Feasibility of Implementing a Pediatric Diabetes Clinic via Telehealth

Jessica S. Pierce,[1,2] Shilpa Gurnurkar,[2,3] Neha Vyas,[2,3] Maura Carakushansky,[2,3] Lindsay Owens,[2] and Susana R. Patton[4]

[1]Center for Healthcare Delivery Science, Nemours Children's Hospital, Orlando, FL; [2]Univeristy of Central Florida College of Medicine, Orlando, FL; [3]Division of Endocrinology, Nemours Children's Hospital, Orlando, FL; [4]Center for Healthcare Delivery Science, Nemours Children's Specialty Care—Jacksonville, Jacksonville, FL

OBJECTIVE | In response to the coronavirus disease 2019 (COVID-19) pandemic and social distancing guidelines, our pediatric diabetes team rapidly changed the format of conducting diabetes clinic from in person to telehealth. We compared the actual number and rate of completed, canceled, and no-show visits between an 8-week period in 2019, when we exclusively conducted visits in person and the same 8-week period in 2020, during the COVID-19 quarantine, when we exclusively conducted visits via telehealth.

METHODS | We used electronic health record data for all patients, as well as Dexcom continuous glucose monitoring data collected for a subset of youths during the COVID-19 quarantine and the immediate pre–COVID-19 period.

RESULTS | Although there was a difference in the absolute number of in-person versus telehealth visits canceled during these two time periods, there was no difference in the rates of completed, canceled, and no-show visits completed in person or via telehealth. This finding suggests that, despite a rapid shift to a completely new health care delivery model, our providers completed a similar rate of patient care via telehealth during the COVID-19 quarantine and that telehealth may be a feasible method for providing diabetes care. However, our results also suggested that youths' glucose management was less optimal during the quarantine period.

CONCLUSION | COVID-19 presented an opportunity to adopt and test the feasibility of using a telehealth delivery model for routine diabetes care. Yet, to make telehealth a viable treatment delivery alternative will likely involve the uptake of new clinic procedures, investment in institutional infrastructure, and team-based flexibility.

Diabetes is a constellation of chronic medical conditions inherently related to how the body metabolizes food into energy. In youths, type 1 diabetes is most common. Currently, in the United States, there are ~200,000 youths living with type 1 diabetes, with another 15,000 youths diagnosed annually (1). Type 1 diabetes develops after destruction of pancreatic islet cells leaves the body unable to produce its own insulin, leading to chronic hyperglycemia. Consequently, modern treatment for type 1 diabetes involves daily coordination of insulin and carbohydrate intake, glucose monitoring, and physical activity (2). In youths, type 2 diabetes is relatively less common. Based on data from the SEARCH for Diabetes in Youth study (3), in 2009, there were an estimated 20,000 youths living with type 2 diabetes in the United States. Type 2 diabetes results when the body becomes less sensitive to its own insulin, thereby leading to a state of hyperglycemia. It occurs in youths from racial or ethnic minority backgrounds at a greater rate than in those from a non-Hispanic White background (3). There is also a direct association between the prevalence of type 2 diabetes and youths' age. The treatment for type 2 diabetes in youths includes healthy lifestyle changes (e.g., diet and physical activity), regular glucose monitoring, and medication (2).

Regardless of diabetes type, it is essential for youths with diabetes to have regular follow-up with their diabetes care team to monitor their glycemic levels and risk for developing complications, track their growth and development, and assess for their psychosocial well-being. These clinical care visits also provide an important opportunity for care teams to make adjustments to youths' insulin and medication dosing, provide youths and their families with diabetes self-management education and support, and recommend new treatment strategies. Based on recommendations from

Corresponding author: Jessica S. Pierce, Jessica.Pierce@Nemours.org

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the American Diabetes Association, at least quarterly clinic visits with a multidisciplinary care team are the standard of care for most youths with type 1 or type 2 diabetes (2). Unfortunately, the goal of regular clinic follow-up and education creates a substantial burden of care for diabetes teams and one that may eventually become less attainable as a result of increasing trends in the incidence of diabetes among youths.

Recent epidemiology data suggest an annual increase in the incidence of type 1 diabetes in youths of 1.8% and an annual incidence of type 2 diabetes in youths of 4.8% (1). Based on these estimates, it is possible that, by 2050, the incidence of type 1 diabetes in youths may triple, and the incidence of type 2 diabetes in youths may quadruple (4). Meeting this increasing clinical demand will require innovative and flexible clinical care models.

Beyond seeking to address increasing clinical demand going forward, diabetes care teams should also consider innovative and flexible care models to reduce family burden and facilitate better access to care. There is evidence that many families of youths with type 1 diabetes do not attend at least quarterly visits with their child's diabetes care team. Specifically, after completing a retrospective chart review, Markowitz et al. (5) found that 61% of families of youths with type 1 diabetes missed at least one clinic visit during a 2-year observation period. Similarly, in a more recent examination of clinic utilization in youths with type 2 diabetes, researchers found that most youths attended fewer clinical visits than recommended by their physician, and about 42% of families appeared to have dropped out of medical care (6). In youths with either type of diabetes, data suggest more optimal glycemic levels are achieved in youths with families who more regularly attend visits (5,6), further underscoring the value of regular follow-up and care.

Telehealth is one example of an innovative and flexible care model that may help diabetes care teams overcome barriers related to clinical demand while facilitating family access to care. Telehealth is a treatment delivery modality that can include telephone calls or video conferencing. Telehealth may offer a highly scalable method of delivering treatment because of the ubiquity of mobile devices and computers and increasing uptake of diabetes devices (e.g., insulin pumps and continuous glucose monitoring [CGM] systems). A number of studies indicate that the use of telehealth for routine pediatric type 1 diabetes care is equal to, if not better than, in person care, when evaluating patient satisfaction, reduction in amount of time off required from work and school, and increase in the use of diabetes technology (7–9). However, until recently, there were notable barriers to uptake of telehealth by clinic systems because of equipment and infrastructure limitations, as well as issues with insurance coverage and reimbursement and professional licensing. Indeed, the Centers for Medicare & Medicaid Services limited telehealth services primarily to people with diabetes in rural designated areas where there is a shortage of specialty care providers, and patients and families still had to travel to an approved location such as a primary care physician's office, health clinic, or dialysis center (10).

However, the coronavirus disease 2019 (COVID-19) pandemic and a U.S. Secretary of Health and Human Services announcement encouraging widespread uptake of telehealth have perhaps forever changed the delivery of routine diabetes care in youths. As a result of the 1135 waiver of the Coronavirus Preparedness and Response Supplemental Appropriations Act (10), many health insurance companies stepped up to reduce barriers related to coverage and reimbursement, and several states have at least temporarily relaxed professional licensing requirements.

Moreover, in response to these changes, many health care systems either created or greatly expanded their telehealth programs to better meet the clinical care needs of their patients and families. The Nemours Children's Health System (NCHS) is a multistate pediatric health system that operates in the eastern United States. NCHS operates the Nemours Children's Hospital (NCH), located in Orlando, FL, which is a freestanding children's hospital providing comprehensive care in more than 50 pediatric subspecialty areas, including pediatric endocrinology. The diabetes clinic at NCH is an example of a clinic that did not have a telehealth program before COVID-19 and, in response to the pandemic, had to quickly adapt and build a new telehealth model of care for patients.

The aims of this article are to *1*) present our team's rapid response workflow for conducting diabetes clinic visits via telehealth during the COVID-19 quarantine, *2*) compare rates of attended, canceled, and no-show appointments during the first 8 weeks of the COVID-19 quarantine (all telehealth visits) to the same time period 1 year prior to COVID-19 (all in-person visits), and *3*) compare diabetes management outcomes in a subset of patients using a personal Dexcom CGM system during the COVID-19 quarantine period and immediately pre–COVID-19.

Research Design and Methods

Aim 1: Rapid Response Workflow for Conducting Diabetes Clinic via Telehealth During COVID-19

For the past 5 years, NCHS has offered primary and specialty care visits through a telehealth platform called

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Nemours CareConnect. However, before the COVID-19 pandemic, no providers in the Division of Pediatric Endocrinology at NCH used telehealth services to provide patient care. Nonetheless, on 13 March 2020, the Centers for Disease Control and Prevention (CDC) declared COVID-19 a national emergency; therefore, beginning on 18 March 2020, the NCH administration required clinics to cancel or convert all ambulatory clinic visits, for an indefinite period of time, to telehealth. With this mandate, the focus of the diabetes team at NCH was to create a process of scheduling telehealth visits for patients and their families that would allow providers and patients to have efficient and meaningful visits despite not being able to meet in person. To this end, within a 3-day period, all diabetes team providers (i.e., endocrinologists, advanced practice nurses, certified diabetes care and education specialists [CDCES], and dietitians) completed training on how to use the CareConnect platform. Telehealth visits began on 23 March 2020.

The process for scheduling a patient began with a medical assistant (MA) calling the family to schedule an appointment and give them the option of either taking a telehealth appointment or going on a waiting list for an in-person appointment at an unknown time in the future. Most families opted for a telehealth visit. The MA then assisted the family in setting up the Nemours CareConnect application on a computer or mobile device and requested that the family try to obtain an updated measure of the youth's weight and height (e.g., by using a scale and tape measure from home) and send the patient's blood glucose logs in one of three ways: *1*) e-mail written logs, *2*) e-mail glucose meter download, or *3*) download glucose meter/insulin pump into a common Cloud-based platform or the specific platform available for their insulin pump or CGM system. About 48 hours before to the telehealth appointment, a CDCES contacted the family to obtain the patient's most recent insulin doses and to confirm that they sent glucose data to the clinic. The CDCES also documented the insulin doses in a telephone encounter in the patient's electronic health record (EHR) and saved a copy of the glucose meter, insulin pump, and/or CGM download on a secured drive on the Nemours network. On the date of the telehealth visit, the patient and family met with an endocrinologist or nurse practitioner to complete the visit, with additional telehealth follow-up available from a CDCES and/or registered dietitian as needed.

Aim 2: Participants and Procedures for Comparing Rates of Telehealth and In-Person Visits

Our study was reviewed by the NCHS institutional review board (IRB) and found to be exempt from further review. We conducted a retrospective EHR query to identify all patients followed in the NCH diabetes clinic who had routine diabetes follow-up appointments scheduled between 25 March and 17 May 2019 (2019 patients) and/or between 23 March and 15 May 2020 (2020 patients). The 2020 dates correspond to the 8-week period during the COVID-19 quarantine when all in-clinic diabetes follow-up appointments were either canceled or converted to telehealth, per NCH requirements, the CDC guidelines, and the Florida safer-at-home order. The 2019 dates correspond to the same 8-week period 1 year earlier, when all diabetes follow-up appointments were conducted in the clinic. For both groups, we only included patients who attended routine diabetes clinic visits with their endocrinologist or nurse practitioner. We excluded all other visit types such as those for new patients, education only, insulin pump training, or basal-bolus regimen training. We collected the following data for 2019 and 2020 patients: whether patients attended their scheduled appointment, canceled their scheduled appointment, or were no-shows to their scheduled appointment, as well as their age, sex, race, ethnicity, insurance payer (private vs. Medicaid), and diabetes type (type 1 or type 2 diabetes). For canceled appointments, we only included appointments canceled by families (e.g., because of scheduling conflict or insurance concern), and we did not include appointments canceled because of providers (e.g., because a provider was out sick) or scheduling errors. Appointments that patients canceled but rescheduled and attended on the same day were not considered canceled appointments.

Aim 3: Participants and Procedures for Comparing CGM Data Before and During the COVID-19 Quarantine

We identified 2020 patients who used a Dexcom CGM and shared their data with the NCH diabetes clinic through Dexcom Clarity, a Web-based diabetes management application (app). We collected the following data from their Clarity accounts during the same 8-week quarantine period as for aim 2 (23 March to 15 May 15 2020) and in the 8 weeks before the quarantine period (13 January 13 to 6 March 2020): sensor usage frequency, glucose management indicator (GMI), average blood glucose, coefficient of variation (CV), SD, and percentage of time spent with glucose very low (<54 mg/dL), low (<70 mg/dL), in range (70–180 mg/dL), high (>180 mg/dL), and very high (>250 mg/dL) (11). We did not include the week of 9 March 2020 because that was spring break for all school districts in the NCH service area, which could have interfered with diabetes management practices independent of COVID-19. We included all patients who wore their Dexcom CGM for at least 1 day during both time periods.

Diabetes Spectrum Online Ahead of Print, published online March 16, 2021

TABLE 1 Patient Characteristics by Year

	2019	2020
Sex		
Male	142 (61.2)	119 (52.2)
Female	90 (38.8)	109 (47.8)
Ethnicity		
Non-Hispanic	133 (57.8)	131 (57.5)
Hispanic	99 (42.7)	96 (42.1)
Did not provide	0 (0.0)	1 (0.4)
Race		
Asian	1 (0.4)	0 (0.0)
Asian Indian	2 (0.9)	1 (0.4)
Black or African American	36 (15.5)	32 (13.4)
White or Caucasian	112 (48.3)	111 (46.6)
Some other race	81 (34.9)	79 (33.2)
Did not provide	0 (0.0)	5 (2.2)
Insurance type		
Commercial	89 (38.4)	7 (38.2)
Medicaid or uninsured	143 (61.6)	141 (61.8)
Type of diabetes		
Type 1	199 (85.8)	199 (88.1)
Type 2	29 (12.5)	24 (10.6)
Other	4 (1.7)	3 (1.3)
Age, years	13.25 ± 3.53	13.45 ± 3.79

Data are *n* (%) except for age, which is mean ± SD.

Analyses

We conducted all analyses using IBM SPSS, v25, software. We computed descriptive statistics to characterize the sample. We computed independent-samples *t* tests to examine mean differences in number of attended, canceled, and no-show appointments in 2019 versus 2020. We computed paired-samples *t* tests to examine mean differences in sensor usage frequency, GMI, average blood glucose, CV, SD, and percentage of time spent with glucose very low, low, in range, high, and very high in 2020 patients before and during COVID-19.

Results

In 2019, a total of 257 patients scheduled a routine diabetes clinic follow-up visit during the 8-week observation period. Of those, 207 patients (80.5%) completed their visit, 37 (14.4%) canceled their visit, and 13 (5.1%) were no-shows to their visit. In 2020, a total of 238 patients scheduled a routine diabetes clinic follow-up visit during the 8-week observation period. Of those, 214 (89.9%) completed their visit, 13 (5.5%) canceled their visit (including those who elected to be placed on a wait list for an in-person appointment), and 11 (4.6%) were no-shows to their visit. The absolute difference among completed, canceled, and no-show visits between years was significant, χ^2 (2, $N = 495$) = 11.09, $P = 0.004$), but there were no differences in these rates between years. Of the 50 patients who canceled or were no-shows in 2019, 24 (48.0%) rescheduled and completed a visit within the 2019 time period. Of the 24 patients who canceled or were no-shows in 2020, 10 (41.7%) rescheduled and completed a visit within the 2020 time period.

Table 1 summarizes participant characteristics. For these data, we only counted once patients who canceled or were no-shows but then completed a visit within the time period. There was a significant difference in the distribution of boys and girls seen during this 8-week period in 2019 and 2020, but there were no differences found for other demographic characteristics. Similarly, there were no differences found on any of the demographic variables between the 26 patients in 2019 who canceled or were no-shows and did not reschedule and attend their visit and the 14 patients in 2020 who canceled or were no-show and did not reschedule and attend their visit. We did not have knowledge regarding the presence of COVID-19 or symptoms of COVID-19 in patients or their families.

Of the 238 2020 patients, 55 (23.1%) wore a Dexcom CGM for at least 1 day during both time periods and shared their data via the Clarity app. Results from paired-sample *t* tests are shown in Table 2. Average blood glucose was significantly higher during COVID than pre-COVID (186 vs. 180 mg/dL, $P = 0.029$); percentage of time in range (TIR; 70–180 mg/dL) was significantly lower during COVID than pre-COVID (49.98 vs. 54.35%, $P = 0.01$); percentage of time >180 mg/dL was significantly higher during COVID than pre-COVID (46.44 vs. 42.79%, $P = 0.01$); and number of days worn (of 56 total days) was significantly lower during COVID than pre-COVID (39.42 vs. 43.72, $P = 0.02$).

Discussion

COVID-19 forced significant changes to health care delivery across the United States, but also offered an opportunity to explore the feasibility of conducting routine diabetes clinic visits via telehealth. Our findings suggest that, despite a rapid shift to a completely new health care delivery model, our providers completed a similar rate of patient care via telehealth in 2020 (10.1% of visits canceled or no-show) as they did during the same period in 2019 (19.5% visits canceled or no-show) via in-person visits. Thus, telehealth may be a feasible method for conducting diabetes clinic.

These rates are consistent with previous research. Markowitz et al. (5) found a 15% cancelation or no-show rate for in-person visits, and Wood et al. (8) found an increase in the

Diabetes Spectrum Online Ahead of Print, published online March 16, 2021

TABLE 2 Mean Differences on CGM Variables Between Time Points

	Before COVID-19		During COVID-19		
	Mean	SD	Mean	SD	Mean Difference
Number of days worn	43.73	13.42	39.42	17.74	4.31*
Percentage of time worn	80.87	24.85	72.96	32.73	7.91*
GMI	7.53	0.87	7.62	0.80	−0.09
Average blood glucose, mg/dL	180.75	38.59	186.40	41.25	−5.56*
Blood glucose <54 mg/dL, %	0.60	1.65	0.81	2.78	−0.21
Blood glucose <70 mg/dL, %	2.33	3.31	2.49	4.27	−0.16
Blood glucose 70–180 mg/dL, %	54.34	19.80	49.98	19.22	4.36*
Blood glucose >180 mg/dL, %	42.79	20.44	46.44	20.42	−3.65*
Blood glucose >240 mg/dL, %	18.47	15.26	20.03	16.97	−1.56
CV	35.77	7.13	35.75	7.22	0.02
SD	65.22	19.12	66.17	21.10	−0.95

*P <0.05.

number of type 1 diabetes clinic visits in young adults after starting a telehealth program. In our study, family interest in telehealth services and/or access to needed technology (e.g., smartphone, computer, or tablet with a camera, e-mail address) did not appear to significantly affect the number or rate of patients seen.

One factor that may be relevant to the question of feasibility is the existence of an available NCHS platform for conducting video-based telehealth visits, called Nemours CareConnect, before COVID-19. Indeed, the primary care physicians in NCHS routinely used the CareConnect platform to conduct after-hours and weekend sick visits before COVID-19, and NCHS already had in place relevant training and technical support for families and providers, as well as procedures and programmed steps (e.g., pre-visit questions) to facilitate telehealth visits. However, as noted previously, none of the endocrinology providers at NCH had experience using CareConnect or any other telehealth platform for diabetes visits before COVID-19, so this experience was novel for both our providers and, potentially, for our patients. Nevertheless, because of the existing CareConnect platform, we cannot discount the possibility that our providers and patient families had an easier transition to telehealth and that this circumstance may have also affected the feasibility of using telehealth to conduct diabetes care visits. It is possible that health care systems that did not already have a telehealth program in place before COVID-19 could have encountered more challenges in transitioning to a telehealth-only care delivery model during the quarantine period in early 2020 and that this situation might have resulted in far lower volumes of patient care and perceptions that it is not particularly feasible to conduct diabetes clinics via telehealth.

Although evaluation of glucose patterns and management behaviors (e.g., frequency of blood glucose checks per day for those not using CGM) is important for all diabetes clinic visits, it was particularly important for telehealth visits because we did not have recent A1C results for the majority of patients. Thus, perhaps another factor underlying our successful transition to telehealth was that the majority of families sent in or downloaded their glucose data before their telehealth appointments. During in-person visits, glucose data downloads are typically done in the clinic at the start of the appointment, which is a time-consuming and cumbersome process. For our telehealth visits, we used a two-step process for ensuring that providers received these data that included one of our MAs prompting families to share their data, followed by a phone call from a CDCES to work through any barriers. This process appeared to be effective in gathering glucose data before telehealth appointments and acceptable to patient families. In addition, we suspect that this process streamlined the telehealth visits and may have allowed providers to have more time with families, which could have been beneficial, especially if families had a lot of questions or concerns related to COVID-19.

We note that the lack of A1C data were a potential drawback of our telehealth visits. The American Diabetes Association's *Standards of Medical Care in Diabetes* recommends A1C testing every 3–6 months in patients with diabetes, with point-of-care testing permitting more timely treatment changes (12). Because of the COVID-19 quarantine, most of our families could not go to a laboratory for blood work, and none had access to the routine point-of-care testing for A1C that they would have had during in-person clinic visits. A1C is the gold-standard measurement of glycemic control and a helpful biomarker of a patient's risk for diabetes-related complications. Although we did not formally evaluate providers' perspectives on the lack of A1C data, anecdotally, most of our providers reported that they did not believe that this was a significant barrier to conducting effective appointments, as long as they had current glucose data available to evaluate. Additionally, this lack of A1C data presented an opportunity to follow consensus guidelines calling for researchers and practitioners to look "beyond A1C" and evaluate other metrics of glycemic outcomes such as TIR (11,13,14). Indeed, for the nearly one-fourth of patients seen via telehealth who used a personal CGM system and shared their data with the clinic, providers were able to evaluate TIR and GMI as proxy measures of treatment effectiveness and complication risk and to use these measures to recommend any changes to patients' daily regimen.

Along these lines, we also compared patients' glucose management during the 8-week COVID-19 quarantine period to the 8 weeks before COVID-19. Overall, our results suggested that youths' glucose management was slightly less optimal during the quarantine period. Youths' average glucose level was significantly higher during the 8-week quarantine period, although it was only 4 mg/dL higher, which may not be clinically meaningful. In contrast, youths' mean percentage of TIR was almost 5% lower during the COVID-19 quarantine period, which may be both statistically significant and clinically meaningful (14). A 5% reduction in TIR means that youths' blood glucose was either >180 or <70 mg/dL for 1.2 more hours per day during the COVID-19 quarantine period compared with before. It also potentially corresponds to an increase of ~0.4% in A1C, which is clinically meaningful (14).

Of note, it may be important to also acknowledge that youths wore their Dexcom CGM sensors about 4 fewer days (or ~8% less time) during the quarantine compared with before. There is evidence to suggest that more frequent CGM use (i.e., greater number of days worn) is associated with greater improvements in A1C (15). Although we do not know why some youths wore their CGM sensor less often during quarantine, it is possible that this difference may account for some of the variance we observed in youths' glucose levels before and during the quarantine period, especially if youths happened to wear their CGM on days when their glucose levels were more variable (e.g., during periods of illness or during transitions).

Although we do not have any person-reported outcomes data to explain why glucose management may have been significantly more challenging during the COVID-19 quarantine, we can speculate on a number of reasons. For example, it is possible that the variance may have been because of changes in or a lack of typical daily routines among youths resulting from a lack of adult supervision (e.g., parents working or unavailable and no access to a school nurse), a reduction in daily physical activity or changes in diet, or increased stress. Because such changes to youths' daily routines would have been sudden, their families would have had no opportunity to plan for them. Moreover, youths with diabetes have higher rates of mental health conditions than the general population (16–18), the symptoms of which may have been exacerbated during the quarantine and may have negatively affected diabetes management. In addition to following general COVID-19 guidelines to reduce risk (e.g., social distancing and wearing masks), recommendations for individuals with diabetes included aiming for tighter glucose management to reduce severe symptoms and complications from potentially being infected with COVID-19. Thus, our findings that glucose management was less optimal during this high-risk period suggest that youths with type 1 diabetes and their families could benefit from additional structure and adjunctive interventions such as problem-solving, goal-setting, and behavioral coping training, which might help them manage similarly challenging events in the future.

In addition to the lack of A1C data, there were a few other drawbacks to our rapid implementation of telehealth. In terms of multidisciplinary diabetes care for families, access to dietitians and mental health professionals was more limited for telehealth visits. For in-person clinics, nearly all clinics were staffed by a dietitian, and about one-third of clinics were staffed with a social worker, both of whom saw families at least annually. For telehealth, dietitians were available on an as-needed basis, and social workers were not available. However, providers could continue to refer patients to outpatient behavioral health services (also conducted via telehealth), as they normally would have. Moreover, before the COVID-19 quarantine, about half of our diabetes providers were consistently screening patients ≥12 years of age for depression symptoms through a relatively new quality improvement process. Unfortunately, because of the format through which our clinic was administering the questionnaire (i.e., integrated into the EHR), it was not possible to administer it unless the patient

Diabetes Spectrum Online Ahead of Print, published online March 16, 2021

was seen in person. Therefore, during this period, we had to temporarily suspend our depression screening program. Another limitation included the lack of vital signs, including blood pressure for monitoring hypertension, and issues related to the accuracy of using patient-reported height and weight measures, which were temporary changes we had to make as a result of our telehealth process.

Despite these limitations, our findings suggest that conducting diabetes clinics via telehealth may be feasible and clinically effective. Without the limitations of quarantine, we now have the opportunity to revisit the format through which we conduct these visits and develop processes to overcome some of the drawbacks to telehealth that we identified through this experience. For example, with our CareConnect platform, it is possible for more than one provider to see a family during a single telehealth visit. Thus, in the future, we can develop a procedure and guidelines to enable us to conduct our more typical multidisciplinary visits via telehealth. Likewise, with more time to plan, it is possible that we can develop a "playbook" to walk families through several different methods by which they may be able to get an A1C test completed by an outside laboratory close to their home or through the use of a clinic-approved home kit. Additionally, converting appointments from in person to telehealth, setting up patients and families on the CareConnect platform, and obtaining glucose meter/pump/CGM data and insulin doses before appointments required a lot of time and effort by the CDCES and MAs. However, efforts to thoroughly prepare charts actually saved time for the providers, who reported anecdotally that visits were more productive as a result. To continue to conduct diabetes clinics via telehealth in the future, we will need to ensure that the CDCES and MAs have time built into their schedules to complete these pre-telehealth visit tasks.

There are also a few lessons from our telehealth experience that could be applied to the management of future in-person visits. For example, we learned that many families have the ability to share their glucose data with the clinical team before visits, which could streamline our clinic procedures and increase efficiency. Going forward, we can institute new pre-visit procedures to encourage families to share their glucose data before their visits. We are also in the process of refining our depression screening quality improvement process to distribute the questionnaire to families through the Nemours patient portal shortly before their visit, which may help to facilitate depression screening for both in-person and telehealth visits. Continued diabetes care visits conducted via telehealth may also be optimal for patients and families who travel long distances to our hospital or satellite clinics.

Conclusion

In summary, we compared the actual number and rate of completed, canceled, and no-show visits between an 8-week period in 2019, when we exclusively conducted visits in person, to the same 8-week period in 2020, during the COVID-19 quarantine, when we exclusively conducted visits via telehealth. Results revealed that, although there was a difference in the absolute number of in-person versus telehealth visits canceled in these two periods, there was no difference in the rates of completed, canceled, and no-show visits conducted in person or via telehealth between these two periods.

Although COVID-19 presented an opportunity to temporarily adopt a telehealth delivery model for routine diabetes care and to test its feasibility, making telehealth a viable alternative for treatment delivery moving forward will likely involve the development of new clinic procedures and flexibility. At NCHS, we may have had a jump start in this process because of our CareConnect telehealth platform and institutional experience using it to deliver primary care services. For health systems without an existing telehealth presence, the adoption of this delivery model may also involve substantial infrastructure and capital investments.

To guide the future development and improvement of telehealth-delivered diabetes care, we will need prospective research that includes obtaining patients', families', and providers' perspectives on telehealth. In addition, it may be important to explore any potential differences in cost related to telehealth versus in-person care (e.g., insurance reimbursement, family time off from work/school, and travel expenses), as well as any health disparities that could limit the reach of telehealth care.

DUALITY OF INTEREST

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

AUTHOR CONTRIBUTIONS

J.S.P. researched data and wrote the manuscript. S.G. and N.V. researched data and reviewed/edited the manuscript. M.C. contributed to the discussion and reviewed/edited the manuscript. L.O. researched data. S.P. wrote the introduction and reviewed/edited the manuscript. J.S.P. is the guarantor of this work and, as such, has full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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