

Division of Diabetes Treatment and Prevention

Advancements in Diabetes Seminar

Hypoglycemia: Increasing Awareness & Reducing Risks and Harms

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Dr. Carol Greenlee:

First of all, I want to tell you that I really appreciate being able to present to all of you, and I want to thank you for attending this webinar. I think the topic is much more interesting than I am but I will tell you that I've been in endocrine practice for over 30 years. I have a passion for helping people with diabetes and that led me to have a passion for patient-centered care. And currently I'm working as a part of a federal grant called Transforming Clinical Practice Initiative to help practices practice better and improve the value of care. I'm working with the federal inter-agency work group on reducing hypoglycemia as an adverse drug reaction and I'm eager to share some of that work with you today.

I think at least the people around where I practice aren't aware that hypoglycemia is the leading cause at the emergency department and hospital admissions for our patients with diabetes. There are about 100,000 emergency room visits for severe hypoglycemia due to insulin. This does not include those due to sulfonylureas. And there are over 30,000 hospitalizations and a surprising thing is that especially for our elderly patients, there's a fairly high in-hospital death rate after they're hospitalized for hypoglycemia and a very high 30-day readmission rate for another bout of severe hypoglycemia.

In our elderly patients, the admissions for hypoglycemia far exceed those for hyperglycemia and it's currently the second leading adverse drug event concern behind the opioids. And as you'll see, there is sort of an interaction with opioid use and hypoglycemia.

There was just recently a study released from the United Kingdom looking at the risk of in-hospital death or prolonged length of hospital stay and readmission after a patient was admitted with a severe hypoglycemic event. And age was a huge determinant of length of stay and in-hospital death. But in addition, that co-morbidity index called the Charlson Index, the more co-morbidities or the more severe the co-morbidity is the more likely that patient was to have an in-hospital death or to have require a prolonged stay.

In addition, they looked at something called the deprivation index and the more deprived the patient was in the social determinants of health such as housing, food, education, et cetera, the more likely they were to die or have a prolonged length of stay.

Those are things that we often don't think about. So, why do we want to talk about hypoglycemia today and have a whole talk? Jan told me she thought the talk might last five or ten minutes when she first heard about it. But there are lot of safety and patient outcome issues that need to be addressed and we need to really work at preventing and reducing the hypoglycemic events, providing our patients and families with an action plan. Maybe adjusting the patient's glycemic target and then also maybe adjusting medication choices and being aware of the impact that other medications might have on hypoglycemic events or risks.



As you listen to this presentation today, I want you to be alert for how this information relates to your patients and what factors might indicate their risk for hypoglycemia, how can that risk be reduced, and how can you increase the awareness of hypoglycemia among your patients as well as your staff. So I know you have to share your ideas in the chat box but I want you all engaged in sharing as part of this.

In our patients with diabetes, we've mainly been focused on beating down that hemoglobin A1C and aiming for tight control. But in our adult patients, it takes 9 to 20 years to develop significant chronic complications due to hyperglycemia. They can occur more rapidly in younger patients. The older the patient, the longer it seems to take to develop these complications.

So when we're deciding about tight control, we need to consider the benefit over the risk. The risk of having a hypoglycemic event as well as the risk of harm from hypoglycemia and that harm is more likely if the patient lives or works alone and has no one to assist them, or if they're driving or operating heavy equipment, or working with chemicals, et cetera, or if they have those co-morbid conditions that increase the damage, the risk from hypoglycemia.

Hypoglycemia in people with diabetes is defined as a hemoglobin A1C, a blood sugar under 70. And of course to our patients and to many of our staff, hypoglycemia means nothing. We need to say low blood sugar. Severe hypoglycemia is a low blood sugar that requires assistance to treat it or a blood sugar less than 40. Asymptomatic hypoglycemia or hypoglycemic unawareness which is very frightening, it's like not having anything on your car to tell you when the gas is getting low and you just end up stalled on the highway. But that's defined as not getting the warning signs from the adrenergic and cholinergic systems. You just end up getting the neuroglycopenia and relative -- or some people call it pseudohypoglycemia relatively common in our patients with type 2 diabetes. They start to get hypoglycemic symptoms maybe at 99 or 95. So a blood sugar above 70, and if they've had really high blood sugars, they can even get hypoglycemic symptoms when they get into the 100s.

So, this is not real or dangerous hypoglycemia. But fear of hypoglycemia is real. And patients often will run their blood sugars high to avoid low blood sugar and then they can end up over treating once that blood sugar gets really high and get on a roller coaster of blood sugars.

The counter regulatory hormones are very important and play a role in keeping our patients from having low blood sugar, keep all of us from having low blood sugar. So, these are counter regulatory to insulin. So once a low blood sugar event is triggered, our alpha cells in the pancreas are triggered to release glucagon which causes the liver to release more sugar. Our autonomic nervous system releases epinephrine and norepinephrine which also stimulates the production of glucose. And then our pituitary can make growth hormone and cause our adrenal to make cortisol which are slower acting but also help to counter balance low blood sugar.

However, if we're sleeping or if we've done vigorous exercise or taking opioids or benzodiazepines, that adrenergic, the epinephrine and norepinephrine response is blunted and people become more prone to hypoglycemia. If someone's had diabetes for a long time, the alpha cells don't respond to the signal from hypoglycemia to make more glucagon. So patients with long standing diabetes become more prone to hypoglycemia because they've lost the alpha cell response to the stimulus of hypoglycemia and an important thing is if a patient has had alcohol to drink, the alcohol keeps the glucagon from allowing the liver to release sugar. So, it's like the sugar gets trapped in the liver and can't get into the blood stream from the body's own natural glucagon or even from a glucagon injection to rescue the patient.

And if a patient has had repeated episodes of hypoglycemia, they develop autonomic failure or what we call hypoglycemic unawareness where they no longer get those warning symptoms as I discussed. But the good news with that if they stay out of the hypoglycemic range for two or more weeks, those warning symptoms can often come back. So, we have the neurogenic symptoms due to the adrenergic and cholinergic system but if we don't know that we don't feel those symptoms or we don't treat the low

blood sugar, the blood sugar keeps going lower, the brain doesn't have enough glucose to operate and the patient enters the phase of neuroglycopenia.

I tell people, it's like running out of gas and their car stops. They can have a seizure. They can have loss of consciousness and we'll talk about what else they can have. So most of us are aware of those signs and symptoms of hypoglycemia, but there are more effects of hypoglycemia that we need to be aware of.

We know that when someone is acutely hypoglycemic, they don't think straight, they don't talk well, et cetera. We know they can go into a coma and that can even result in brain death. But repeated bouts of hypoglycemia can also accelerate the development of dementia. Acutely, hypoglycemia makes patients more prone to falls. Our patients with diabetes already have more falls and they have more fractures and there's strong data showing that hypoglycemia is an additional major cause of falls. But it might not just be the patient who has the trauma. And we worry about our patient's driving or operating heavy equipment.

Most of us are now aware that during a hypoglycemic event, that release of adrenaline and norepinephrine can trigger an acute ischemic event in our patients. So we know in our patients with cardiovascular disease that we want them to avoid hypoglycemia. But most people don't recognize that hypoglycemia is a cause of cardiovascular disease, that it stimulates atherogenic pro-inflammatory and pro-coagulant states. And that pro-inflammatory, pro-coagulant state is worse at a blood sugar of 50 than it is at a blood sugar of 200.

So, we have patients who are trying to keep their A1C as low as possible to avoid complications, actually causing more complications by getting their blood sugars too low. And that pro-inflammatory atherogenic state remains elevated for seven to eight days after a hypoglycemic event. And one of the most frightening things for me as an endocrinologist is the "Dead in Bed" syndrome, which we now know now to be due to prolonged acute QT Syndrome. And so this is from the American Diabetes Association, the QT prolongation is new information, so I added it there for you. But I actually put a picture of this up on my bulletin board in my exam rooms to impress on my patients that if they're trying really hard to not get complications by running low, that they're -- that they're backfiring -- that's backfiring. That's even worse for them.

So the risk of hypoglycemia, especially in our type 2 patients, all of our type 1 patients are at risk for hypoglycemia. But the type 2 patients are those who are treated with insulin and insulin secretagogues primarily the sulfonylureas like glyburide and glipizide. So that's the entry point for the risk of hypoglycemia, then aiming for very tight or intensive control increases the risk. But the risk of an adverse event from hypoglycemia is actually higher in patients with a high A1C. So, the risk is not just from tight control. Having missed or irregular meals or having food insecurity is a major cause of hypoglycemia. The longer a patient has had diabetes with a progressive loss of beta cells and then loss at the response of the alpha cells, the higher the risk that they will have a hypoglycemic event. And that risk is magnified if they have a cognitive impairment. And as we'll see in a minute, the cognitive impairment is a vicious cycle.

If a patient has renal impairment or hepatic impairment, the insulin half-life and the medication, the sulfonylurea half-life is prolonged. And then they also have less of an ability for the liver or the kidney to make sugar, what we call gluconeogenesis. So there are two reasons why renal or hepatic impairment makes hypoglycemic risks higher.

Patients often have health literacy or inadequate numeracy, lack of education about how to use their insulin and that's a major risk for hypoglycemia. We've already talked about the fact that alcohol blocks the response to glucagon and opioids and benzodiazepines, block the response -- or block the adrenergic response.

We talked about exercise and increased activity and it could just be random, like needing to shovel the walk or it could be an exercise class. But whatever form of exercise, not only burns off sugar, lowering the blood sugar, but it makes you less likely to have that counter regulatory response.

So this is a study again in three different European countries and for all three, missed food or irregular insufficient food intake was the leading cause of hypoglycemia, followed by physical activity and difficulty calculating that insulin dose.

So irregular or insufficient food intake is the leading trigger for our patients on insulin or sulfonylureas to have a hypoglycemic event. And food could be missed, delayed or reduced because of job demands, getting stuck on the tarmac on an airplane, getting into a long meeting. But we can also kind of cause it by telling them to fast for tests or procedures and not telling them how to adjust their medication. We need to teach them sick-day rules because if they are unable to eat or not eat very much or have nausea and vomiting, they need to know how to adjust that medication.

Many of our patients don't know nutrition very well -- and a bacon and eggs breakfast versus a toast or a pancake breakfast require different amounts of insulin. And many, many people, not just our patients have trouble with math. And diabetes really throws the numbers at people, carb counting, calculating insulin doses. And people really can't do that great a job. Many people can't with that. As our patients get older or have complications, they have less ability to even buy their food or prepare their meals. And many of our patients don't even have enough food.

The next slide is a study looking at the incidence of appendectomies over a month in high-income and low-income patients. And as you can see, there's no difference. But hypoglycemia rates rise as the month goes on, only in our low-income patients as a sign that food insecurity and running out of money for food and having to skip on food is a trigger for this hypoglycemic events.

So the American Diabetes Association recommends that all individuals at risk for hypoglycemia and again, that's our patients on insulin or sulfonylureas should be asked about symptomatic or asymptomatic hypoglycemia at each encounter. So the symptoms of hypoglycemia, the mild adrenergic, cholinergic symptoms, most of us are familiar with, sudden moodiness or confusions, sort of looking dazed, feeling shaky, cold sweats, turning pale, heart racing, often we'll be touching them and they'll be clammy. They might feel anxious. If the blood sugars drop lower, they start to get neurocognitive symptoms, difficulty speaking, slurring, unable to answer, poor coordination, feeling numb or having other neurologic symptoms, having a seizure or passing out, and unfortunately, coma and death, or brain death.

Hypoglycemia at night is more common, but it can be more sneaky. They can wake up soaked. They can have nightmares or bad dreams. They can wake up tired with irritability or headache or not wake up unfortunately. I really like these kinds of sheets. They are made by a lot of different companies. I would use these to take home to family members, grandparents. I took care of children as well as adults. I would have them show their coworkers, their college roommate, their babysitter. And this helps the patient identify not just those around them.

So, the American Diabetes Association recommends that the treatment of hypoglycemia, if the patient is conscious is 15 to 20 grams of glucose and checking the blood sugar 15 minutes later if it is not over 100, repeating that treatment with 15 to 20 grams of glucose and then having a snack. This is a more detailed description about rule of 15 and 15 with some examples of what 15 grams of glucose are. We want them to have fast-acting carbohydrates, not a ham sandwich or a peanut butter sandwich. We want fast-acting carbs.

And this is a list of carbs that are faster-acting and sort of ranked by those that are faster-acting and less fast-acting. And there was just a meta analysis study looking at response rates. So when a patient had a low blood sugar and they used the glucose tablets or the glucose gel, they actually got

their blood sugar up faster than when they used food glucose. But I tell my patients if there's nothing around, take what you can get.

The nice thing about the gel is that it can be absorbed right from the lining of the mouth. So if the patient is awake, but you're not sure they can swallow, you can get the gel into their mouth. If they're seizing, that's a lot more difficult.

So, if those patients do have a seizure or loss of consciousness, unable to take oral glucose, they need glucagon. Now keep in mind that if they think the hypoglycemia is due to alcohol, then -- or accompanied by someone having drunk alcohol, the glucagon will not be effective or not be very effective. The American Diabetes Association recommends that if a patient is at risk for significant hypoglycemia or has had a significant event, that they be prescribed glucagon. And it's really important that you're aware and your patients are aware that you don't have to be a healthcare professional to give a glucagon shot. We run into this a lot with school personnel who tried to tell us that only a nurse can give glucagon, which is absolutely not true.

This is from the Joslin Diabetes Center patient guide on glucagon and I put a picture of the glucagon kit there because we need to teach the family members or significant others how to use the glucagon kit. Because as you all know, there's the diluting agent here and the glucagon powder is in here. And the two have to be mixed as you can see in the instruction and then injected. So in a moment of panic, if our family members don't know where the kit is or they don't know how to mix it and inject it -- and it doesn't have to be intramuscular, it can be subcutaneous and it will still work. But they need to have some instruction and look at the kit before. And if these kits expire and when they expire, they're really expired. So we will tell families to practice mixing and injecting into an orange so that they have that experience if they ever need it. Fortunately, nasal glucagon is coming. So that should be a big relief.

Now, some of the new technology for insulin pumps -- insulin pump delivery of insulin is more reliable, it can be more precise. And that the continuous glucose monitoring with or without a pump will send an alarm if the blood sugar starts to drop rapidly or passes say 70 as a threshold. If that glucose sensor is attached to the pump, then with some of the newer models, it will actually stop the insulin if the blood sugar goes under 60 and no one turns off the alarm. And then the new artificial pancreas model as the blood sugar is dropping, it will cut back or stop the insulin even before the patient gets to that low blood sugar level. So these are wonderful improvements for our patients and particularly for our kids and adults with type 1 diabetes.

The recommendations to improve patient outcomes from hypoglycemia include individualizing the glucose targets, increasing patient education, including how to have dietary intervention to avoid hypoglycemia, like sick-day rules, et cetera, exercise management, which includes snacking to prevent low blood sugar, or reducing the insulin and being aware that that low blood sugar may happen hours after the exercise, not just during the exercise. Also, adjusting medication, increasing glucose monitoring and surveillance and we'll touch on a number of these.

Individualized glucose targets is important. Not everybody needs intensive control and our older patients, those patients more prone to hypoglycemia and more prone to adverse effects from the hypoglycemia often get the least benefit from tight control. So they're going to get the highest risk and the least benefit.

So we may not want to aim for an A1C under seven in those patients. We need to adjust the glucose targets for the patient's risk, their other co-morbidities, the context of their living situation and treatment burden. And I can't talk a lot about treatment burden today, but that's a big one -- as well as the patient's values and preferences.

So a recent wonderful paper on this in a cardiology journal actually talked about no single A1C level is appropriate for all patients. And we should abandon that notion, that someone who has an A1C over

seven is, “uncontrolled.” It needs to be a balance and this is a form from the -- that the American Diabetes Association actually uses in its guidelines where you can sort of -- I actually use this with my patients. I kept copies of this in my exam room and so I would put circles around -- you know what their age was, how long they'd had diabetes. And we would look at this together to kind of set their target.

Now, before we get too busy setting targets, we need to be aware that the hemoglobin A1C has its own issues. It's not always accurate -- and by accurate, I mean the A1C does not always reflect how high the blood sugar is. And then it's not that precise. The A1C measurement is better as a range not an absolute cut-off due to that lack of precision. And it also doesn't tell us how much the blood sugar goes up and down, so it's really not safe to adjust medicines especially insulin or sulfonylureas based on just the A1C. Sure, you have a patient with an A1C of 7.5 who's only on metformin and they're not on the maximum dose. It's safe to take the metformin up, but it is not safe for our patients on insulin or sulfonylureas.

So the assay accuracy, meaning how well does it indicate what the average blood sugar really is. Well, that accuracy is altered by age and ethnicity. So we know in African Americans that for the same blood sugar, the A1C is 0.4 higher. And the higher the blood sugar, the greater that skew. So if you have a really high blood sugar, the A1C might be 0.5 or 0.6 higher. So if someone has an A1C of 7.4 and they're African American, and you're trying to get it under seven, that would be for a Caucasian, it would already be at seven. And the same with our elderly patients, they tend to run a higher A1C for the same blood sugar that another person would have a lower A1C.

In addition, there are common interfering substances or conditions. Iron deficiency is fairly common and it can make the A1C run high even the people who don't have diabetes, it can make the A1C into the sixes and sevens, even in a non-diabetic. Sickle cell trait tends to lower the A1C. So patients with sickle cell trait usually have some African American. So there's kind of a balance -- African American, the A1C is higher, sickle cell trait -- it's lower, but they don't really balance each other out. We need to be aware of this lack of accuracy.

This is a list of things that can impact -- make the A1C read low for instance, blood transfusions or hemolysis or bleeding out, acute blood loss. Iron deficiency tops the list for inappropriately high A1Cs. And when I lived in Atlanta, I took care of a lot of HIV-AIDS patients and they would often have really high blood sugars and A1Cs in the fours and fives because of the interference of many of those medications. So we just need to be aware.

Now assay precision means when you get a result, how close is it to a real result? And even with a good A1C assay that has 3% precision, when you get an A1C of 8, the true value is anywhere between 7.5 and 8.5. So if we run the risk of overtreating patients and undertreating patients, if we don't realize that an A1C range is more appropriate because of that precision issue. And then these are real patients on those glucose sensors that get blood sugars every few minutes. And you can see, even though these patients all have an average A1C of 6.7, the one person in the purple -- several people in the purple have low blood sugars during the night hours and high blood sugars in the day. So, if we only went by A1C that would not be a good outcome for our patients.

So currently, 90% or more of patients with type 2 diabetes are treated in the primary care setting. Less than 25% of those are referred to a specialist. The primary care physician also serves as the main source of diabetes education, 24% or more of our patients with diabetes have no access to a certified diabetes educator in their geographic region and I can tell you I live next to one of those regions. I treat many patients from Eastern Utah. I'm in Western Colorado, and if someone gets newly onset diabetes or gestational diabetes, they have to drive to Grand Junction, Colorado to get a diabetes educator and many of them can't do that very often. So they go uneducated.

At the same time, primary care physicians and staff don't have the time to provide the in-house education. So many of our primary care physicians, their staff, and patients have not been educated

about the hypoglycemia while at the same time, there's immense pressure from payers, Medicare, Medicaid et cetera, to get those A1Cs under 7 or under 8 whereas really the government's metric, the Medicare, VA, et cetera metric is avoiding A1Cs over 9. But there's a lot of pressure in the guidelines without the counterbalancing education around hypoglycemia.

So we really need to bolster up patient education. Let our patients know what low blood sugar is and why it's dangerous. Make them aware of the symptoms and like I said, I like the picture handouts, how you treat hypoglycemia.

Many, many patients will tell me ham sandwich. I don't know why they picked that or peanut butter, and of course, that's not a good treatment for hypoglycemia, what to do when they are sick. How to prevent hypoglycemia and especially if they're on mealtime insulin, they often will take that insulin at a given time not necessarily in relationship to when or what they eat. So we really need how to prevent hypoglycemia as part of the education and then that they need to let their care team know if they have an unexplained hypoglycemic event.

Also, our staff need to be aware that people with type 2 diabetes can have serious and harmful hypoglycemia. I hear day in and day out, "Oh, I didn't know people with type 2 diabetes could have hypoglycemia." Our staff also needs to know how to recognize it, how to treat it, and how to teach families and patients about it.

So, surveillance starts by asking we should always ask at every appointment about low blood sugar or symptoms of low blood sugar, or low blood sugar on their monitor. I always ask my patients how they treat it because that sometimes takes repeat education and if they're having medication changes like they're stopping prednisone or starting prednisone, or you've increase insulin or glipizide, or you've added something like extra dose of metformin, they should monitor their blood sugars more often to let you know whether they have low -- and that might include 3 a.m. blood sugar check.

Again, the ADA recommends and this is that vicious cycle recommends that if a patient is having, one that their cognitive function be assessed and if they're having a decline in cognition, think about that being caused by hypoglycemia. On the other hand, if a patient has cognitive impairment, it is a cause of hypoglycemia and that's where the vicious cycle comes in and thus, patients need to have a higher A1C and blood sugar goal.

So, another part of routine clinical surveillance that we're not really doing right now that we're hoping to get instituted is to consider risk stratification for hypoglycemia even if we start with those patients at the highest risk for the most severe events. Those patients taking insulin who've already had a bout of severe hypoglycemia or who have hypoglycemic unawareness, and are elderly and or have renal impairment. We're not going to catch everybody, but we're going to catch those at the highest risk of harm and the highest risk of an event.

So, I told you that I'm into patient-centered care and working on improving care delivery and that includes the patient-centered medical home and a key part of the patient-centered medical home or the Chronic Care/ Expanded Care Model is empanelment of the patients and then risk stratification of the patients and providing care consistent and appropriate to the level of that patients risk.

So most patients are going to be healthy, they may need some preventive services and acute care services. Then we have the patients who are at rising risk, maybe they have diabetes or high cholesterol or hypertension. And then we have those patients who have the highest risk of having a bad event. And as all of us know that's not just related to their medical condition, it's also related to behavioral health and social determinants of health.

Up until now, no one has really considered hypoglycemia risk in there, so this is a risk stratification tool and I know it's hard to see. Hopefully, if you get the slides, you can magnify it, but this was created by

one of the Federally Qualified Health Clinics in Northwestern Colorado and they've been working with me for a while. This is for someone with diabetes -- I'm so sorry you can't see it -- but the higher the A1C, the more points they get, the higher the cholesterol, the more points they get, the higher the blood pressure, the more points they get and down here, we put some things for hypoglycemia, the higher their score, the higher the intensity of the care that they get.

And so we put hypoglycemia in here and just tested for the past year what that has done to their risk scores and has that helped them and I got a really excited call from the physicians. One of the physicians from that clinic just saying that the staff wasn't even aware people with type 2 diabetes could have hypoglycemia and how much adding this risk stratification amount or adding a hypoglycemia points to the risk stratification help them better match the care to their patients. So, hopefully we'll have tools to help with this.

So currently the ADA recommends that if someone does have hypoglycemic unawareness or you discover that they've had hypoglycemic events that we re-evaluate their treatment regimen, that we raise their glycemic targets and adjust their medication. So medication adjustments are often needed in our patients with diabetes. As they get older, they have declining renal function and maybe hepatic function, declining cognitive function. They may gain or lose weight. So the diabetes gets worse over time and our patient's bodies change over time, and we just need to make adjustments for those.

Common type of errors, I call them errors that lead to hypoglycemia is what I call "Blanket Insulin". And so I'm going to go back a click, you can see that there's the baseline insulin and when we eat, there's mealtime insulin and that's how our pancreas work. If we give so much basal insulin to even cover those mealtime peaks, then overnight or in between meals or with any exercise, our patients are going to go low. So lowering that basal and then if needed doing something for the mealtime is a better approach.

Another common trigger of hypoglycemia in our patients on insulin is when you have them on a basal insulin and it's not enough and you add insulin before mealtime insulin before that supper or evening meal, that bedtime blood sugar comes down and now the basal insulin is too much and they go low blood sugar in the middle of the night or upon awakening. And so often when you add mealtime insulin in the evening, there needs to be a reduction in the basal. Just for safety, you can always go back up on it.

So just thinking for a minute how does this change your approach to your patients? The current paradigm of approach is that the endocrinologists tell the primary care doctors what to do. The primary care doctors don't have time to do all of that. They then tell the patients what to do and it doesn't always come out the right way.

The new paradigm is individualization; individualization of the blood sugar and A1C goals and targets and the kind of treatment that we use. We try to match that to the patient's age, co-morbidities, pathophysiology as well as to their socio-economic status. And we've talked about that already today.

So that requires that we do what I call and what many people call contextualized care where we adapt the science and our scientific knowledge to watch best for the patient in their circumstances to meet their needs, to meet their values and preferences and to provide a burden of care that they have the capacity of meeting. So, that's all part of shared decision-making, adapting it to the patient. So we become more of a coach, working with them to help them get the goals they want and adapting to their personal needs.

So, I had the fortune of chairing a collaborative effort around the developing shared decision-making tools around insulin and glucose targets, and these are the organizations that collaborated.

So I'll start showing you how to use these tools with the patient of a 72-year-old, male whose has had type 2 diabetes for around 20 years. He has some renal impairment, peripheral neuropathy and cardiovascular disease. He is in the obesity range. He had metformin and glyburide stopped about a year ago because of his renal insufficiency and I think now we all know that the metformin guidelines have recently changed, but at his age, he may still have needed that metformin stopped or at least reduced.

His last A1C was 7.7% and based on that, he had been told to increase his insulin glargine from 48 to 54 units. So, he comes in for a follow-up appointment and gets a point of care A1C at 6.9% and everybody is telling them, "Oh, this is great you're doing great." But his wife is hysterical, he's been having low blood sugars around 4 in the morning or if he goes out to do his gardening or yardwork and she's scared to death.

So, we have a tool for the physician that says if your patient is having trouble controlling their blood sugar, first be sure that the target blood sugar and goals are appropriate, and this is the physician's tool using the chart from the American Diabetes Association and then some other recommendations here. So that we ask the physicians say take a look at where you think your patient should be. And like I said, I even circle those with my patients. I do that together.

So, here is Rudy's where I put his circle. So, most of his circles are up here. It's really hard to know what his self-care capacity is, but most of his circles are towards the eight end of the range.

So we've been bidding on our patients for years telling them they have to get their A1C under 7, so this takes some re-education. So we need to ask the patient and his wife to look at what they think his goal should be. We have to be re-educate them and let them know that they're not going to fall off the cliff if his blood sugars went a little higher. He's more likely to have all kinds of bad things happen if they continue to run low.

So, this is for the patient and the patient can and the wife can look to say, oh, he's over 65, he's had some heart problems and they can start to get comfortable with the fact that it's okay maybe to have some higher blood sugars and a higher A1C.

At the bottom of this page is the A1C range from 6.5 to 8 and the patient can kind of chart where they fall. This talks a lot about the fact that low blood sugars are bad and then this talks about what is hypoglycemia, what medications make you more prone to hypoglycemia, what are the symptoms, what makes you more prone to have problems from hypoglycemia.

So, using those tools, then with shared decision-making, the physician and Rudy and his wife can decide that his goals should be between 7.5 and 8.5. It was up around 8, remember it should be better as a range and not less than 7, and they can back down on his insulin.

So, this tool is designed to be used by a full practice team. I hear primary care doctors "I don't have time, I don't have time." But there's a lot of ways we can pull the team in to help with this kind of shared decision-making with our patients. But it's invaluable. The patient feels more confident, they feel more engaged and I think it's really better for us -- really what we want to do is take care of each individual patient in a special way.

So now, we do have some time for questions and comments, but I want you to think about what actions you can take to identify patients in your clinic who are at risk for hypoglycemia especially that most severe category that we talked about and what can you do to reduce the risk, what can you do to increase awareness of hypoglycemia throughout your entire practice team, and to ensure that patient education for patients who are on insulin or on sulfonylureas includes information on hypoglycemia sick-day rules, what to do if you're going to go shovel the walk, and what to do if you can't eat, et cetera.

So, I'll see if there are questions and I did include for you a link to those tools if you want to use them. I will say that they are not updated for the new basal insulins, the new Tresiba and that type of insulin, Toujeo, but it's still really good information for our patients on goal setting, shared decision-making on goal setting. and risk of hypoglycemia.

Jan Frederick:

Thank you, Dr. Greenlee and while we're giving people a chance to enter their questions or comments for you. Dr. Ann Bullock, the Division of Diabetes Director, is on our call and I'm going to invite Dr. Bullock to make some remarks.

Dr. Ann Bullock:

Thanks, Jan. Thank you, Dr. Greenlee. That was excellent. I had the opportunity to hear Dr. Greenlee give a shorter version of this presentation as part of a Federal Interagency workgroup that is working to reduce adverse events for medications which I think you heard at the beginning of the presentation which include from insulin and sulfonylureas, of course, the main one being hypoglycemia as Dr. Greenlee has just discussed.

So there's a lot of interest in this. You know, we spent so long talking about how we have to get blood sugars controlled that we forgot the other side of that. And our patients have been telling us how miserable hypoglycemia is and because we weren't trained to think about it very well, we didn't always take their concerns as seriously as we might have, at least in terms of how guidelines told us to react to them. So now that we are much more aware with the science that Dr. Greenlee has gone through, how important this is, it's something we must do and this whole concept of individualized treatment targets is something we've talked about quite a bit in this Advancements in Diabetes series.

So, as usual, the younger patients who are healthier if they have the capacity and the interest and tighter control, absolutely we should take care of them, they are the ones that will have the best benefit and the least risk overall. Whereas as patients are getting older who've had diabetes longer, more comorbidities, we need to take this information seriously and loosen up a little bit on their A1C targets and goals. That is not bad practice. That is better practice than what we've been doing. We just need to make sure we're all aware and help our clinical leaders and administrative leaders to understand that as well.