-cgms/product-detail/freestyle-libre-pro](https://www.adces.org/danatech/glucose-monitoring/continuous-glucose-monitors-(cgm)/view-compare-cgms/product-detail/freestyle-libre-pro)

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- ▶ [https://www.adces.org/danatech/glucose-monitoring/continuous-glucose-monitors-\(cgm\)/view-compare-cgms/product-detail/freestyle-libre-14](https://www.adces.org/danatech/glucose-monitoring/continuous-glucose-monitors-(cgm)/view-compare-cgms/product-detail/freestyle-libre-14)
- ▶ [https://www.adces.org/danatech/glucose-monitoring/continuous-glucose-monitors-\(cgm\)/cgm-101/pros-cons-of-cgm](https://www.adces.org/danatech/glucose-monitoring/continuous-glucose-monitors-(cgm)/cgm-101/pros-cons-of-cgm)