Continuous Glucose Monitoring

You've seen your first CGM reports, but now what? Here are some tips for reviewing what you're seeing on your CGM.

Continuous glucose monitoring (CGM) can be done by wearing a device that allows you to monitor glucose levels at a glance, 24 hours a day. The traditional fingerstick blood glucose monitoring only provides a snapshot of glucose values for a moment in time. CGM can provide more detailed information about glucose levels, trends, and patterns. With new glucose readings every few minutes, CGM provides valuable data that can be used to determine how well a current diabetes care plan is working; it helps highlight areas needing improvement (such as patterns of hypoglycemia); and it can summarize how often glucose levels are within target range. In addition to glucose readings, CGM users can also note information about things that can impact glucose levels, such as the timing of meals/snacks, exercise, medication, stressful events, etc.

It is important to note that CGM systems measure glucose levels in body fluid (with a very small sensor beneath the skin) and not directly in the blood (such as with a fingerstick). Because of this, there can be a delay or 'lag' of a few minutes between blood glucose measurements and CGM measurements particularly when blood glucose values are changing rapidly (for example during exercise). Each CGM device is unique, and persons with diabetes should consult device-specific resources about features applicable to his/her CGM system and the software for tracking glucose data captured with CGM.

Most CGM systems consist of 3 parts:

- <u>Sensor</u>: A tiny part of the CGM system that is inserted under the skin and measures glucose levels. Some sensors are implanted beneath the skin by a health care provider. Sensors last for varying lengths of time before needing to be replaced (ranging from 7 to 90 days, depending on the device).
- <u>Transmitter</u>: A small, rechargeable, or disposable transmitter connected to the sensor that allows the CGM system to send glucose readings wirelessly to another device that displays glucose data. The transmitter may be separate from the sensor or combined with the sensor.
- <u>Receiver or reader</u> (or compatible smart device): A rechargeable stand-alone device or an app on a smartphone/tablet that wirelessly receives glucose data from the transmitter and displays current levels, historical trends in levels, and arrows to show the direction that glucose is heading.

A Brief Overview of Key CGM Data

The amount of information available with CGM may be overwhelming, so it can be helpful to think about the information in two categories: (1) current glucose values and what direction they are going, and (2) past glucose values. Remember that each CGM system is different, so information may be presented in slightly different ways. [As noted before, it is important to consult with your diabetes care team and CGM device-specific resources for information about your CGM system.] Current glucose values can be seen by looking at the receiver or app on your smartphone, or if your device is an intermittently-scanned CGM, the sensor will need to be scanned with a reader or smart phone to see current glucose values.

Current Glucose Values and What Direction They are Going

- Glucose value: When you check your current glucose level, think about your target range; including glucose targets for specific times of day, such as waking up, before meals, 2 hours after a meal, or before bed. Are your values within the target range, or out of range? Consult your action plan if adjustments are needed.

- Trend Arrow: CGM trend arrows provide information about the direction and speed of change in your glucose values. Trend arrows differ by type of device, but in general they can convey if your glucose values are relatively stable; rising or falling, and how quickly the values are changing. These trend arrows can help you monitor and manage treatment. Be sure to work with your diabetes care team to ensure that you have a clear understanding of how to react to the trend arrows, for example through adjustment of medication, change in activity level, or actions to prevent hypoglycemia.
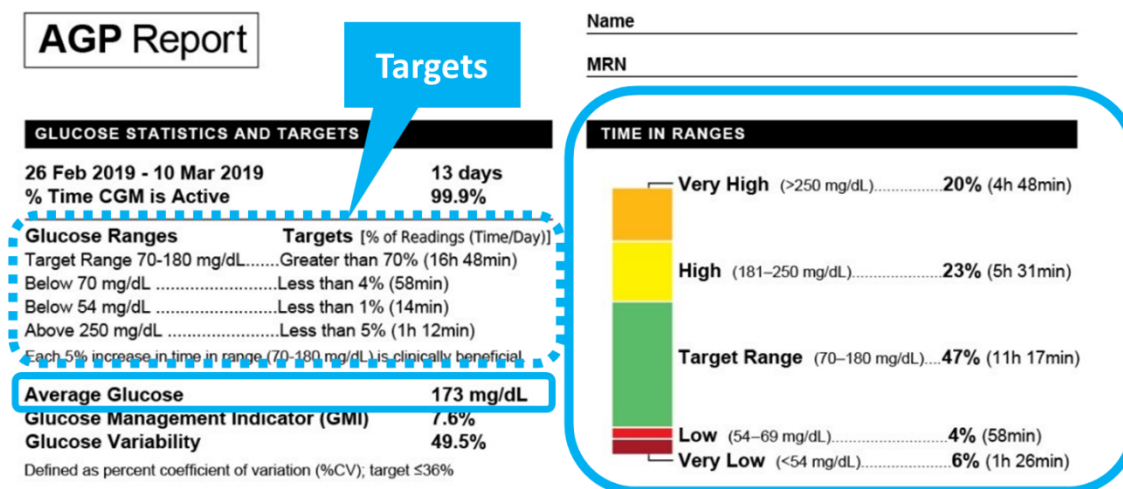
  Examples:

Past Glucose Values and Reports

With CGM data collected over a number of days, it is possible to review daily trends and patterns in your glucose levels and the amount of time your values are in the target range (70-180 mg/dL). The information collected by CGM can be viewed in a standardized report, called the Ambulatory Glucose Profile (AGP) report. The AGP report has 3 parts:

1. Glucose Metrics and Targets
    – Try to collect enough glucose readings by using your CGM for at least 10 to 14 days
    – Review your average glucose level (how does this compare to your target range?)
    – Look at your time in ranges. The time in range figure shows the percentage of time glucose values were in 5 different categories over the report period of 10 to 14 days.
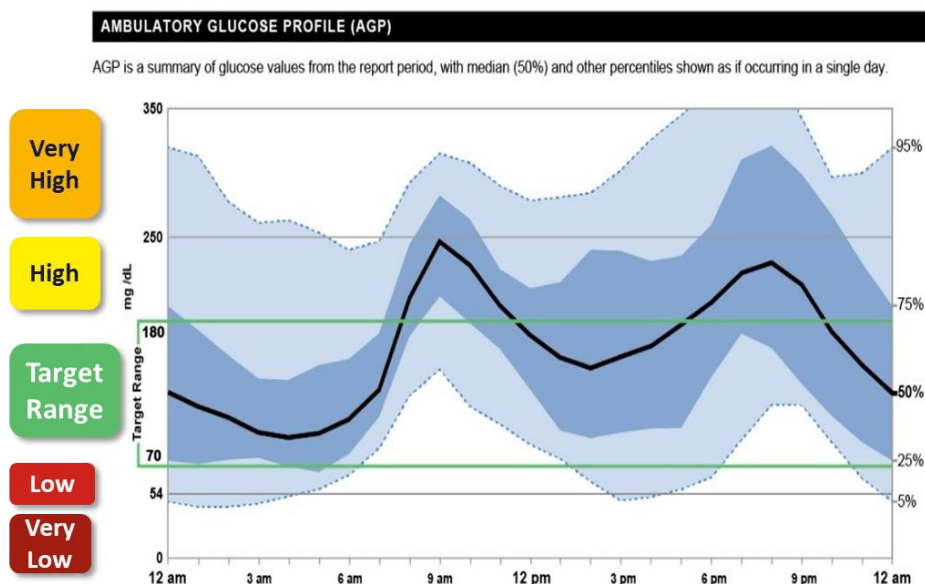
Example:

AGP Report

Targets

GLUCOSE STATISTICS AND TARGETS

26 Feb 2019 - 10 Mar 2019   13 days
% Time CGM is Active   99.9%

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 250 mg/dL ....Less than 5% (1h 12min)
Each 5% increase in time in range (70-180 mg/dL) is clinically beneficial.

Average Glucose   **173 mg/dL**
Glucose Management Indicator (GMI)   7.6%
Glucose Variability   49.5%
Defined as percent coefficient of variation (%CV); target ≤36%

Name _____

MRN _____

TIME IN RANGES

Very High (>250 mg/dL)..............**20%** (4h 48min)

High (181–250 mg/dL)...................**23%** (5h 31min)

Target Range (70–180 mg/dL)....**47%** (11h 17min)

Low (54–69 mg/dL).........................**4%** (58min)
Very Low (<54 mg/dL)....................**6%** (1h 26min)

The goal is to aim for "**more green**, and less "red" (in other words, increase the time in target range and decrease the time below range). Glucose levels in target range for 70% of the time generally corresponds to an A1C of 7%.

2. 24-Hour Glucose Profile or Ambulatory Glucose Profile (AGP)
    – The AGP combines glucose readings throughout each day that you use your CGM (for example, the last 14 days) into a single 24-hour glucose profile
    – It can be helpful to print your AGP and write down the timing for factors that can affect glucose levels such as food, activities, medication, exercise, and usual times for waking and bedtime

- Review your AGP and look for times when your glucose patterns are the lowest. If glucose levels drop very low (such as below 54 mg/dL), it is extremely important to make changes promptly.
- Review your AGP and look for times when your glucose patterns are the highest. Are these times following meals? Is there any relationship to the timing of your medication(s)?
- Look for times where there is more variability on your AGP (see the blue shaded areas in the example below)—this means that your glucose level differs a lot from day to day at that time of day. Can you think of factors that may be contributing to the variability seen on your AGP?

Example:

AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.
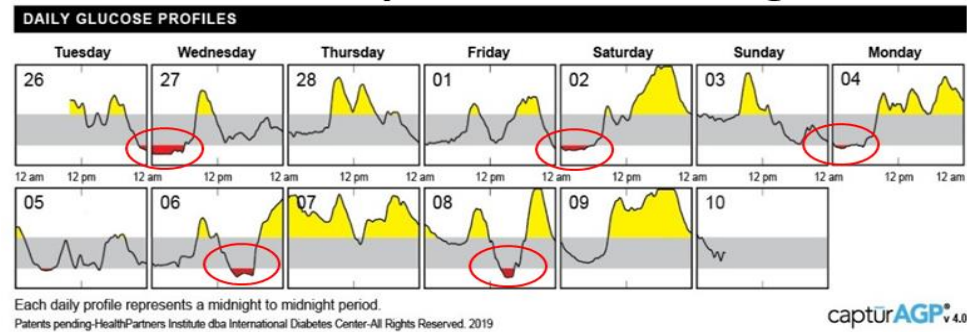
Very High
High
Target Range
Low
Very Low

Note: The heavy black line on the AGP is the median (or middle), which means that at a given time point half of the glucose values were above this value, and half were below

- Looking at separate daily views of glucose levels may help to confirm patterns that you observe on the AGP and identify specific days of the week that are more challenging to stay within target range
- If you have previous CGM information and AGP, compare it with your new AGP. What has changed? What strategies do you think are helping? What is still in need of improvement?

3. Daily Glucose Profile
   - Daily glucose profiles allow the user to see what was happening to glucose levels for each individual day over the last 10-14 days. As noted above, this information can help to better understand wide variability seen on the AGP.

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Example:

DAILY GLUCOSE PROFILES

Each daily profile represents a midnight to midnight period.
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capturAGP v 4.0

Putting it All Together

The information collected with CGM can be extremely valuable to inform diabetes management as part of shared decision-making with your diabetes health care team. A helpful acronym for thinking about CGM data is 'DATAA':

DATA: Together with your diabetes health care team, review your downloaded CGM data. Look at key metrics, the AGP, and your daily glucose views. What does this information mean? What is most noteworthy? What is going well with your diabetes self-management plan?

Assess Safety: Importantly, assess safety-- what percent of time have you experienced hypoglycemia? When are your glucose values below target range? Discuss possible causes and develop solutions.

Time in Range: Review your time in target range. What is working well for you? Can you apply that strategy to other days of the week or times of day that seem to be more challenging?

Areas to Improve: Work together with your care team to identify possible causes of hyperglycemia and adjustments that could be implemented.

Action Plan: Develop an action plan together to address any safety concerns and modify self-management strategies (medication, meals/snacks, lifestyle) for areas needing improvement.

References

Continuous Glucose Monitoring Connecting the Dots.
https://www.diabeteseducator.org/docs/default-source/living-with-diabetes/guides/pocket_cgm_guide_english.pdf?sfvrsn=2

So You Got a CGM—Now What? https://diatribe.org/so-you-got-cgm-%E2%80%93-now-what

EM Miller. Using continuous glucose monitoring in clinical practice. *Clin Diabetes*. 2020;38(5):429-438. https://pubmed.ncbi.nlm.nih.gov/33384468/

Continuous Glucose Monitoring Patient Guide. Step-by-step instructions for understanding your glucose profile. http://www.agpreport.org/agp/sites/default/files/CGM_Patient_Guide_AGP.pdf

Links to Resources and Product Information

Continuous Glucose Monitoring Connecting the Dots:
https://www.diabeteseducator.org/docs/default-source/living-with-diabetes/guides/pocket_cgm_guide_english.pdf?sfvrsn=2

> In Spanish: Monitoreo continuo de glucosa. Establecer relaciones:
> https://www.diabeteseducator.org/docs/default-source/living-with-diabetes/guides/pocket_cgm_guide_spanish.pdf?sfvrsn=2

So You Got a CGM—Now What? https://diatribe.org/so-you-got-cgm-%E2%80%93-now-what

Making the Most of CGM: Uncover the Magic of Your Ambulatory Glucose Profile.
https://diatribe.org/making-most-cgm-uncover-magic-your-ambulatory-glucose-profile

Continuous Glucose Monitoring Patient Guide. Step-by-step Instructions for Understanding Your Glucose Profile.
http://www.agpreport.org/agp/sites/default/files/CGM_Patient_Guide_AGP.pdf

Tip Sheet: Glucose Monitoring What's in it for Me?
https://www.diabeteseducator.org/docs/default-source/living-with-diabetes/tip-sheets/blood-glucose-monitoring/whatsinitforme-final.pdf?sfvrsn=14

Tip Sheet: Glucose Monitoring Insider Tips and Tricks:
https://www.diabeteseducator.org/docs/default-source/living-with-diabetes/tip-sheets/blood-glucose-monitoring/insidertipstricks-final.pdf?sfvrsn=14

Tip Sheet: Glucose Monitoring Recommendations:
https://www.diabeteseducator.org/docs/default-source/living-with-diabetes/tip-sheets/blood-glucose-monitoring/expertrecommendations-final9049dc36a05f68739c53ff0000b8561d.pdf?sfvrsn=16

FreeStyle Libre Tutorials: https://www.freestyle.abbott/us-en/support.html

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FreeStyle Libre 14 day System: https://www.freestyle.abbott/us-en/products/freestyle-14-day.html

Freestyle Libre 2 Features: https://www.freestyle.abbott/us-en/products/freestyle-libre-2.html

How to use the FreeStyle Libre family of products: https://www.freestyle.abbott/us-en/how-to-use.html

Dexcom G6 Tutorials: https://www.dexcom.com/tutorials

Dexcom G6 CGM System: https://www.dexcom.com/g6-cgm-system

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Dexcom G6 CGM System User Guide: https://s3-us-west-2.amazonaws.com/dexcompdf/G6-CGM-Users-Guide.pdf

Guardian Connect System Training Resources: https://www.medtronicdiabetes.com/guardian-connect-system-training-resources

The Guardian Connect System: https://www.medtronicdiabetes.com/products/guardian-connect-continuous-glucose-monitoring-system

Guardian Connect System User Guide: https://www.medtronicdiabetes.com/download-library/guardian-connect

Eversense Continuous Glucose Monitoring: https://www.ascensiadiabetes.com/eversense/eversense-cgm-system/

Eversense Continuous Glucose Monitoring User Guide: https://resources.eversensediabetes.com/sites/resources/files/2021-05/LBL-1602-01-001%20Rev%20O_Eversense%20User%20Guide_mgdL_R2.pdf