The Evolving Landscape of Diabetes Care: Technological Advances to Biosimilars

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Interview Summary

With the incidence of diabetes rising annually across the globe to an estimated 537 million adults, healthcare expenditure is also rising. To gain a wide perspective of diabetes care, EMJ discussed a range of pertinent topics with four international experts: Chaicharn Deerochanawong, Diabetes and Endocrinology Unit, Department of Medicine, Rajavithi Hospital, College of Medicine, Rangsit University, Pathum Thani, Thailand; Yehuda Handelsman, The Metabolic Institute of America, Tarzana, California, USA, and Diabetes Cardiorenal & Metabolism Institute, USA; Thomas Stulnig, Department of Medicine III and Karl Landsteiner Institute for Metabolic Diseases and Nephrology, Clinic Hietzing, Vienna, Austria; and Priya Manjoo, University of British Columbia, Vancouver, Canada.

The topics discussed included the diagnosis and treatment of diabetes, evolution of technologies for managing diabetes, and financial considerations that impact

patient's access to treatment. The physicians' opinions were informed by their experiences with patients and their country specific health care perspectives. They discussed how, while the journey for people with Type 1 diabetes (T1D) often starts with a dramatic medical presentation, those with Type 2 diabetes (T2D) often have preceding risk factors that can delay or prevent the onset if managed appropriately. Early detection and management of diabetes is essential for the prevention of comorbidities associated with hyperglycaemia in both T1D and T2D. Also discussed was the chronic progressive nature of T2D and the need for early intensification of treatment using both non-insulin and insulin therapies. The options for insulin therapy have grown over the years, and now include the use of more affordable biosimilar insulin formulations of insulin glargine or lispro. The experts discussed how this has increased access to insulin therapy, including among those with T2D, for whom prescriptions for glargine insulin had been hard to justify in some cases. The experts additionally discussed how technologies such as continuous glucose monitoring (CGM), insulin pumps, computer and smartphone apps, and telemedicine have revolutionised the treatment of diabetes.

INTRODUCTION

In 2021, the International Diabetes Federation (IDF) estimated that, globally, 537 million adults (aged 20–79 years) were living with diabetes, with around 6.7 million dying from the condition. In both instances, numbers are rising worldwide, with projected prevalence going from 10.5% currently to 12.2% by 2045. The majority of cases are of T2D, with around 10% being T1D. Annual global healthcare expenditure for diabetes is around 777 billion GBP.[1]

Here, four diabetes experts from North America, Europe, and Asia discuss the patient journey with diabetes; stakeholders involved in that journey; and diabetes treatment, including intensification, insulin therapy, the advent of biosimilar insulin, and technological advances.

THE PATIENT JOURNEY WITH TYPE 1 AND TYPE 2 DIABETES

For people with T1D, the experts agreed that the journey will typically start with a fairly dramatic medical presentation to the emergency room or a primary care physician (PCP) or general practitioner (GP). As T1D most often develops in childhood, diagnosis may, highlighted Handelsman, include a period of denial by the parents and, especially in adolescence, by the patient. "For the first couple of years, it can be very difficult to accept and there's a lot of impact on their personality and how they deal with it."

During this period, patients and caregivers need time to adjust to insulin administration. "The fear of hypoglycaemia is huge in the T1D population, even when it's controlled," explained Handelsman. "That fear determines when they take insulin, how they take it, and why we're seeing more hyperglycaemia in them. However, later on, there's hypoglycaemia unawareness." Another important part of the patient journey with T1D Handelsman discussed is that "the longer they have diabetes, the more complications they have." This may arise after just 5 years with T1D, and can include vascular complications, heart failure, neuropathy, and retinopathy.[2,3]

"With T2D," explained Manjoo, "there are often predisposing conditions such as weight gain or other adiposity-related comorbidities that accompany the development of resistance that evolve into pre-diabetes,[4] followed by T2D. The big difference between T1D and T2D," she emphasised, "is that T2D should not come as a surprise to healthcare providers and to patients who have consistent access to primary care." Deerochanawong stated that "for T2D, most are asymptomatic at first and they don't recognise they have it until their blood sugar is very high."[5]

As with T1D, T2D is associated with complications including eye disease, kidney disease, and neuropathy, as well as cardiovascular disease (CVD) and cerebrovascular disease.[6] Indeed, agreed, Manjoo, T2D "shares the same risk in terms

of microvascular disease as T1D does." However, she discussed how trials published in the late 2000s did not support improvement in cardiovascular outcomes with intensive glycaemic control in patients with established T2D, "so practitioners have been less aggressive about glycaemic control in older patients who have been on insulin for years unless there are other indications for tight glycaemic control." However, Manjoo noted that these studies were carried out before the advent of newer, non-insulin treatments and before CGM was available, and suggested that achieving and maintaining normoglycaemia with the tools and medicines now available may have a different impact on these outcomes.

STAKEHOLDERS INVOLVED IN PATIENT MANAGEMENT

Stakeholders involved with diabetes management, Deerochanawong explained, include the patient and their family or carer, healthcare professionals, and the healthcare system, including the government or any third-party paying for treatment. One major role of the healthcare system, Manjoo discussed, is "to support patients, keeping them out of hospital and preventing microvascular complications."

In primary care in Thailand, reported Deerochanawong, "the GP needs to do everything themselves." This is mirrored in Austria where Stulnig discussed how, for T2D, "the GP is the most important person to identify patients with increased risk for diabetes, detect pre-diabetes, regularly monitor patients at risk, make the primary diagnosis, and start and intensify oral treatment as needed."

At some stage in T2D, and for all T1D patients, an endocrinologist or diabetologist may be involved, usually as part of a diabetes clinic, which is where, discussed Stulnig, important treatment decisions are made, including intensification of non-insulin treatments and insulin initiation. In his diabetes clinic in Austria, Stulnig explained that while there are diabetes-trained nurses and dieticians, as well as a counsellor, it is the diabetologist who decides on treatment modalities. In Thailand, Deerochanawong explained how all tertiary care hospitals have a diabetic team that includes a diabetologist, diabetes nurse, dietitian, and podiatrist. The limitation here though, is the small doctor to patient ratio such that the diabetologist has only 5–6 minutes per patient. Stulnig described how in Austria there are also specially trained GPs "who are paid for this additional effort when managing patients within a diabetes disease management programme." This is in contrast to the USA where, Handelsman discussed, PCPs are not compensated for having diabetes training.

In Israel, where Handelsman is originally from, children with T1D are followed by the same endocrinologist throughout adulthood. However, he discussed how "the transition to adult endocrinology always creates a problem [in the USA]. In a lot of places there's not enough endocrinologists, often patients lose glycaemic control and there's a gap for quite a while; meanwhile the PCP generally will not manage T1D well."

EARLY DETECTION OF DIABETES

Early detection of diabetes, pre-diabetes, or factors that contribute to T2D development was a key point raised by the experts. In Thailand, Deerochanawong highlighted, there is a diabetes screening programme for adults aged 35 or older, as well as education about healthy diet and exercise for diabetes prevention. This is important, he stressed, as most early T2D is asymptomatic. "If we don't screen, we may delay [diagnosis] for 5–10 years and patients can get complications."

Majoo discussed that the healthcare system tends to respond to the needs of T1D earlier than for people with T2D because of the acuity of the presentation in the former. The healthcare system, she stressed, has a role to play in early education, detection, and access to interventions because, "if intervention occurs early enough, the development of T2D can be prevented." One of the major risk factors for T2D is obesity,[7] now recognised as a chronic disease in several provinces of Canada. Manjoo explained that "early intervention in states of adiposity is associated with better outcomes and can reduce the burden of adiposity-related diseases." However, she relayed her concerns about the lack of support for interventions to treat adiposity, and that "decreasing the development

of T2D is limited by inadequate resources to address the obesity epidemic."

Handelsman agreed, stating that "for people with pre-diabetes, as the large majority of them have obesity, really managing weight and managing obesity in any way possible is key. Lifestyle is not always enough, some need medications for obesity and some with morbid obesity should get surgery." He also discussed how critical early treatment is. "We have nearly 100 million people with pre-diabetes in the USA. If I see the patient's HbA1c or glucose levels are getting close to diabetes levels, I go big on starting to manage them, not necessarily with hyperglycaemia medication but with intensive lifestyle and weight loss medications. The American Diabetes Association (ADA)," he explained, "were involved in the change of diabetes diagnosis to an HbA1c level of 6.5. However, the goal was 7.0 and they didn't encourage treatment before that, which is where inertia in treatment started."

TREATMENT INTENSIFICATION AND USE OF INSULIN FOR TYPE 1 AND TYPE 2 DIABETES

People with T1D require insulin; however, for many, T2D can initially be controlled with diet and anti-hyperglycaemic agents other than insulin. For Manjoo, early detection and treatment of T2D, as well as factors contributing to excess adiposity is paramount as, "while we have the tools to treat T2D, early intervention with adequate patient support could decrease the need for insulin," she said. "However, β-cell function is already markedly affected by the time a patient develops T2D and if fasting plasma glucose (FPG) and HbA1c levels are not well controlled then insulin therapy should be initiated."[8,9]

Insulin treatment may consist of basal insulin only, with neutral protamine Hagedorn (NPH), glargine, detemir, or degludec insulin.[10] If this is insufficient to control fasting plasma glucose and HbA1c, the patient may require one to three additional injections of rapid acting insulin analogues such as lispro, glulisine, or aspart, or use premixed basal and rapid-acting insulin.[8,11,12] Non-insulin anti-hyperglycaemic agents include metformin, sulfonylureas, dipeptidyl peptidase-4 inhibitors, glucagon-like peptide 1 receptor agonists (GLP-1RA), and sodium-glucose co-transporter 2 inhibitors (SGLT2i). Treatment intensification may be underused though, with one study reporting that of 11,696 patients on basal insulin but with an HbA1c ≥7.5% (58 mmol/mol), only 30.9% were prescribed additional therapy.[13]

Availability of individualised insulin and non-insulin regimens differed between the expert's countries. "In Thailand," discussed Deerochanawong, "everyone with T1D can access insulin and some oral diabetic agents freely. Detemir is quite expensive, degludec is very expensive, but glargine is the least expensive and the government allows reimbursement for patients with T1D." However, while Deerochanawong estimated that around 90% of people in urban areas use an insulin pen and only 10% use syringes, in rural areas only around half of patients use an insulin pen, even though the cost is not much different from the syringe. This is an issue as having someone help inject insulin if it's needed three times a day may also be a barrier to use.

In the USA, Handelsman explained, the PCP will usually start treatment for T2D with metformin and will initiate basal insulin therapy with glargine if HbA1c is not controlled. "We also have a big push to start patients on long acting GLP-1RAs and SGLT2is." Metformin, and especially pioglitazone, is used for people who are overweight or obese with insulin resistance, and was seen as a good option by Handelsman "because it allows their body to use their own insulin." With GLP-1RAs, a better HbA1c reduction may be obtained with less hypoglycaemia compared with insulin and there is the benefit of weight loss;[14] hence, the ADA now recommends GLP-1RAs as the first injectable to be tried for T2D.[12] Handelsman also discussed the use of combination therapy, with insulin and a non-insulin medication, stating that "we found it to be very good even early on in management." Indeed, Manjoo highlighted, as people with T2D have an increased incidence of CVD, "you want to maximise the use of non-insulin therapies that are associated with CVD risk reduction, optimise the treatment of adiposity-related diseases and comorbidities, and, once you've done that, if blood sugar targets are not yet there, then you use insulin." She explained how, in Canada, the CVD risk and other complications associated

with T2D has driven coverage of medications.

For T2D patients in Thailand, Deerochanawong reported how he also usually initiates treatment with an oral drug, then either an injectable GLP-1RA or NPH insulin. The former has benefits in terms of less hypoglycaemia, weight loss, and cardiovascular health.[14] "The problem though," Deerochanawong discussed, "is it's very, very expensive; more than 30–50 times that of insulin, so the government won't reimburse it. If the patient wants it, they have to pay for it themself." In general, he continued, "we are not allowed to use glargine for T2D because the benefit of glargine in T2D is less than in T1D." However, as the cost of glargine in Thailand is falling, this is now being used for people with T2D who have severe hypoglycaemia with NPH.

Handelsman also identified the price of insulin as an issue in the USA, where currently Congress is trying to pass laws to control costs. For instance, he discussed how even NPH insulin may be up to 200 USD a month. "The price of the medication," he explained, "depends on the different insurance companies and where they get it, either directly from the pharmaceutical companies or premier provider network intermediaries." In Austria, all insulin is covered by insurance, so costs are not an issue for Stulnig, who stated that "there is a fixed rate for any prescription the patient has to pay, a few Euros, independent of what the cost of the drug itself is."

Although Austrian government guidelines for T2D require basal insulin therapy to start with NPH, Stulnig said that, if needed, patients will receive whatever insulin is most appropriate for them. This may include premixed insulin for a considerable portion of patients, which is also a choice in Thailand, whereas in the USA, Handelsman reported, premixed insulin is used much less.

One important consideration in people with T2D is when to initiate insulin therapy. According to Stulnig, this may occur after an episode of acute metabolic derangement. To mitigate this, he advised that "every patient should start with insulin when non-insulin options are not sufficiently effective anymore for glycaemic control and HbA1c goes just over the target." Indeed, according to Manjoo, she also does not wait for HbA1c to increase as "early initiation of basal insulin prevents further deterioration of pancreatic cells and can help to conserve existing pancreatic function."

Deerochanawong agreed regarding treatment intensification timing. "Every doctor knows that we need to do this as early as possible. Don't wait until complications are coming." With this in mind, he stressed the need to inform and educate the patient as to why intensification is needed. Delaying T2D treatment intensification may also mean that the insulin regimen is more complex because T2D is progressive.[9]

While guidelines discuss therapy intensification, Manjoo highlighted how "there's a need for greater focus on strategies to support healthy behaviours to reduce the progression of diabetes, one of many adiposity related disorders. This requires resources to improve health literacy, education about nutrition, and an understanding of the neurobiological response to weight loss that acts subconsciously to resist efforts for patients to persist with healthy behaviours. With newer therapies," she continued, "including weight management medications and psychological interventions, patients increase their chances of sustaining their engagement in the healthy behaviours shown to prevent disease progression." With this in mind, Manjoo discussed how "the lack of resources for supporting healthy behaviour change in primary care represents a healthcare gap, not just for diabetes management but also for other adiposity-related diseases. The advice to eat less and exercise more is an antiquated notion. Weight management is a complex process requiring a multidisciplinary approach that needs to be in conjunction with diabetes medication to support the patient journey to optimise their health and increase the durability of glycaemic control. This will work better than medication alone."

One of the barriers to intensification, Deerochanawong discussed, may be the patient themself. "First, they have a misconception. They have a friend that injects insulin and has renal failure or they're dead, so they have the misconception that using insulin means they are very sick. The second thing, because of having injections, a lot are afraid. The third is difficultly about use; for instance, in some elderly patients,

they need someone to help them to do injections. If the patient denies treatment, we need to talk together, we have to talk with their family. Sometimes a diabetes nurse can help explain the benefits of intensification."

Manjoo agreed, reporting how sometimes "patients may feel that taking another medication represents a failure on their part rather than a strategy to get ahead of disease management. So again, access to patient support programs really is one of the cornerstones of therapy with T2D." The challenge is, she discussed, "getting patients comfortable with the idea that insulin is a beneficial and easy to use treatment that's safe and can improve overall health. I start having the conversation about insulin early on in the disease process, to encourage dialogue around, and insurance about, it."

Another problem identified by the experts was treatment inertia, whereby treatment goals are not recognised or addressed early enough. This is important as, in the long run, Deerochanawong discussed, "if we can lower HbA1c, we can reduce complications and the cost of treatment, because most of the cost of diabetes comes from treating complications."

One reason for treatment inertia in the USA, Handelsman identified, was the limited amount of time a patient is seen. "In some places you can't see a patient more than every 6 months and only for 7–9 minutes per patient. This means they can only address one or two problems, so the inertia continues." Patients should, he proposed, be monitored every 3 months. A further issue in the USA Handelsman highlighted is that people most often do not stay with the same insurance company, and "the insurance companies don't care if they don't give patients expensive medications today when the later heart attack will be covered by another insurance company." Another note of concern for Handelsman was that "access to specialists that know how to manage diabetes is poor in some parts of the USA. That is responsible for a lot of the issues we have. I doubt if we have more than 3,500 endocrinologists who treat diabetes. Many of us would only see very late and complicated cases when they're on a lot of other medications."

Switching Insulin

Sometimes, a patient may be required to switch the insulin regimen that they are on. This may be for convenience, described Deerochanawong; for instance, if a patient is on a basal-bolus regimen but they sometimes forget to inject prandial insulin, they may be switched to a premixed insulin. Stulnig reported that switching insulin is "primarily justified by a specific pharmacokinetic profile I need for the patient." Handelsman agreed, saying that "if they're not controlled well, I may change if a patient is on glargine and has low sugars, or if they forget to take their medication or taking it at night is not convenient to them, I may move them to the newer, longer-acting basal insulin."

Switching insulin includes not only changing a regimen or formulation of a similar type of insulin, but also switching brands of the same insulin. This is most often due to price; for instance, Deerochanawong discussed how human insulins are made by a number of companies that will bid for a hospital contract, with the lowest priced one gaining the contract for a year. The only problem he saw for the patient in this scenario is that sometimes different companies have different insulin pens, which they need to supply. Similarly, Handelsman explained that he will only switch insulin without a medical need if it is dictated by the insurance company refusing reimbursement for the insulin the patient is using, be it brand or formulation. Manjoo agreed, adding that in Canada, "there are some cases, for instance, when the supplier is switched by the government, then the patient has no choice but to switch formulations."

Switching between formulations should be well-tolerated and provide control, Manjoo explained; however, she said: "I usually recommend more conservative dosing initially, until the patient is comfortable with the way they respond to the new insulin." She discussed that hypoglycaemia can be lethal in a short time if not treated; however, high blood sugar can be managed by adjusting insulin. Manjoo also stressed the importance of vigilance in self-monitoring with any switch in therapy. Stulnig agreed, saying he will "train the patient to increase the dose over a certain amount of time, for example, by using fasting blood sugar levels."

Biosimilar Insulins

Biosimilar insulins, unlike generic insulins, may differ slightly to the insulin type they can replace (currently glargine and lispro) due to slight manufacturing and formulation differences. However, they have similar efficacy as well as pharmacokinetic, pharmacodynamic, and immunogenicity-related properties.[15] The major advantage of biosimilar insulins is the cost savings, which may be of great importance to some patients with diabetes as, according to Handelsman, "we are facing the issue that patients can't pay for medications and many patients don't take insulin or ration it." As such, he welcomed the advent of biosimilars, but highlighted that if there is a cost reduction of only 15%, it may not impact the patient much compared with generic medications, which could be 10-times cheaper. However, in Austria, Stulnig reported that while a biosimilar may be less expensive, "for the physician, usually if there's not pressure from the insurance, the cost considerations themselves are secondary. More importantly, prescription limitations apply for higher cost basal insulin analogues but not for generic glargine"

The choice of a biosimilar versus brand name insulin in Canada, Manjoo discussed, depends on the price that is negotiated between pharmaceutical companies and the government of third-party insurance carriers. Biosimilars tend to be less expensive, and Manjoo highlighted how, when their universal coverage switched to a biosimilar glargine, monies saved may have facilitated the coverage of SGLT2is and GLP-1RAs for certain patients. Where Manjoo has switched to a biosimilar insulin, she reported that most patients have no problems. Handelsman agreed, saying: "I've seen my patients go back and forth between a couple of biosimilars, it all depends on the contract the insurance company has, I'm not going to stand in the way because I'd rather they be able to afford that."

Biosimilar glargine has been available in Thailand for a couple of years, recounted Deerochanawong, but, although currently few hospitals use it, "we have three glargine biosimilars coming in and they will share a big market because they put the price down to at least 50% of original glargine." He highlighted how in patients with T2D, "in the past, I wanted to use a lot of glargine but couldn't because the price is so expensive. If we have a biosimilar glargine that is a good quality and price, it's more accessible for the patients and for the healthcare system. It's opened up the use for a lot more patients, at least 30% more." Manjoo agreed, saying that a biosimilar are "certainly a good choice in that it increases the number of options available to a patient and options are always good." She discussed that with any new agent, there may be a lot of therapeutic options, and this also applies to switching to biosimilar insulin, asking: "Why should we switch, is it really necessary?" Handelsman agreed, saying: "If we see a patient who is on glargine, there's no reason for me to put them on a biosimilar if they're controlled well."

Choice of which biosimilar to use when there are more on the market will be, for Deerochanawong, based on worldwide use and company reputation. If it is manufactured by a lesser-known company and not widely used, he said: "we need to see a lot of data, a lot of research, about the purification process." This was reflected by Stulnig, who discussed how it is important to know "which qualities of the biosimilar are tested and hence have shown similarity to the original with regard to pharmacokinetics, the action, time and activity plots, how it's working overtime, and if there are issues of generating an immune response. There may be safety questions that have to be addressed. This is all very important to have good acceptance of biosimilars." Manjoo agreed, and highlighted how her main concern was that biosimilar formulations had not been studied in large clinical trials, so there is a need for more vigilance and monitoring when first using them.

One issue with any insulin is consideration of immunogenicity, though Stulnig discussed that clinically significant immunogenicity is a rare event. Both Manjoo and Handelsman reported that they had not seen any immunogenicity issues with a biosimilar, with Handelsman recounting: "I participated in several trials with various biosimilars, and I've not experienced any specific immunogenicity." Manjoo added that she had also not seen any immunogenicity alerts in the literature, but that when changing insulins, she counsels patients to "not change their dietary and exercise patterns at the same time as adding a new medication, as they want to be

able to understand the impact of the new agent on their blood sugars."

The experts also discussed how a biosimilar may get onto a hospital formulary. In Thailand, Deerochanawong discussed that, like all medications, biosimilars need to be individually approved by the Thai Food and Drug Administration (Thai FDA), who look at aspects such as purification and immunogenicity, then the hospital pharmacy can choose and they may adopt the cheapest one.

THE ROLE OF TECHNOLOGICAL ENHANCEMENT AND ARTIFICIAL INTELLIGENCE IN DIAGNOSING AND MONITORING DIABETES

The world of technology has heavily infiltrated diabetes management, with devices that can directly monitor HbA1c and deliver insulin, as well as computer and smartphone applications that can help support and encourage health measures. Monitoring and adjustment may be by the patient, by the device itself, or by a, sometimes remote, healthcare professional.[16] While in many countries the basic technology of self-monitoring of blood glucose is standard,[2] Deerochanawong discussed how in Thailand, although it is in the guidelines for all diabetes patients, "the problem is the cost is still very expensive and it's not reimbursed by universal coverage."

CGM systems attached to the patient's skin provide a glucose value, either continuously or at regular intervals. Readings can be sent to a number of devices, such as a smartphone app, a receiver, or a smartwatch that can be viewed by both the patient and their healthcare team.[2] CGMs are recommended in the latest ADA and European Association for the Study of Diabetes (EASD) guidelines for all patients with T1D,[2] and Stulnig reported how in Austria they use CGM in all patients who need functional insulin therapy. One advantage of CGM Handelsman discussed is that it can be used to immediately assess the time someone is within acceptable glucose range without the otherwise dependency on assessing HbA1c level in the clinic every 3 months.[2] Taking access further, Handelsman expressed how he believes such systems should be used by all people who have diabetes, regardless of whether they are using insulin or are diet controlled. "If you have CGM, you can control diabetes very well." Further, he said: "If I could prescribe CGM to all people with pre-diabetes, I think I would potentially cut down progression to diabetes by 50–80%." In Thailand, few patients can access CGM, as it is very expensive and not covered by insurance.

Manjoo reported how in Canada there is coverage for insulin pumps and CGM for patients with T1D, although access for patients with T2D requires certain criteria be met and is more restricted. However, she pointed out that "disease management can be improved with the use of CGM as it provides patients greater insight into how different things affect their glycaemia." In the USA, Handelsman reported that just over 50% of people with T1D are using insulin pumps, and discussed how he believes the future is in implantable pumps that only need to be filled with insulin once a month, meaning there will be children who do not even really know they have diabetes.

CGM systems can also send data to an insulin pump to provide the patient with a 'closed-loop' system, whereby blood glucose monitoring and insulin delivery is completely automated.[2] "In my clinic," Stulnig discussed, "we have the largest centre for insulin pumps for Austria and one of the largest in Europe, with around 500 patients on insulin pumps so we are very used to these technologies."

"For T1D," discussed Manjoo, "pumps and CGM have allowed patients greater convenience and that has removed one of the barriers to engagement in chronic disease management. The technology has allowed us to get tighter glycaemic control, which in T1D is important to reduce microvascular complications. The challenge in scaling this technology comes with affordability and training for patients." However, she did note that "some patients do not want to have a thing attached to them, they don't want to have dependence on a device, but with more education I believe that's something that might improve."

Technological advances for diabetes also include smart pens that can remember injection dose and frequency,[17] and apps to help track various aspects associated with diabetes such as blood

sugar and nutrition.[18] Deerochanawong also reported how they take advantage of diabetic retinopathy systems, where a digital camera can take a photo of the retina and the results are interpreted via an artificial intelligence system, without the need for an ophthalmologist. Telemedicine has become a key tool during the COVID-19 pandemic, Stulnig highlighted; however, he cautioned: "You see the limitations of telemedicine. It's good to adapt insulin doses but if the patient needs training, it has to be onsite so they can interact with the trainer, particularly with elderly people. They're not used to chatting on an internet platform, so they have to show up and get the information they need."

CONCLUSION

According to the panel of experts, early recognition and treatment of diabetes is key to controlling this disease. For T2D, interventions can begin in patients with risk factors for development of such. Treatment should be initiated early and reassessed regularly to ascertain if and when to intensify therapy. Biosimilar insulins have recently been added to the range of treatments, which, the experts agreed, may be able to replace their counterparts with the benefit of cost reduction and improved accessibility for patients. However, large-scale post-marketing studies will help understand their more widespread utility. Technological advances in diabetes care, including the use of apps, CGM, and insulin pumps, is helping make diabetes treatment and monitoring easier and more accessible for an increasing number of patients.

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