Transcript Module 2

[0:16] Dr. Eugene Wright:

Welcome to Module 2, "Beyond the Numbers: Interpreting CGM Data and Addressing the Human Side of Monitoring." My name is Eugene Wright. I'm the Medical Director for Performance Improvement at the South Piedmont Area Health Education Center here in Charlotte, North Carolina. It's my privilege and honor to be joined today by my colleague and friend Davida Kruger, who is at Henry Ford Health System in the Division of Endocrinology, Diabetes, Bone and Mineral Diseases.

[0:45] Dr. Eugene Wright:

Let's jump right in with CGM reports and AGP fundamentals. The ambulatory glucose profile is a single-page report standardized for interpreting a patient's daily glucose patterns. It provides both graphic and quantitative characterizations of those patterns. I like to think of the AGP as a report that translates a large amount of glucose data into actionable information.

The slide is divided into three sections. First, the summary metrics, values and goals, including time in range, which help assess the overall quality of glucose management. In the middle is the ambulatory glucose profile itself, which shows all the values as if collected over a single 24-hour period. This shows variability, the mean glucose, and patterns of highs and lows. In the lower section are the daily glucose profiles, which help determine causes of patterns or exceptions to usual patterns.

[1:59] Dr. Eugene Wright:

The ambulatory glucose profile and the metrics section has a number of metrics, and we'll try to go through those briefly to give you an idea of the value of these.

[2:10] Dr. Eugene Wright:

Step one is the number of days. Before any productive review of glucose metrics, you want to make sure enough data was captured, at least 70% of the time. Here we have 14 days and about 89% of data captured, which is a good start.

[2:37] Dr. Eugene Wright:

Step two is time below range. Identifying hypoglycemia is a priority in systematic AGP review. Hypoglycemia is the major limiting factor in glycemic management of type 1 and type 2 diabetes, and reducing its occurrence and risk is at the heart of good diabetes care. If less than 4% of sensor readings are below 70 mg/dL, the patient is on target and the consultation can move on. If 4% or more of readings are below 70 mg/dL, it's important to understand why, especially if 1% or more are below 54 mg/dL.

[3:29] Dr. Eugene Wright:

Step three is time in target range, a metric we shoot for as a goal. Greater than or equal to 70% of the time is good, and higher is better. Time in range doesn't necessarily translate into A1c. A1c provides only an average of the patient's glucose, typically over about 120 days. Time in range is more actionable information than A1c alone and should complement, not replace, the A1c. In these examples, patients A, B and C all have an A1c of 7% but very different time in range. Increases of 5% or more in time in range can be clinically beneficial.

[4:28] Dr. Eugene Wright:

Step four is glucose variability. It's an important metric because evidence is emerging of an association between glucose variability and increased risk of microvascular and macrovascular complications of diabetes. In the AGP report it is the variance in glucose measurements, both within and between days. The target is a coefficient of variation of 36% or less, because the risk of hypoglycemic events rises significantly above this.

[5:08] Dr. Eugene Wright:

Step five is the glucose management indicator. GMI is a measure of short-term glucose exposure over the 14-day AGP period. It's calculated from CGM-derived mean glucose values and is often used as an A1c comparison. I want to turn over now to my colleague and friend Davida Kruger, who will talk about pattern recognition and training.

[5:38] Davida Kruger:

Okay, let's start by identifying common patterns, beginning with the dawn phenomenon. Gene gave you nice background information to help you apply to what I'm about to say. I've been in diabetes for more than 40 years, and we used to talk about the dawn phenomenon without knowing where it came from, what to do with it, until we had CGM. So let's talk about what it is, what it isn't, and how to view it.

In people without diabetes, in the early morning hours, hormones such as cortisol and growth hormone signal the liver to produce glucose for energy to wake up. That happens in all of us. If you don't have diabetes, glucose production triggers beta cells in the pancreas to release insulin, and the combination keeps blood glucose in check. If you do have diabetes, you may not have enough insulin, or be too insulin resistant to counter the increase, and you get an elevated fasting glucose. We call it the dawn phenomenon because blood sugars rise with the dawn.

It occurs in about half of people with type 1 or type 2 diabetes, and you can see on this CGM screen the blood sugars rising. Look at the postprandial blood sugars after breakfast. Now that I have this information, I can say, wait, this is where this person's dawn rise is, and I can adjust medications to help get rid of it. They don't have to live with that. Before CGM, I didn't have this ability.

[7:28] Davida Kruger:

Other common places to look are postprandial excursions and nocturnal hypoglycemia. Let's start with postprandial excursion. This takes everything Dr. Wright taught you and puts it on a one-pager,

and that's all you really need. Don't let it sound complicated or scare you. Everything he taught you is on one page. I look at the bottom panel and at the time in range, which here is 56%. They're having a lot of high blood sugars and some lows, and I try to figure out where that's coming from. In the bottom panel it appears to be after meals. I can go back and have that conversation. What time do you take your insulin? What else is happening? Have I given you enough medication for each meal? Sometimes people don't even know that what they eat causes a rise in blood glucose. This is very obvious, and I can see it and can show it to the patients.

[8:43] Davida Kruger:

Nocturnal hypoglycemia scares the patient and the provider. If a patient is having hypoglycemia, they may stop their medication, or a well-meaning family member gives them an extra meal before bed, causing hyperglycemia in the morning. Without CGM, patients sometimes tell me, "I don't think I'm having any hypoglycemia," and I look at the CGM and say, you're just not feeling it. Being able to determine nocturnal hypoglycemia is huge, and I can make adjustments to get rid of it.

[9:23] Davida Kruger:

Now, identifying the impacts of lifestyle, exercise and medication. You don't have to get into the weeds like I do, because diabetes is all I do. You can look at the one-page AGP report and make big decisions on how to help that patient. And once you put a CGM on a person with diabetes, I guarantee they will make lifestyle changes, exercise changes, and take their medication more regularly. Research and publications show a 1%-2% percent lowering of A1c just from giving a person continuous glucose monitoring, because they make lifestyle changes on their own.

[10:13] Davida Kruger:

What I want to do is translate the patterns I'm seeing into actionable interventions, such as insulin titration. When I look at this individual's AGP report, is that person doing great? Yes, they are. If I only looked at the A1c, I couldn't tell you that, because A1c is an average of the last 30 to 90 days. They could be having 10% lows and the highs balance out the A1c. In the AGP report I can see this person's 81% time in range. We want greater than 70%, less than 5% lows, though I'd like to get rid of all the lows, and less than 25% high.

So, this individual is making the mark on AGP. Based on A1c alone, someone may have a great A1c and too much low blood sugar. In this scenario his A1c goal is met and overall glycemic control is well managed, but he's having some hypoglycemia, and I can adjust his insulin, for example from long-acting 34 units down to 28 units. That improves safety in his regimen while getting him to appropriate treatment goals.

[11:37] Davida Kruger:

More actionable interventions: meal planning and exercise. If your patient hasn't seen a diabetes educator or a dietitian, please offer that opportunity. They'll learn so much they can incorporate into their lives. They also need to know what food does to their glucose, and CGM lets them see that. And what does exercise do? Typically it lowers blood glucose, as muscles contract and pull glucose from the blood for fuel and the body's cells become more sensitive to insulin. Here's the key: that sensitivity

can last 24-48 hours, so the next day they can have hypoglycemia and need to be aware of that. CGM keeps that patient safe.

Some lifestyle behaviors can prompt hypoglycemia: delayed meals, catching up with insulin, increased activity, skipping a meal. Exercise after a meal can help reduce glucose spikes and postprandial levels. Patients tell me all the time, "Now that I can see my CGM, I go for a walk every night after dinner, or at least three or four nights." Those are nice, actionable things.

[12:55] Davida Kruger:

What about alarm fatigue? We want to give a patient a sensor but not overwhelm them with it. We can reduce the alarms, because if the patient is over-alarmed, they'll take the sensor off, turn alerts off, or walk away from it and not benefit. Reduced or absent responsiveness from frequent faults or unnecessary alarms erodes trust and long-term use of diabetes devices. Family members complain all the time about nocturnal alarms. If the alarms help keep the patient safe, that's okay, but if they're a nuisance, everybody gets upset. I sometimes tell them to have their spouse sleep on the couch.

About 62% of patients reduce their use of CGM because of alarms. Strategies to reduce the burden: customize the alarm thresholds. The patient doesn't need to know while sleeping that their blood sugar is 170 mg/dL, and hypoglycemia is not at 80 mg/dL, it's below 70 mg/dL. Then there's anxiety, guilt or frustration from looking at the data. We want the patient to use the data appropriately and look at the positive side. Then collaborative review of CGM data: the patient wants us to look at it with them, or to give them the tools to look at it themselves, with realistic goals, and motivational interviewing to support behavior change.

[14:33] Davida Kruger:

We have three cases for you, and I'll start with case one. Here's Maria, a 62-year-old woman with type 2 diabetes for the past 12 years. She's on metformin 1,000 mg twice daily, semaglutide 1 mg weekly, and insulin glargine 24 units at bedtime. A nice regimen. She's used a CGM for the past six months. Her A1c has been 7%, time in range 82%, time below 70 mg/dL is 1%, and she has no episodes of severe hypoglycemia requiring help.

Her concern today is the CGM alarms. They wake her up several times each week. She's frustrated and has considered turning off the alerts overnight. No, we don't want that. They go off too often and nothing is ever wrong. This is a real problem we can fix.

[15:36] Davida Kruger:

Her overnight glucose remains stable, 95 mg/dL to 130 mg/dL. Most nighttime alarms occur when glucose reaches 80 mg/dL and is slowly drifting downward. Her predictive alerts trigger even though glucose is stable and not falling below 70 mg/dL, and there's been only one true hypoglycemic event below 70 mg/dL recently. People get caught on 80 mg/dL being hypoglycemia, but really it's below 70 mg/dL.

So her current alarms are very conservative, and that's causing the problem. Her low glucose alert is at 80 mg/dL, her predictive alert fires 20 minutes before reaching 70 mg/dL, and her high alert is 180, 24 hours a day.

[16:23] Davida Kruger:

How can we remedy this? We lower the nighttime low alert from 80 mg/dL to 70 mg/dL, which still protects her. We turn off the predictive low alert, if applicable to the sensor she's wearing. And we raise the nighttime high alert from 180 mg/dL to between 220 mg/dL and 250 mg/dL, which is probably safe while she's sleeping, while during the day we leave it at 180 mg/dL. That should take away a lot of the alarms that are upsetting her and allow her to keep wearing her sensor. I'll give this back to Gene to do his case.

[17:00] Dr. Eugene Wright:

Thanks, Davida, for that very informative case. I have James, a 58-year-old man with type 2 diabetes for eight years. His current medications are metformin 1 g twice daily and empagliflozin 25 mg daily. He started a CGM about three weeks ago. His A1c is 7.4% and his BMI is 31. He's here for his first CGM follow-up. He says, "I'm checking my app all the time. Every time my glucose goes over 180 mg/dL, I feel like I'm failing. I thought the goal was to stay at 100 all day." He reports checking his glucose more than 30 times a day and has started avoiding foods he enjoys because he worries about brief glucose increases.

[17:54] Dr. Eugene Wright:

Here's his AGP summary. His time in range is 76%. Time above range is about 22%, with about 20% above 180 mg/dL and only about 2% above 250 mg/dL. His time below 70 mg/dL is about 2%, and his average glucose is 154 mg/dL. His GMI is 7%, and his coefficient of variation is about 30%.

Looking at his patterns on the AGP overlay, he has stable glucose overnight, between 100 mg/dL and 130 mg/dL. He has a consistent glucose rise after dinner that peaks around 200 mg/dL for approximately 60-90 minutes, and he returns to his target range before bedtime with no significant hypoglycemia.

[18:54] Dr. Eugene Wright:

What do we do? Patient education and discussion for James focuses on using the AGP as a pattern recognition tool, not a report card. The clinician opens the AGP report rather than reviewing individual daily traces and says, "Let's look at the big picture instead of every number." This is a classic example of missing the forest for the trees. The AGP summarizes his glucose patterns over two weeks, and we're looking for trends, not perfection.

The highlights: he has excellent time in range, 76%, exceeding the recommended greater than 70%. Very little hypoglycemia and none below 54 mg/dL. One consistent pattern is post-dinner glucose excursions. We explain that a temporary rise after eating is expected, and what matters is whether it comes back down, and how quickly. We assure him that his does come back down. So rather than

focusing on isolated glucose values, we discuss the evening pattern of glucose rise after a meal and what we can do to remedy it. Davida?

[20:13] Davida Kruger:

Thank you. David is our final case, a 61-year-old man with type 2 diabetes for 10 years. He's on metformin twice daily and tirzepatide 10 mg weekly. He recently started CGM, and for routine follow-up the clinician downloaded his AGP data before the visit: 68% time in range, minimal hypoglycemia, recurrent excursions to 220 mg/dL to 250 mg/dL after dinner, and stable overnight glucose.

[20:43] Davida Kruger:

Rather than immediately adding another medication, the clinician reviews the AGP with David and asks about his evening routine. He shares that he often eats dinner late while watching television and is usually sedentary afterward. Together they develop two realistic goals: 10-15 minute walks after dinner at least five evenings per week, and smaller portions of high-carb foods at dinner. The clinician asks David to keep wearing the CGM and use the data to see how these changes affect his post-meal glucose patterns.

[21:19] Davida Kruger:

At a follow-up four weeks later, time in range improved from 68%-77%. Post-dinner excursions were smaller and shorter, and no medication changes were required. It was done by behavioral changes.

[21:38] Dr. Eugene Wright:

We hope you've found this activity informative and clinically relevant in getting beyond the numbers, interpreting CGM data, and addressing the human side of monitoring.

Thank you very much, Davida, and thank you for your participation.