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How Overnight Glucose Levels Impact Daily Activities in T1D Patients

Dr. Buse:

Welcome to *Diabetes Discourse* on ReachMD. I'm Dr. John Buse, and joining us for a discussion on the impact of overnight glucose in adults with type 1 diabetes is Dr. Elizabeth Pyatak. Dr. Pyatak is an Associate Professor of Occupational Science and Occupational Therapy at the University of Southern California.

Beth, thanks so much for speaking with me today.

Dr. Pyatak:

Thanks so much for having me.

Dr. Buse:

Well, first, tell us a bit about how someone from occupational science and occupational therapy ends up working in type 1 diabetes.

Dr. Pyatak:

This is a question I get a lot, as you probably imagine, and what I like to say is that OT is really oriented on how the activities that we do every day impact our health and well-being, and so within that, diabetes has a couple of impacts. So one is, as we know, type 1 is associated with a lot of self-management activities, and those can interfere with or make more challenging some of the other things that we want or need to be doing in our daily lives as well as some of the symptoms of type 1. And so for an OT perspective on type 1, it's really about trying to reconcile and make easier all of the daily tasks that go along with living with type 1 as well as maintaining all of the other important activities that we want to be doing in daily life.

Dr. Buse:

I have patients that complain to me all the time that even if their blood sugars don't get very far out of bounds, any fluctuations make them feel tired or just not feel well. We'll get to your very interesting study in a moment, but what kind of research has been done to examine and validate those kinds of complaints?

Dr. Pyatak:

You know, it's really just been emerging in the last several years, I'd say, really rigorous research that can look at this. And it's really due to the technology advances we've had in continuous glucose monitoring, so now we can get really accurate data on people's glucose as they go about their daily lives. GluCog is one that was recently focusing on the relationship between those fluctuations in cognition, and DIA-LINK out of Germany has really looked at mood and well-being in relation to glucose fluctuations, and so far, there's really not a definitive answer. Some studies are finding associations and some aren't, and I think there's a lot of unanswered questions still in this area of research. I don't want to dismiss the really important qualitative data and people who are reporting on their own experiences, but in terms of quantitatively how we understand that, we're still, I think, in the early days.

Dr. Buse:

Well with that in mind, can you tell us what you were looking to expand on in the field and how you designed your study?

Dr. Pyatak:

Sure. So we wrote this grant from a call from NIH that really wanted to see relationships between glucose and daily life variables, and so our team really wanted to take a broad perspective because there was such limited research in the field, and we wanted to capture a little bit about a lot of different constructs. So we have things about function and daily activity, and even within that, we have cognitive function; we used accelerometers to look at physical activity; we asked people to self-report what are they doing and how well are they

able to do those activities, as well as a lot of robust measures about mood and well-being. And then, of course, we also had sleep data, and we had cognitive tasks that we asked people every three hours throughout the day to respond to these questions and to do these kinds of cognitive activities. And we wanted to really just kind of have a first look at what might be some of these important relationships that we should go and do further studies on to look into.

Dr. Buse:

And just as a follow-up to that, what was the population that you studied?

Dr. Pyatak:

Our collaboration was between USC in Los Angeles and Einstein College of Medicine and Yeshiva University in New York, and this partnership really came about because we really cared a lot about representing diverse populations in type 1 diabetes research. There tends to be a bias toward large academic medical centers that serve people who generally have a higher SES and are not racial-ethnic minorities, so we recruited from Los Angeles and New York, and our population is pretty ethnically diverse. We have about, I think, 40–50 percent Latino, and we also offered our study in English and Spanish. I should say it's any adult aged 18 or older who had the capacity with their daily life schedule and with their vision and motor function and so forth to really engage in the study.

And I guess one other important thing to mention is we also tried to have representation across the range of treatment regimens, so people who were doing finger stick blood testing and injections as well as people on non-AID systems and people on AID systems because we thought some of those aspects might impact the findings as well.

Dr. Buse:

For those just tuning in, you're listening to *Diabetes Discourse* on ReachMD. I'm Dr. John Buse, and today I'm speaking with Dr. Elizabeth Pyatak on the impact of overnight glucose in adults with type 1 diabetes.

So now that we've got your background, Beth, can you tell us about the key findings?

Dr. Pyatak:

Sure. So this study in particular was looking at how overnight glucose variables were impacting function or were associated with functioning variables the following day, so we took glucose overnight, and we looked at a few key parameters around there. We looked at coefficient of variation, of course, which is how variable glucose was; we looked at time below 70; and we looked at time above 250. And a small side note: We looked at time above 180, but we actually didn't see a lot of relationships there. It was only when glucose got into that sort of very high range that we saw relationships with functioning.

So what the study found is that kind of in an omnibus test where we're bundling all of the functioning outcomes, which included cognition, physical activity, and self-reported activity participation, there was a prediction of worse functioning if you had higher CV overnight and more time over 250. And then when we got into the details, we found specifically that higher variability overnight led to lower sustained attention and lower engagement in demanding activities the following day. People spend more time low overnight also had poorer sustained attention, and people who had more time over 250 overnight had more sedentary time the following day.

Dr. Buse:

So there are so many techniques that can help establish glycemic variability, time in hypoglycemia, and time in hyperglycemia. We have the use of CGM, hybrid-closed loops, and various insulin analogs to reduce various glycemic parameters. Based on the context of your study broadly involving people with diabetes, do you have any particular recommendations for people with type 1 diabetes and their providers around the glucose targets that they're aiming to achieve or the technologies they use to achieve it?

Dr. Pyatak:

You know, I'm always an advocate for increasing access to technology. Here in California, we have some difficulty getting coverage, for example, from Medi-Cal for some of these devices, and so I would use these findings to advocate for better technology and better access to closed-loop systems for people because, particularly overnight, it does tend to do a better job of keeping glucose in a target range, and our studies would suggest that that would improve not only the long-term complications that we worry about but also day-to-day functioning, which is probably in the short run what really could impact people's quality of life.

Dr. Buse:

Were you able to look at subgroups? Was there less impact on how people felt the next day in patients that were using hybrid closed-loop systems versus, let's say, multiple daily injections or people who had CGM versus people who were just doing glucose monitoring?

Dr. Pyatak:

We do those analyses for each of these papers and manuscripts that we're working on, and this study in particular didn't see those, but we have seen those trends in some of our other analyses. So in other words, someone whose blood sugar tends to run much higher

overall is going to have worse functioning quality of life than someone whose glucoses tend to be in range more, whereas someone who's typically in range and then one night their glucose is high, they might feel a little bit worse the next day, but in the big picture, they're probably doing better overall than someone whose glucose is high more regularly.

Dr. Buse:

Is there anything else you'd like to share before we close for the day?

Dr. Pyatak:

I guess I'd say we have a lot more data that we're working on analyzing, and if there's anybody else who's interested in getting involved in this type of research, we'd love to hear from others in the community either to advise on your own studies or if there's any aspect of this that you're interested in that we might collaborate on, I would be more than happy to talk to those folks.

Dr. Buse:

This has been a really interesting conversation. I'd like to thank my guest, Dr. Elizabeth Pyatak, for being here and for sharing her insights on fluctuations in glucose levels in adults with type 1 diabetes.

Thank you so much for joining us today.

Dr. Pyatak:

Thank you so much.

Dr. Buse:

For ReachMD, I'm Dr. John Buse. To access this episode and others from our series, visit *Diabetes Discourse* at ReachMD.com, where you can Be Part of the Knowledge. Thanks for listening.