Telehealth Technologies and Their Benefits to People With Diabetes

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This article reviews the current diabetes technology landscape and how recent advancements are being used to help overcome barriers in the management of diabetes. The authors offer case examples of how digital tools and platforms can facilitate diabetes care via telehealth and remote patient monitoring for individuals in special populations. They also provide tips to ensure success in implementing diabetes technology to provide the best possible care for people with diabetes in outpatient settings.

The ultimate goal of caring for people with diabetes is to prevent complications from prolonged hyperglycemia while improving quality of life. The number of therapeutic classes of medications to treat diabetes has dramatically expanded. Unfortunately, the proportion of patients who are meeting American Diabetes Association (ADA) treatment goals has remained the same (1). This fact suggests that we need more than novel drug therapies to optimally manage diabetes. Established barriers to achieving glycemic targets for people with diabetes include limited access to care and low engagement with the therapeutic regimen. We anticipate that the introduction and adoption of technologies to aid in diabetes management will help to address both care access and engagement barriers and thus improve efforts to successfully meet ADA treatment goals.

Significant advances in medical technology have occurred across many disciplines in the past several decades. Such advances are particularly evident in the area of diabetes with regard to technologies available to help manage the disease. For the past 60 years, we have been able to accurately and reliably measure capillary blood glucose levels (2). Now, with the development of continuous glucose monitoring (CGM) systems, we are able to measure interstitial glucose levels and obtain even more information regarding time spent in various glycemic ranges. We have seen similar advancements in available options to deliver insulin therapy. Continuous subcutaneous insulin infusion (CSII), or insulin pump therapy, was first introduced in the 1970s, and the superiority of CSII over multiple daily injection (MDI) therapeutic regimens was soon apparent (3,4).

As with most new technology, both insulin pumps and CGM systems were initially bulky and available to only a few people with diabetes. Advancements in production have made both technologies much more widely accessible, which is immensely beneficial to people with diabetes. Insulin pump therapy has been shown not only to reduce A1C, but also to improve quality of life (5,6). The integration of insulin pumps with CGM systems has led to the creation of automated insulin delivery (AID) systems, which can automatically adjust basal insulin delivery based on real-time CGM data. Previous studies have demonstrated the effectiveness of such systems in reducing hyperglycemia and improving glycemic time in target (7–9).

We have also seen the advantages of being able to access insulin delivery and glucose monitoring data remotely. Remote access of such detailed data has enabled effective remote patient monitoring (RPM) (10), the advantages of which have been clarified for health care providers (HCPs) through the current coronavirus disease 2019 (COVID-19) pandemic. With or without barriers to care presented by COVID-19, RPM has helped to overcome transportation barriers to effective care and most likely has helped people become more engaged in their care, leading to improved self-management.

However, although transportation barriers have largely dissolved, technology barriers remain, including limited access to the internet and/or lack of personal ownership of a smartphone or similar device necessary for transmitting data from a connected glucose meter, insulin pump, so-called "smart" insulin pen, or CGM system to an internet site where providers can access them easily.

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Devices Facilitating Telehealth and RPM

CGM Systems

CGM systems measure interstitial fluid glucose levels throughout the day and night. In 1999, the U.S. Food and Drug Administration (FDA) approved the first CGM system, which was a blinded professional (clinic-owned) system meant for short-term use by people with diabetes to collect glucose data for retrospective review by HCPs (11). Insufficient data has long been a barrier for HCPs seeking to provide accurate recommendations for adjusting patients' medication doses and overall diabetes management regimen. With the creation of CGM, clinicians were able to stop guessing and provide higher-quality care (12,13). Some modern professional CGM systems now also have optional unblinding to provide patients with real-time biofeedback during their short-term use.

Soon after professional CGMs entered the market, personal CGM systems (owned by people with diabetes and intended for longer-term or periodic use) became available. As with unblinded professional CGM, personal CGM systems allow users to see their glucose levels and trends in real time and act on them as needed to improve glycemic management. First-generation personal CGM systems all required fingerstick blood glucose monitoring (BGM) using a glucose meter for frequent calibrations. However, many of the latest CGM systems are factory calibrated and do not require patients to calibrate with BGM.

Another unique benefit of CGM is its ability to overcome some of the limitations of relying on A1C as the primary means of assessing glycemic management (14). A1C, which represents the average of blood glucose during the 3 months before it is measured, has been the gold-standard metric of blood glucose control for decades. However, a single A1C value correlates to a wide range of average glucose values and does not provide precise information regarding time in range (TIR; the amount of time glucose is within the target range), frequency of hypoglycemia, degree of glucose variability, and times during which glucose excursions occur. CGM can provide hundreds of continuous glucose measurements each day, helping to fill in these gaps. Information about glucose levels during sleep or after meals or exercise can be obtained without a person having to perform fingerstick BGM. Many CGM systems also have predictive alarms that can warn users of imminent hyper- and hypoglycemia, thus reducing the anxiety many people feel with regard to optimizing glycemic control. The alarms have proven to be especially valuable for individuals with hypoglycemia unawareness.

Another significant benefit of CGM is that it allows for remote access to data, not only for HCPs, but also for users' designated family members, friends, or caregivers. Diabetes affects individuals of all ages and across all geographic areas. Many people living with diabetes are older and may not live close to loved ones. Technology now allows HCPs, caregivers, and loved ones to see CGM data online or even monitor a person's glucose levels using an app on their smartphone. Historically, individuals living in rural settings have struggled to receive adequate health care because the distance they had to travel to the nearest clinic was too great. With the remote accessibility of CGM data, HCPs can offer meaningful recommendations for therapeutic adjustments and then closely follow up from afar to determine the effects of medication changes. Even for people with diabetes who lack internet access or a smartphone, a CGM system's receiver can provide data they can report to their HCP during a telehealth virtual visit, including their mean glucose by day, maximum and minimum glucose levels, and frequency of hypo- and hyperglycemia (15).

Modern Insulin Pumps

Advances have also been made in CSII. Earlier-generation insulin pumps delivered insulin continuously based on preset static information programmed into the device. For the pump's insulin delivery rates to change, people had to be evaluated by their HCP, and then necessary changes were made to device settings manually. Often, the speed with which such changes were made was determined by the clinic availability of the HCP or the savviness of the individual with diabetes.

The major companies that manufacture insulin pumps have now made data accessible remotely. HCPs need only to log into the pump site or app, view a person's current settings, view glucose readings, and provide recommendations. Usually, pump users can be guided on how to make needed adjustments to pump settings; however, there are still instances in which patients are unable to make these changes because they may not be comfortable with managing technology on their own. The newer iterations of insulin pumps have helped to overcome this problem. Sensor-augmented pumps (SAPs) receive data from a CGM system and can automatically suspend basal insulin delivery temporarily in response to current or impending hypoglycemia. Taking this a step further, automated insulin delivery (AID) systems connect to a CGM system more completely via a software control algorithm. When used in automated mode, they automatically adjust basal insulin delivery rates based on a person's real-time CGM data to prevent both hypoglycemia and hyperglycemia and maximize a user's TIR. Some AID systems can even deliver correction boluses to help bring glucose into the target range. However, in most cases, users of these systems still deliver bolus insulin doses manually, aided by built-in dose calculators that can recommend appropriate bolus doses based on users' programmed insulin-to-carbohydrate (I:C) ratios and insulin sensitivity factor (also known as correction factor).

Modern insulin pump–CGM systems do not replace the expertise of HCPs, who can still analyze data to determine whether basal rates need to be lowered overall or I:C ratios need to be strengthened to optimize glycemic control. When needed, HCPs can still view data remotely and recommend changes to pump settings or other aspects of therapy.

Smart Pens/Caps

We have discussed the benefits of CSII therapy, especially with the integration of pumps and CGM systems. However, most people with insulin-requiring diabetes still use pen devices to deliver their doses. One of the most common barriers for HCPs in managing these patients is a lack of information about the exact amount and timing of insulin doses patients are taking (or not taking). People with diabetes can find recording their daily insulin doses challenging, particularly if they are on an MDI therapy regimen and using I:C ratios and a correction factor that result in frequent changes in doses of rapid-acting insulin. The introduction of smart insulin pens have helped to overcome this obstacle.

The FDA approved the first smart insulin pen in 2017. Smart pens record the time and amount of insulin doses given through the pen. They support optimal medication-taking and appropriate dosing decisions (16). They can also transmit insulin dosing data to a digital app, where it can be accessed remotely online by users and their HCPs. This innovation provides invaluable information to ensure the precision of individualized diabetes management recommendations. Smart insulin pens have similar settings to those found in insulin pumps, allowing HCPs to set a patient's I:C ratios, correction factor, and target glucose values. Like insulin pumps, smart pens provide a bolus dose calculator that can recommend appropriate doses of mealtime and correction boluses. Also, these smart insulin pens can be integrated with CGM to incorporate glycemic trends and patterns, thereby further optimizing dosing recommendations. Smart insulin pens have also been shown to improve clinical outcomes such as TIR (17). Another benefit for smart pen users is the freedom of not being physically attached to an insulin pump via tubing or a patch pump cannula. Yet, they can still enjoy the benefit of having a smart device that calculates insulin dose recommendations based on current glycemic values and trend and the amount of carbohydrates being consumed.

The first of a similar technology, a smart pen cap, was approved by the FDA in 2021. The smart insulin pen cap can fit onto most commercially available disposable insulin pens. It uses glucose data from a person's CGM system together with HCP-determined settings programmed into the accompanying app to provide insulin dosing recommendations. A nice benefit of smart caps over smart insulin pens is that they are available for both rapid-acting and long-acting insulin. This technology is relatively new, and more studies are needed to evaluate its potential to improve diabetes care. However, early studies have supported its effectiveness in improving glycemic control with good levels of patient satisfaction (18).

Connected Options for BGM

There are now also approaches that merge the use of traditional devices such as glucose meters with remote data monitoring capabilities. Programs that use this approach store glucose data obtained from a glucose meter (19–22) either in apps and/or platforms designed specifically for a given meter or in an app and/or online platform that works with multiple brands and types of meters. These data can then be relayed to HCPs or other diabetes coaches via the internet or cellular technology. HCPs or coaches can then provide feedback and therapy adjustment recommendations through the same platform without the need for an in-person clinic visit. The use of such programs has been shown to reduce the likelihood of hypoglycemic and hyperglycemic events (22).

Telehealth Technology

The evolving telehealth practice of medicine has the potential to minimize some of the traditional barriers to optimal care such as transportation obstacles and possibly low patient engagement. To illustrate some of these potential benefits to people with diabetes, we present below a few case examples, with an emphasis on special populations such as those living in rural areas and those with hearing or other impairments.

Benefits for People With Language Barriers

Individuals With Hearing Impairment

People who are deaf or hard of hearing have long had to rely on in-person health care visits with companion translators present to aid in their interactions with HCPs. Technological advancements first allowed for more independence and improved access for these individuals through the use of video translators supplied through medical office technology systems. However, this solution still requires the person's physical presence in the clinic to access this support. With the recent increased access to videoconferencing and remote data uploading capabilities, these individuals can now receive health care from home in ways that were previously inaccessible for them.

Patient A is a 36-year-old woman with deafness and insulin-dependent diabetes. She presented to the endocrinology clinic for an initial consult having had no diabetes technology options offered to her in the 10 years since her diagnosis. With the support of the clinic's diabetes education team, she obtained and was started on a personal CGM system and an insulin pump in the clinic. Much of her initial follow-up training was provided with the support of remote videoconferencing, to answer her questions, titrate her pump settings, and review her carbohydrate counting skills. Since her transition to technology-assisted diabetes management, Patient A has been able to connect remotely via the clinic's patient messaging portal to request review of her glycemic data. Review of her CGM data shows that her TIR on CGM increased to >75% (generally recommended target is >70%), and she reports increased satisfaction with her care and a reduced disease burden.

Multiple Health Insurance Portability and Accountability Act–compliant videoconferencing platforms are commonly used by HCPs. Smartphones expand access to videoconferencing for people living in remote areas; however, basic cellular phones and landlines still only offer voice calling. Apps such as Doximity allow HCPs the option of calling with a cellular phone or computer to connect with patients via their preferred contact method. Patients can choose to receive text messages, e-mail messages, or direct voice calls, allowing for expanded options to accommodate their individual circumstances and comfort level. One area for potential improvement would include integration of video and text messaging as a standard feature to allow for increased access for individuals who are deaf or hard of hearing.

Nonverbal, Nonambulatory Individuals

In the past, many chronically ill people with mobility and/or cognitive concerns required emergency medical service transportation to health care visits and caused great stress for patients and their caregivers. In such cases, a routine 15-minute face-to-face visit with an HCP likely required significant time and advanced preparation to ensure patient safety and access to medical support. However, telehealth services are improving this situation.

Patient B is a 31-year-old man who suffered a traumatic brain injury (TBI), resulting in a chronic vegetative state. He relies on a consistent schedule of tube feeds and receives insulin in an MDI regimen to control his blood glucose. Because of his TBI, Patient B is nonverbal and nonambulatory, and in-person clinic visits are very taxing on him and his family caregivers. However, the advent of video telehealth visits has allowed him to maintain regular contact with his endocrinology clinic for review of his glycemic data and adjustments to his insulin therapy regimen without compromising the quality of the care he receives. His family caregivers are able to take advantage of both videoconferencing and online messaging to communicate remotely with his medical team without the increased burden of transportation time, cost, and stress.

Patient B has primarily been supported by smartphone conferencing, which allows for easy transition between direct, patient-facing interactions and discussions with family caregivers without the need for a bulky computer. Increased ownership of smartphones has greatly increased providers' ability to perform limited visual physical exams remotely. Perhaps even more significantly, smartphones have improved patients' engagement in their care and made it much easier for them to stay connected with their HCPs despite long distances or physical limitations.

According to 2018 U.S. Census data, 84% of American households had access to a smartphone, and up to 92% had access to some form of computing device such as desktop computer, laptop computer, tablet, or smartphone. These statistics certainly have their limitations, as rural communities were noted to have less internet connectivity, potentially limiting video access from home. However, it is worth noting that individuals from lower-income households, and particularly younger Americans and Hispanic men, were found to be more likely to have a smartphone, which served as their sole means of internet connectivity (23).

Individuals Who Do Not Speak English

Technology advancements have also improved health care access for people requiring the services of a translator. In clinics, HCPs can link to audio and video translator services, allowing a translator to join the visit. For example, at Atrium Health Wake Forest Baptist Endocrinology, in Winston-Salem, NC, dedicated iPads are available for use with patients in exam rooms. These can be set up at patient check-in to enable translation services throughout the encounter and check-out process. Efforts also continue to be made to increase access to telehealth for the clinic's non–English-speaking patients, who for now mostly still rely on in-person visits. Positive steps include providing audio translators via three-way phone calls for audio-only telehealth visits and integrating technology conducive to remote monitoring into the diabetes care regimen. This strategy allows the clinic's patients who do not speak English to still benefit from the improved glycemic management and data-sharing afforded by diabetes technology. Furthermore, all available insulin pumps and CGM systems have an option for English or Spanish. Pumps manufactured by Medtronic also offer Chinese as a third language option, and the app for the Abbott FreeStyle Libre 2 CGM system recently incorporated a voice feature for people who are visually impaired.

Benefits for Rural Populations

Montana, a rural state with vast geographical expanses between communities, was an early adopter of telehealth to deliver health care "on the frontier." Networks created by health care facilities in larger communities have long supported more rural communities to reduce disparities in health care in underserved regions of the state. In Montana, certified diabetes care and education specialists (CDCESs) have been engaged in providing telehealth medical nutrition therapy (MNT) and diabetes self-management education and support (DSMES) services since the mid-1990s.

One example is the Eastern Montana Telemedicine Network, one of the first 10 such networks in the country that were created when legislation first enabled insurance coverage of health care services offered to rural communities via electronic, interactive, audio, and video two-way communication media. Using traditional models of "hub-and-spoke connectivity" linking facilities where an HCP was located to rural communities without local services has allowed CDCESs to reach patients with no access to DSMES in their hometowns. This arrangement has created a virtual highway across hundreds of miles. Studies have shown that patients have high levels of satisfaction with interactions via telehealth (24). Savings of time for travel, which could be up to several hours each way, as well as costs for missing work and travel expenses, were mitigated by offering telehealth DSMES.

This success could not have been achieved without the network access, as well as champions in remote, rural facilities who saw the need and assisted in channeling patients to telehealth DSMES services. CDCESs worked to create an extension of the DSMES program being offered in person at the central hub facility. Many telehealth-connected DSMES patients were in health care facilities that did not have an affiliation with the health facility where the DSMES care provider was located. The telehealth connectivity was created to forge and facilitate facility-to-facility referral and patient care. It was necessary to also engage with rural HCPs and clinic staff, as well as facility and telehealth administrators at the rural sites.

The use of rural telemedicine in general has greatly increased during the COVID-19 pandemic (25), and the strength of the Montana DSMES telehealth program was put to the test as well. Patients continued to be seen throughout the pandemic either via the traditional Eastern Montana Telemedicine Network telehealth or via virtual visits to their home on the Microsoft Teams online meeting platform as access allowed through the CARES (Coronavirus, Aid, Relief, and Economic Security) Act. The CARES Act expanded insurance coverage of telehealth services and relieved some of the pre-pandemic restrictions on these services. An unanticipated positive outcome from the pandemic-related pivot to virtual visits was that it allowed health care facilities to rapidly integrate more technology across the telehealth spectrum, including increasing RPM and remote support of patients' use of diabetes technology devices.

CDCESs found that technology barriers could be minimized as patients accepted a greater role in their self-management, including achieving greater autonomy in the use of technology and connected devices. This was true for Patient C, a 78-year-old woman living with diabetes for >20 years. Patient C was referred for telehealth DSMES with a treatment order from her HCP to start mealtime insulin to address her elevated A1C of 9%. She engaged in telehealth using her facility's traditional network, connecting to the central hub site from more than 200 miles away.

Patient C did not agree with her HCP's plan to add prandial insulin, stating that she felt her basal insulin with oral medications were burdensome enough. She also said that she had not been using her meal-planning skills and now wanted to engage in a plan that focused on awareness of what she ate based on BGM results. She had not had DSMES in many years and was not routinely performing BGM. However, she did say that she had received a new meter from her insurance company but was not sure about using it. She confirmed that the glucose meter she received was from the Livongo program and was a smart meter. This allowed her to use the meter for BGM, and the device's cellular connectivity automatically uploaded readings to her private account. The Livongo program provides support for individuals dealing with chronic medical conditions such as diabetes. The glucose meters used in this program generate data that can be shared with a CDCES. Based on these readings, the CDCES can then provide advice and support. Patient C was excited to use the device share settings to share her BGM results with the telehealth CDCES. She sent her glucose and dietary logs every 2 weeks using the feature on her connected meter. She shared at her DSMES sessions how this device supported tracking, allowed for easy ordering of test strips, and gave her confidence in her ability to make meal plan choices that she could see were supporting achievement of her glucose targets. Patient C was happy to see her HCP after 3 months, at which point her A1C had decreased to 7.8%. She and her HCP agreed that bolus insulin was not indicated and that she would continue to engage in self-management, including making healthy meal plans and activity choices supported by her BGM results, which her meter allowed her to share with her telehealth CDCES.

The path to Patient C's success involved a large array of necessary elements, including a CDCES who was interested in providing telehealth DSMES and had the ability to connect to patients in underserved communities with known health care disparities. The dedicated Eastern Montana Telemedicine Network allowed for connection to 10 rural health care facilities across the region that identified as having a lack of DSMES access for their patients. By taking action and reaching out to administrators, HCPs, and other health care staff in rural spokes sites, this program was able to improve access to quality DSMES across a large rural region. The foundation of the program provided a smooth transition to wider use of virtual visits when necessitated by the COVID-19 pandemic. Both the traditional Eastern Montana Telemedicine Network telehealth program and the CARES Act's expansion of insurance-covered telehealth services allowed for the continued delivery of quality care to rural populations.

Blueprint for Success

CDCESs have always been investigators, putting all the pieces of the diabetes treatment puzzle together in a strategic action plan for each individual with diabetes. This goal has not changed, but in the age of COVID-19, it has become more challenging to achieve. Whether DSMES is being offered in a diabetes and endocrinology center or in a primary care clinic, the initial referral for such services must seek education designed to ensure patient safety, lessen the disease burden, and maximize TIR and quality of life. When CDCESs can stay focused on these priorities, they can successfully troubleshoot obstacles to self-care and provide holistic assessment for each person with diabetes, helping to ensure that patients are well informed and ready to engage in shared decision-making with the HCP to select the best treatment options and technology devices to meet their needs in maximizing their health and minimizing diabetes complications.

Allow us to describe a blueprint for success—in other words, what we think of as an ideal diabetes management journey for a person with diabetes being treated in an outpatient clinic that has implemented telehealth services. The person's first visit would be with a CDCES, either via telehealth or in person. In an in-person visit, the person with diabetes can actually examine and handle sample devices; in a virtual visit, introducing technology may require more time and creativity on the part of the CDCES. One advantage of an initial in-person is that it can build rapport that can help to optimize the virtual visit experience for both the person with diabetes and the HCP when they meet later on. An in-person visit also allows the CDCES to perform a hands-on assessment of injection sites for people using insulin or other injectable medications. When the CDCES is able to identify and troubleshoot such problems early, the primary prescribing HCP will be able to focus on selecting the most appropriate medications and dosages and having a more meaningful and productive virtual encounter with the patient when the time comes.

The initial visit with the CDCES should include a thorough assessment of injection sites and injection/device technique, dietary recall, and an opportunity to remotely link to or review data from any diabetes device the person is already using. Once all the obstacles are removed, the person can be scheduled for a telehealth visit with their primary prescribing HCP. Before that visit takes place, however, clinic staff should obtain any needed data downloads or device reports and upload them into the electronic health record system. Additionally, clinical support staff (e.g., a nurse or pharmacist) should reconcile the patient's medication administration record, refill prescriptions, and identify any contraindications to medications or concerning laboratory values. Once all the information and glycemic data are collected and reviewed, the clinic is ready to provide the person with diabetes with an optimal HCP virtual visit experience.

Ideally, the nurse or other support staff would stay involved during the visit to assist the HCP in charting and data analysis while the HCP's attention is fully focused on the person with diabetes. Together, the HCP and support staff design the optimal individualized treatment plan for the patient. The HCP and staff are able to maximize their specialty-specific skills, thus enhancing the patient experience. If technology devices are recommended, the HCP would then refer the patient back to the CDCES for training and setting up a remote connection to the clinic portal. This process will help to ensure ongoing high-quality care and safe sharing of data for analysis.

This ideal scenario was inspired by a heartbreaking comment we received from an elderly patient at the beginning of the COVID-19 pandemic. "I feel so abandoned and disconnected from my doctor," she said. "What's going to happen to my sugars?" With the expansion of telehealth visits in response to the pandemic, patients still worry about the quality of care they receive during telehealth encounters (26). However, remotely connecting their diabetes devices to their HCP's clinic can reassure them that treatment decisions will be based on analysis of accurate data, much like they probably felt when clinic staff downloaded the glucose meter during in-person visits before the pandemic began.

Diabetes is a progressive disease and often takes people with diabetes down a rocky path of blame and shame. Our job as diabetes HCPs is to find ways to help our patients realize their dreams of optimal glycemic management and prevent the nightmares that can arise during times when they feel disconnected from their care team, such as during the COVID-19 pandemic. Telehealth is one important way of doing just that, and its success involves the entire diabetes care team. In the words of Helen Keller, "Alone we can do so little; together we can do so much."

Conclusion

In this article, we have reviewed the types of beneficial technology devices that are now available for people with diabetes and can facilitate successful telehealth and RPM services. In our experience, partnering with a patient to implement CGM and other forms of diabetes technology allows both the patient and the care team to gain a clearer understanding of what the patient's blood glucose is and in what direction it is headed throughout the day, which in turn enhances patient engagement with the diabetes care plan and helps to minimize hypoglycemia and increase TIR while improving quality of life. Modern insulin pumps now incorporate CGM technology to automatically adjust insulin delivery based on real-time glycemic data. For many patients, diabetes technology has allowed more freedom in daily activities, as the device adjusts insulin instead of people with diabetes having to alter their lifestyle to minimize the variables that change their need for insulin throughout the day and night.

Although there are some data showing that the increased volume of glucose data provided by diabetes devices can increase diabetes distress and anxiety levels for some people with diabetes (27), ongoing support from the diabetes care team can help patients overcome this obstacle to improved glycemic management. Meanwhile, there are clear benefits of these technologies, including their ability to facilitate and improve telehealth diabetes care, which can be particularly important during times of necessary social distancing and especially for people with access issues such as transportation issues, remote locations, and speech, language, or other barriers to diabetes care and support. Our vision for what is possible for people with diabetes is made brighter by the availability of diabetes device and telehealth technologies, which together can empower our patients to live healthier lives with minimal disease burden.

DUALITY OF INTEREST

K.K. is employed by Novo Nordisk as a diabetes care specialist. J.A.A. has received research support from Medtronic Diabetes and Abbott Diabetes. No other potential conflicts of interest relevant to this article were reported.

AUTHOR CONTRIBUTIONS

C.O.U. researched data and wrote, reviewed, and edited the manuscript. K.K., C.K., and C.P.J. contributed to the writing of the manuscript. J.A.A. wrote, reviewed, and edited the manuscript. C.O.U. is the guarantor of this work and, as such, had full access to the information provided in the review and takes responsibility for the integrity and accuracy of the article.

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