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Challenges and Opportunities in Using Telehealth for Diabetes Care

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The ongoing coronavirus pandemic led to a rapid and dramatic increase in the use of telehealth for diabetes care. In the wake of this transition, we examine new opportunities and ongoing challenges for using telehealth within diabetes management, based on data and experiences from the pre-pandemic and pandemic time frames.

Pre-Pandemic Use of Telehealth in Diabetes Care

Looking back from our current vantage point, it is hard to recall a time when the terms "COVID-19" (coronavirus disease 2019) and "telehealth" each sounded novel. In taking stock of our current challenges and opportunities for using telehealth in the management of diabetes, however, it is useful to consider the history of telehealth within our field. Among chronic health conditions, diabetes is particularly well suited to telehealth because treatment relies on patient-generated health data (PGHD) and a health-coaching approach to behavior management, both of which can be used at a distance. Although research has shown since the 1990s that more frequent diabetes care leads to better health outcomes (1), diabetes specialists remain scarce (2–4), particularly in rural areas (5,6), and frequent office visits have historically been difficult to achieve even with dedicated care coordinators (7–9). For these reasons, our field has often relied on supplementary telephone contact for diabetes management in both clinical settings and research studies such as the landmark Diabetes Control and Complications Trial, which provided telephone care in addition to monthly clinic visits (10). However, the limitations of telephone care in diabetes practice have historically included challenges in obtaining glycemic data (e.g., A1C values and blood glucose monitoring [BGM] results) remotely and poor reimbursement prospects (11), necessitating the use of unbilled provider time or grant funding to provide such care.

With the advent of Health Insurance Portability and Accountability Act (HIPAA)-compliant videoconferencing platforms (12,13) and the introduction of telehealth reimbursement codes (14) over the past two decades, greater use of telehealth became possible in the United States for multiple health conditions. Additionally, several developments within the diabetes world during this time period have enabled health care providers to more easily access and use PGHD for telehealth-based diabetes care. These developments include greater availability of Bluetooth-enabled glucose meters (15); a dramatic increase in use of continuous glucose monitoring (CGM) technology (16); the creation of secure, internet-based platforms for diabetes data management (17,18); and the publication of standardized CGM-based metrics for evaluating glycemic control (19). Building on these advances, diabetes researchers have used telehealth in a variety of targeted programs throughout the past 20 years, both to replicate usual care at a distance and to explore new models of care that would not be feasible to deliver in person.

In the realm of type 1 diabetes, pilot programs in the United States and Australia have used telehealth to facilitate remote care in rural areas, resulting in high levels of satisfaction, as well as savings in time and costs, for people with diabetes residing in these areas (20–23). Some of these programs have also demonstrated an increase in the frequency of diabetes visits associated with telehealth use (20,22). At academic centers in the United States, telehealth outreach programs have connected primary care providers (PCPs) with diabetes specialists for remote consultations (18,24), demonstrating improved completion of consultations (17) and increased diabetes-specific knowledge among PCPs (18). In the past 15 years, researchers have also harnessed telehealth to explore novel care models designed to benefit specific subpopulations of people with type 1 diabetes. For example, telehealth has been

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used to facilitate school-based diabetes visits in youth (25), to deliver behavioral therapy to people with diabetes and their families (26,27), to enable group visits for young adults (28–30), and to provide monthly visits for individuals with suboptimal glycemic control (31). These interventions have been associated with improvements in glycemic control (25–27,31), frequency of care (25,29,31), and patient engagement and self-efficacy (29,30).

Telehealth innovation in the care of type 2 diabetes during this time period has been even more extensive and varied. Dozens of programs have applied various forms of telehealth—from remote data review with asynchronous feedback to real-time telephone or video support—to deliver supplemental patient education and treatment modifications, and many of these have been highly successful (32–35). Published reviews and meta-analyses of telehealth interventions for diabetes care are hampered by the heterogeneity of interventions and treatment populations, but tend to conclude that telehealth is associated with significant improvements in glycemic control (32–35) and that treatment effects are often larger for individuals with type 2 diabetes than for those with type 1 diabetes (32–34) and for adults compared with youth (32,34).

When considering telehealth outcomes, one must keep in mind that the term "telehealth" encompasses a broad array of potential interventions and that telehealth is a care modality rather than a specific treatment or therapeutic technique. Just as grouped outcomes for "outpatient care" or "telephone encounters" would be difficult to interpret in a meaningful way, data about "telehealth" at a broad level are far less informative than the results of specific approaches in well-defined settings. We use the term "telehealth" for the remainder of this article to refer to synchronous audio-visual encounters between patients and providers who are not geographically co-located, and we recommend that all publications referring to telehealth likewise define their use of the term to improve clarity for readers.

Use of Telehealth in Diabetes Care During the COVID-19 Pandemic

The COVID-19 pandemic led to rapid widescale adoption of telehealth for diabetes management by rendering in-person care less accessible and less safe, and by necessitating policies that reduced existing barriers to telehealth adoption. By autumn of 2020, all but six U.S. states had imposed pandemic-related stay-at-home orders (36), and ~25% of households nationally had lost a job, while another 32% had lost wages as a result of the coronavirus outbreak (37). The social distancing policies and economic hardships imposed by the pandemic augmented barriers to accessing in-person care for people with diabetes. Furthermore, observational studies raised concerns very early in the pandemic regarding increased COVID-19–related morbidity and mortality among people with diabetes (38–40), making diabetes care providers and individuals with diabetes hesitant to choose in-person care even when it was available. Simultaneously, new health care policies enacted during the pandemic circumnavigated many preexisting barriers to telehealth use. For example, the U.S. Department of Health & Human Services allowed the use of videoconferencing platforms that were not designated as HIPAA-compliant (41). Likewise, the U.S. Centers for Medicare & Medicaid Services (CMS) waived several prior requirements for telehealth reimbursement, allowing for patients' homes to qualify as originating sites, for telehealth to be delivered to new as well as established patients, and for telehealth visits to be reimbursed equivalently to in-person visits (41). In addition, both CMS and multiple U.S. state licensing boards waived in-state licensing requirements temporarily during the pandemic so providers could deliver telehealth care to patients across state lines (41,42).

As a result of these changes in health and economic conditions and health care policies, telehealth use for diabetes care increased dramatically during the COVID-19 pandemic. Internet-based surveys conducted in spring of 2020 indicated that the majority of U.S. endocrinologists had moved to entirely or predominantly virtual care (43) and that 28% of individuals with type 1 diabetes globally had already engaged in remote diabetes care as a result of the pandemic (44). A recently published study of U.S. clinics participating in the T1D Exchange Quality Improvement Collaborative (T1DX-QI) revealed that telehealth made up only 1% of diabetes visits at these locations before the pandemic but constituted the majority of visits from April through July 2020 (13). From the patient standpoint, an internet survey conducted in autumn of 2020 demonstrated that 65% of U.S. individuals with type 1 diabetes participating in the T1D Exchange patient registry or online community reported using telehealth for their diabetes management during the pandemic (45). During this rapid transformation in care, telehealth was a new experience for the majority of health care providers and patients. In the United States, only 11% of endocrinologists and 5% of patients with type 1 diabetes who used telehealth during the pandemic reported having any pre-pandemic telehealth experience (43,45). Now, more than a year after this abrupt transition to telehealth, the diabetes community has begun to study its effects on the delivery of care to people with diabetes, and several themes have emerged regarding the benefits and challenges of remote diabetes management.

Benefits of Telehealth in Diabetes Care

The transition to telehealth during COVID-19 was primarily driven by the need to maintain access to care in the context of new health risks and economic stressors. However, experiences with telehealth during the pandemic have also demonstrated that it can be a highly effective, satisfactory, and patient-centered form of care for people with diabetes.

Available data suggest that access to diabetes care was better achieved by telehealth than by in-person visits during COVID-19, particularly early in the pandemic. At our institutions, we observed higher completion rates within endocrinology for telehealth encounters compared with office visits during the pandemic, with completion rates for telehealth visits during the pandemic matching or exceeding the pre-pandemic completion rates for office visits (Figure 1). These data mirror studies from the pre–COVID-19 era demonstrating higher frequency of visit completion with telehealth than with in-person care (17,20,29). However, the difference between telehealth and office visit completion rates during the pandemic appears to be waning at our institutions over time, as demonstrated in Figure 2. This trend reflects both an increase in completion of office visits that is possibly related to the lifting of shelter-in-place guidelines, reduced fear of infection, and/or improved economic stability, as well as a decrease in completion of telehealth visits since the beginning of the pandemic. Reduced completion of telehealth visits over time may relate to provider factors, such as waning technical support to assist patients who are new to video encounters, and/or patient factors, such as higher competing time demands with the resumption of in-person work and school. These data trends are informative and hypothesis-generating, but because the pressures and motivations driving patient behavior during the pandemic have been unique in many ways, further analysis of visit completion data for in-person and remote diabetes care will be essential in the coming years.

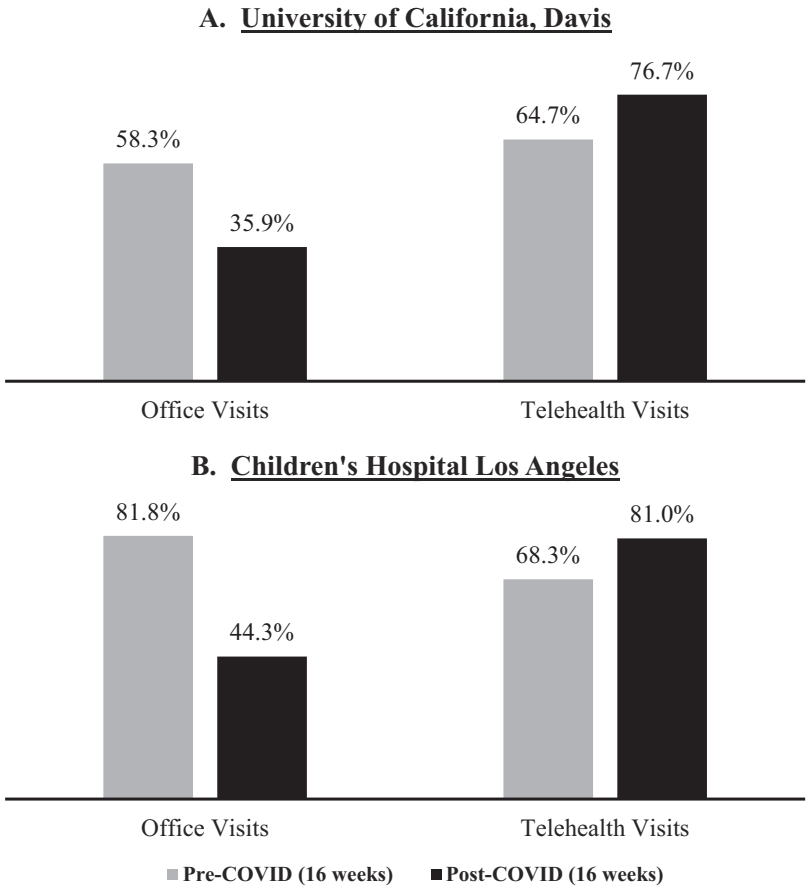

FIGURE 1 Completion rates for endocrinology encounters pre– and post–COVID-19. Depicted are completion rates for scheduled endocrinology office visits and telehealth visits at the University of California, Davis (*A*), and Children's Hospital of Los Angeles (*B*) during the 16 weeks before (pre-COVID) and 16 weeks after (post-COVID) a statewide shelter-in-place order that was given on 19 March 2020.

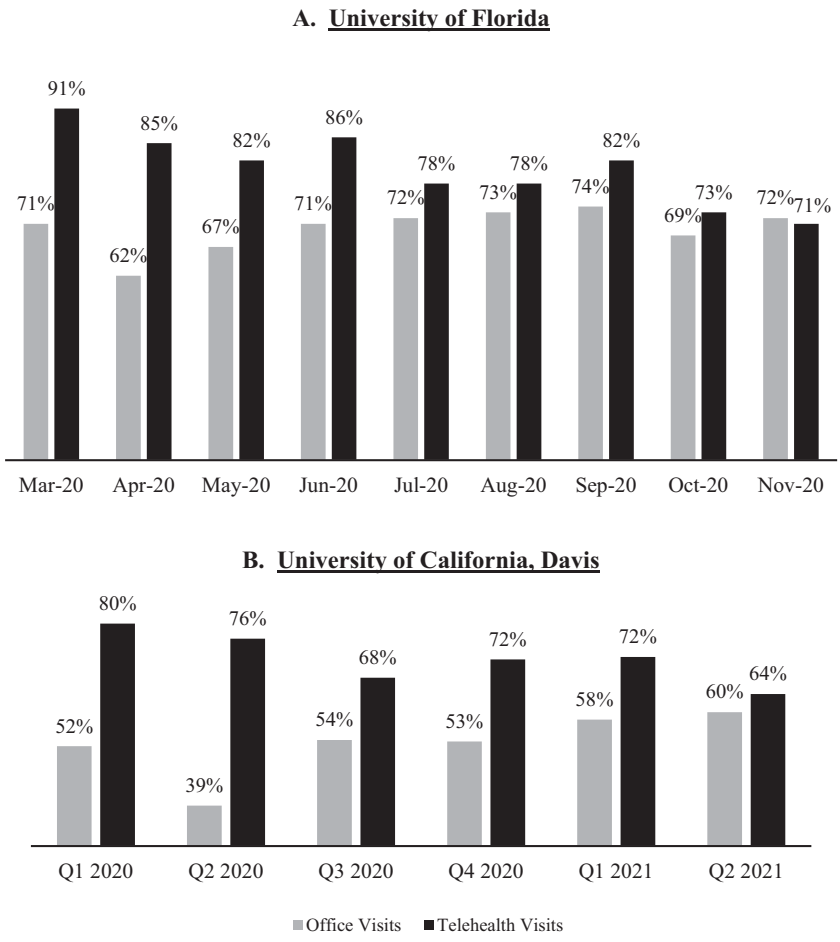

FIGURE 2 Changes in completion rates for endocrinology encounters during the COVID-19 pandemic. Depicted are completion rates for scheduled endocrinology office visits and telehealth visits at the University of Florida, displayed monthly between March and November 2020 (*A*) and at the University of California, Davis, displayed quarterly between January 2020 and June 2021 (*B*).

Data during the pandemic also indicate high satisfaction with telehealth among patients who have used this care modality, similar to the high levels of satisfaction with telehealth observed among specific diabetes populations prior to COVID-19 (20,28,31). In a national survey of 1,452 individuals with type 1 diabetes who reported using telehealth during the pandemic, 85% felt that telehealth had saved them time, 44% felt it had saved them stress, and 29% felt it had saved them money as compared with in-person care (45). Furthermore, 62% of these respondents felt that telehealth was as effective or more effective than in-person care for management of type 1 diabetes, and 82% stated that they would prefer to use telehealth for some or all of their future diabetes appointments (45). In addition to these patient-level data, encounter-level feedback collected at our institutions during the pandemic via patient surveys demonstrates patient satisfaction after telehealth visits that is equivalent to or greater than that reported after in-person visits (Figure 3).

Other benefits of telehealth within diabetes care have been harder to quantify but noted anecdotally by providers and patients. For example, within pediatric diabetes care, the use of telehealth can enable additional caregivers such as grandparents, step-parents, and parents with less work flexibility to participate in medical visits and thereby engage directly with the medical team to give input and receive ongoing education (31). This benefit has been particularly important during the COVID-19 pandemic, as the number of visitors accompanying patients to their appointments has been restricted at many medical facilities, and families have had to rely on extended caregivers for child supervision during school closures and illnesses. Home-based telehealth visits also enable providers to visualize the home environment, affording them a better understanding of how diabetes supplies are stored and used and how food is accessed and prepared. In our experience, people with diabetes often appreciate the chance to demonstrate the daily challenges they are facing in carrying out

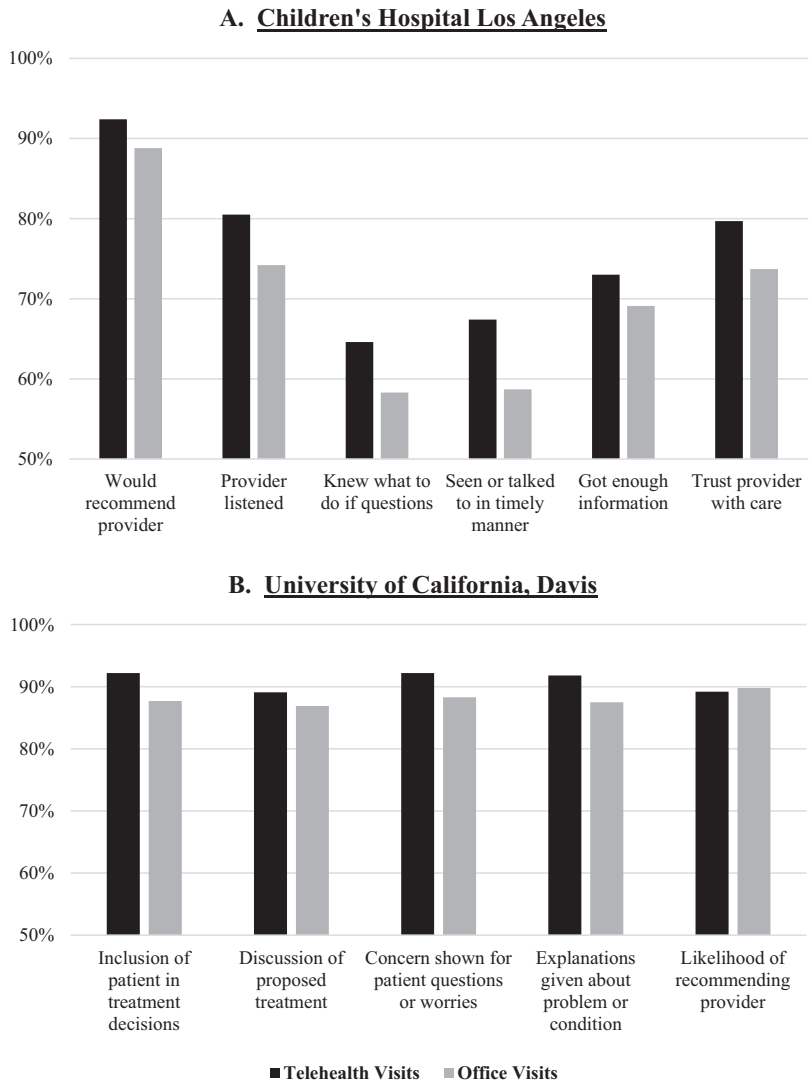

FIGURE 3 Patient satisfaction after endocrinology telehealth visits and office visits. Depicted are responses to patient surveys administered at Children's Hospital of Los Angeles after endocrinology office visits ($n = 995$) and telehealth visits ($n = 447$) conducted between 25 March 2020 and 31 January 2021 (*A*) and responses to patient surveys administered at the University of California, Davis, after endocrinology office visits ($n = 797$) and telehealth visits ($n = 243$) conducted between 1 February and 31 July 2020 (*B*).

recommended diabetes tasks, and video encounters can facilitate discussion of difficult home circumstances (e.g., lack of private space or lack of refrigeration) that patients or families might not bring up during an office visit. Furthermore, the ability to provide telehealth care across state lines during the pandemic has enabled endocrinologists to serve people with diabetes in locations with low geographic availability of subspecialists (6) and to continue caring for established patients during relocations necessitated by travel restrictions, college closures, job losses, or caretaking responsibilities. In addition to these benefits for established patients, telehealth has also been used during the pandemic to facilitate remote insulin initiation and intensive education for patients with newly diagnosed diabetes and their caregivers, thereby reducing the duration of hospitalizations and minimizing COVID-19 exposures (46,47).

Finally, telehealth appears to facilitate more patient-centered and individualized diabetes care in several ways. Pre-pandemic research suggested that the act of accessing and transmitting diabetes-related data to providers before telehealth visits facilitates higher levels of patient engagement and self-efficacy in their diabetes care (29,30,48). During the pandemic, many providers have noted this phenomenon anecdotally within their patient panels, appreciating improved awareness

of and dialogue about BGM or CGM trends during telehealth encounters. Providers have also observed that telehealth allows for greater customization of diabetes care by enabling more frequent contact for patients who are struggling, while replacing in-person visits for individuals with high self-efficacy and adequate glycemic control. Interestingly, of the 777 individuals with type 1 diabetes who responded to an autumn 2020 online survey and reported not using telehealth for type 1 diabetes care, many cited the fact that they were already in touch with their providers and receiving care by other means such as phone calls or electronic messaging (45). This finding speaks to the evolving individualization of diabetes care. It also highlights the need in diabetes practices to secure provider time and reimbursement for telephone encounters and asynchronous electronic messaging, which are often supplementing and at times replacing in-person care. More consistent use of billing codes for asynchronous telehealth or remote patient monitoring (49) can help practices offset the costs of providing this unscheduled care, but ultimately a move toward capitated or outcomes-based payment models may be necessary to appropriately value these encounters from the provider, patient, and payer perspectives.

The widescale use of telehealth during the COVID-19 pandemic has confirmed previously suspected benefits within diabetes care in terms of its convenience, perceived efficacy, and patient-centeredness. In addition, it appears to have accelerated the move toward greater individualization of diabetes care and to have broadened a potential avenue to address geographic provider shortages and promote continuity of care during times of patient mobility.

Telehealth-Related Challenges in Diabetes Care

In addition to confirming many benefits of telehealth for people with diabetes, data gathered during the COVID-19 pandemic highlight some significant challenges to the optimal use of telehealth within diabetes care. Although the transition to telehealth has facilitated access to essential care for many people with diabetes during the pandemic, retrospective studies over the last year demonstrate that use of telehealth and overall receipt of diabetes care have not been evenly distributed.

Research pertaining to a variety of patient populations, including some focused on people with diabetes specifically, has documented lower use of telehealth by patients with public insurance, minority race or ethnicity, older age, and non-English language preferences (50–57). These publications reveal disparities both in remote versus in-person care (50,55,57) and in telephone versus video care (51,52,54–56). Lower rates of smartphone ownership (58,59), broadband internet access (58–60), and digital health literacy (61,62) in these subpopulations may be contributing to reduced use of telehealth. However, research also suggests that telehealth may be perceived as less beneficial by people with diabetes from households with lower educational attainment (45) and by those with less optimal glycemic control (44,45), suggesting that this care modality may be less patient-centered for individuals in these populations. Finding private space to participate in telehealth visits can be more challenging for people with diabetes who live in smaller homes or in multigenerational households, which in turn may limit the ability to address sensitive topics such as mental health or personal relationships as they relate to diabetes management. The care provided by nonphysician team members such as nurses, certified diabetes care and education specialists, dietitians, and social workers is beneficial for all but is particularly crucial for a subset of people with diabetes. Therefore, the fact that these providers have not participated in synchronous telehealth encounters at many diabetes centers—instead contacting patients separately or on an as-needed basis (13)—may also reduce the perceived efficacy of telehealth for many people with diabetes.

When considering disparities in the use of remote care during COVID-19, it is important to note that delivery of ambulatory care decreased overall during the pandemic despite the addition of telehealth (63), and 38% of global primary and specialty providers rated diabetes as the chronic condition most affected by reduced care delivery (64). This reduction in overall care delivery has not been experienced equally by all people with diabetes. A recent analysis of data from two large medical centers in northern California revealed that 23% of established patients with diabetes did not complete any subspecialty diabetes visits during the 6 months following a March 2020 statewide shelter-in-place order (65). Disproportionate discontinuation of care was observed among adults of working age (25–65 years), individuals with type 2 diabetes, and those at a care site offering exclusively telehealth during this time (65). This finding raises an important point about how the mix of care modalities offered by specific providers and medical centers during the pandemic has strongly influenced both telehealth use and the overall receipt of care for people with diabetes. Data from clinics participating in the T1DX-QI confirm a wide variety in telehealth use at these centers, both at the start of the pandemic in April 2020 (ranging from 52.3 to 99.5% of visits) and 4 months later in August 2020 (ranging from 10 to 86.6% of visits) (13). Among 777 U.S. survey respondents who reported not using telehealth for their type 1 diabetes care as of autumn 2020, 49% cited their primary reason for not using telehealth was that their providers had not offered video appointments (45).

The reasons for variability in telehealth use among medical centers during the pandemic have likely been multifactorial. In addition to basic software and hardware infrastructure, successful diabetes care via telehealth relies on establishing new workflows to replicate essential visit processes (e.g., scheduling, diabetes data acquisition, provider documentation, engagement of nonphysician care team members, and coding and reimbursement) for remote care and also hinges on changes in provider training and culture that enable engagement with this new care modality (48). Nearly all of these factors have varied among diabetes centers during the pandemic, although perhaps the most universal experience has been the challenge in obtaining glycemic data remotely. This challenge is manifested by the fact that 80% of diabetes visits at T1DX-QI clinics in April 2020 lacked A1C data, and by August 2020, after 4–5 months of ongoing telehealth use, this proportion was still as high as 30% (13). The availability of PGHD from diabetes devices at the time of telehealth encounters is harder to evaluate because of inconsistent incorporation of these data in the electronic health record (EHR). However, the acquisition of PGHD remains a challenge for many diabetes providers, particularly those who serve populations with limited access to home computers and broadband internet service for uploading data from glucose meters, insulin pumps, and CGM systems that are not connected to cellular devices. As U.S. policymakers work to expand internet access at the federal and state levels, the implications of this expanded access should be analyzed from a health standpoint as well as an educational perspective. Within the diabetes community specifically, expanded internet access combined with universal internet connectivity among therapeutic devices (e.g., insulin pumps, CGM systems, and glucose meters) and a unified system of transferring PGHD directly to EHR systems could dramatically improve the efficacy of telehealth encounters. Given evidence that supplemental telehealth visits can improve glycemic control among patients with uncontrolled diabetes (31), these technological improvements might also be cost-effective by reducing short- and long-term diabetes complications. The health economics of such proposals should be formally evaluated as our field continues to collect and analyze data related to the large-scale use of telehealth within diabetes care since spring of 2020.

In summary, data from the pandemic demonstrate that access to telehealth for people with diabetes is significantly affected by individual demographics and local care delivery systems, the perceived utility of telehealth may vary among people with diabetes based on demographic and clinical characteristics, and overall receipt of care for diabetes during the pandemic has therefore been unevenly distributed. The missing puzzle pieces at this time are whether differential access to telehealth or overall receipt of care during the pandemic will be associated with differences in health outcomes moving forward and whether telehealth—in its current or in a future, more optimized state—might also improve the cost-effectiveness of care for high-risk populations.

Conclusion

The COVID-19 pandemic has provided an informative natural experiment in telehealth use for diabetes management by stimulating widescale telehealth adoption with varying implementation practices across localities and health systems. Care approaches that were adopted precipitously in the context of a public health emergency must now be developed thoughtfully in the wake of this crisis. As we analyze the available data to identify the benefits and challenges of telehealth within diabetes care, our field must also use these findings to advocate for policies that can maximize the utility of telehealth for all people with diabetes.

The documented advantages of telehealth among users support the continuation of health care policies that will increase access (e.g., expansion of the Interstate Medical Licensure Compact [66]) and sustain parity in reimbursement for telehealth encounters (67). Evidence that demographic groups with lower rates of broadband internet access are less likely to use telehealth adds urgency to national and state efforts to expand broadband accessibility. Within the diabetes community specifically, ensuring universal access to therapeutic diabetes technology, as well as improving the internet connectivity and EHR integration of these devices, would expand the PGHD that can be used during telehealth encounters and circumnavigate ongoing challenges in obtaining A1C data remotely. The development of consensus guidelines for telehealth use in diabetes care such as have been published in psychiatry (68) would help to standardize remote care for diabetes, improve provider training programs in this arena, and focus existing resources on evidence-based practices. Finally, adapting provider schedules and reimbursement practices to better prioritize unscheduled remote care (e.g., telephone calls and asynchronous electronic messaging) and increasing the participation of nonphysician care team members in telehealth workflows would help to meet the growing demand for individualized care while ensuring sustainability of the endocrinology workforce, which is an urgent concern (69).

Although there is evidence that telehealth can support effective, patient-centered diabetes care, ongoing research will be needed to evaluate the patient experience, health outcomes, health equity, and cost-effectiveness of the many emerging hybrid care models. The quest to democratize diabetes care

will undoubtedly face a number of uphill challenges, but the opportunity to improve care through the use of telehealth has been a silver lining permanently exposed by the COVID-19 pandemic.

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DUALITY OF INTEREST

No potential conflicts of interest relevant to this article were reported.

AUTHOR CONTRIBUTIONS

S.S.C. wrote the manuscript and researched data. B.S.B., M.J.H., and J.K.R. researched data and reviewed/edited the manuscript. S.S.C. is the guarantor of this work and, as such, takes responsibility for the integrity and accuracy of the information it contains.

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