



# The Rapid Transition to Telemedicine and Its Effect on Access to Care for Patients With Type 1 Diabetes During the COVID-19 Pandemic

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## OBJECTIVE

We compared the uptake of telemedicine for diabetes care across multiple demographic groups during the coronavirus disease 2019 pandemic to understand the impact of telemedicine adoption on access to care.

## RESEARCH DESIGN AND METHODS

The study analyzed demographic information of patients with type 1 diabetes seen between 1 January 2018 and 30 June 2020 at a single center. We compared the odds of completing a visit via telemedicine across multiple demographic characteristics.

## RESULTS

Among 28,977 patient visits, the odds of completing a visit via telemedicine were lower among non-English-speaking (1.7% vs. 2.7%; adjusted odds ratio [aOR] 0.45, 95% CI 0.26–0.79) and Medicaid-insured (32.0% vs. 35.9%; aOR 0.83, 95% CI 0.72–0.95) pediatric patients. No clinically significant differences were observed for other demographic factors.

## CONCLUSIONS

Rapid transition to telemedicine did not significantly impact access to diabetes care for most demographic groups. However, disparities in access to care for historically marginalized groups merit close attention to ensure that use of telemedicine does not exacerbate these inequities.

Delivering high-quality diabetes care within the constraints of our current medical system is challenging, particularly for low socioeconomic status, non-English-speaking, and rural populations (1,2). Providers and commentators have expressed concern that the rapid shift to telemedicine as a result of the coronavirus disease 2019 (COVID-19) pandemic might have unintended negative consequences (3–5). We analyzed demographic data from patients with type 1 diabetes from the pediatric and adult diabetes clinics of a major academic diabetes center to identify demographic differences associated with this shift in care delivery and the potential impact on patients' access to diabetes care.

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## RESEARCH DESIGN AND METHODS

We performed a retrospective cohort study of patients with type 1 diabetes identified in a database derived from Vanderbilt University Medical Center's clinical data systems and restructured for research. Patients were identified as having type 1 diabetes using provider-assigned ICD-10 diagnosis code (E10.\*), a highly specific predictor of diabetes diagnosis (6). Patients included in the analysis completed at least one clinic visit at the adult or pediatric clinic each calendar year between 2018 and 2020. Patients potentially contributed multiple encounters to the analysis. All visits with non-English-speaking patients, regardless of visit method, were completed with an in-person, video, or telephonic interpreter. Patients were excluded if they died prior to study completion ( $n = 19$ ). Demographic data were extracted from clinical records through the date of study completion (30 June 2020).

Telemedicine visits were approved across the medical center on 17 March 2020 and offered to all existing and new patients living in Tennessee, Kentucky, and Alabama by standardized protocol, and began on 23 March 2020. Telemedicine visits were available to patients with mobile or landline internet connections and a video-enabled device. Telemedicine visit completion between 17 March 2020 and 30 June 2020 was identified from provider billing information. During this time, the pediatric and adult clinics both continued to see in-person visits. In-person visits conducted after 17 March 2020 were excluded from the primary analysis.

Results are reported separately for patients seen in the pediatric and adult clinics. Descriptive statistics were used to compare characteristics between patients completing telemedicine or in-person visits. We used repeated-measurement analysis at the encounter level, clustered by patient, to compare the odds of completing a visit via telemedicine across demographic characteristics. Adjusted odds ratios (aORs) and 95% CIs were estimated from generalized estimating equations that accounted for within-person correlation and were weighted for the total number of visits (7). Sensitivity analyses were conducted using different prepandemic time

periods. Analyses were completed using Stata 16.1 software (StataCorp, College Station, TX).

## RESULTS

We identified 28,977 type 1 diabetes clinic visits by 2,237 pediatric and 1,861 adult patients in our pediatric and adult clinics conducted between 1 January 2018 and 30 June 2020. Approximately 94% of telemedicine visits were completed via video conference. Demographic analyses are reported in Table 1.

In adjusted analyses, non-English-speaking pediatric patients and those with Medicaid as their primary insurance coverage had significantly lower rates of telemedicine adoption. Visits by non-English-speaking pediatric patients comprised only 1.7% of telemedicine visits compared with 2.7% of in-person visits, or a 54% lower odds of using telemedicine (aOR 0.46, 95% CI 0.26–0.80). Similarly, 35.9% of pediatric prepandemic in-person visits had Medicaid compared with 32.0% of telemedicine visits (aOR 0.83, 95% CI 0.73–0.95). Visits by those from rural ZIP Codes also comprised a significantly smaller number of telemedicine visits than in-person visits (38.2% vs. 39.2%; aOR 0.88, 95% CI 0.78–0.99) but had a smaller effect size and, unlike the findings for non-English-speaking and Medicaid-covered visits, the decrease was not observed in sensitivity analyses (Supplementary Table 1). We did not observe any other statistically significant differences across demographic factors among pediatric patients.

Within the adult cohort, there were no statistically significant differences in the odds of completing a telemedicine visit across any groups (Table 1). Notably, non-English-speaking patients during the previous 3 years represented only 23 visits, with only 1 visit completed via telemedicine.

## CONCLUSIONS

We examined the uptake of telemedicine for diabetes care during the transition to telemedicine amid the COVID-19 pandemic in a major academic diabetes center. This transition did not significantly impact access to diabetes care for most patients; however, among pediatric patients, we observed small-to-moderate and statistically significant reductions in the proportion of telemedicine visits

among non-English-speaking and Medicaid-insured patients. Despite concerns that differential access to broadband internet might decrease access in rural populations, we found only a small decrease in visit frequency among rural patients, which was nonsignificant in sensitivity analyses, unlike our other findings (Supplementary Table 1). While unclear from our data, we suspect that increasing access to high-speed mobile data mitigated this effect among patients in rural areas (8,9). In fact, prepandemic studies of telemedicine leveraged this technology to improve care access to these patients (10). Reduced use among Medicaid patients suggests that socioeconomic status poses a larger barrier for access. Along with the affordability of internet services and cellular data, other barriers, such as housing insecurity and unpredictable work schedules, also likely contributed. Seeking creative solutions, such as partnering with school systems to provide mobile broadband for health and education or collaborating with other social service agencies to address access barriers, could align multiple interests to support this patient population.

Decreased use of telemedicine by non-English-speaking patients as seen here has also been observed in other subspecialty telemedicine clinics (3). Improving access for these patients requires a multidisciplinary effort to ensure user interfaces are available in multiple languages and that providers are able to integrate interpreters easily into visits. More research is needed to better understand other potential causes for decreased use among this demographic group.

This study has notable strengths, including the large sample of clinic visits and the inclusion of all visits completed for patients with type 1 diabetes during the study period. Further, our data were obtained from a real-world, large-scale implementation of telemedicine, making our findings more generalizable than those from studies conducted in controlled settings. In addition, the inclusion of pediatric and adult clinics reveals similarities and differences in telemedicine adoption across these distinct populations.

Limitations of this study include the small number of non-English-speaking visits in both telemedicine cohorts and Medicaid patients in the adult cohort, which constrain our ability to assess the

**Table 1—Demographic data by year and visit type**

	Telemedicine visits, 2020 (Mar–June)	Completed in-person visits			All years	Telemedicine vs. all years, aOR (95% CI)
		2018 (Jan–Dec)	2019 (Jan–Dec)	2020 (Jan–Mar)		
Total pediatric visits	1,086	7,549	7,725	1,610	16,884	
Age, years, mean (SD)	14.9 (6.2)	15.6 (4.2)	14.8 (4.3)	14.3 (4.2)	15.1 (4.3)	
<6	38 (3.5)	171 (2.3)	278 (3.6)	62 (3.9)	511 (3.0)	Reference
6 to <10	149 (13.7)	725 (9.6)	940 (12.2)	215 (13.4)	1,880 (11.1)	1.14 (0.83–1.57)
10 to <14	278 (25.6)	1,515 (20.1)	1,753 (22.7)	409 (25.4)	3,677 (21.8)	1.01 (0.75–1.36)
14 to <16	177 (16.3)	1,165 (15.4)	1,282 (16.7)	286 (17.8)	2,733 (16.2)	0.87 (0.64–1.20)
16 to <18	234 (21.6)	1,579 (20.9)	1,563 (20.2)	309 (19.2)	3,451 (20.4)	0.90 (0.66–1.21)
18 to <20	148 (13.6)	1,333 (17.7)	1,190 (15.4)	215 (13.4)	2,738 (16.2)	0.65 (0.48–0.89)
>20	62 (5.7)	1,061 (14.1)	719 (9.3)	114 (7.1)	1,894 (11.2)	0.36 (0.25–0.52)
Female sex	533 (49.1)	3,694 (48.9)	3,719 (48.1)	790 (49.1)	8,203 (48.6)	1.03 (0.92–1.16)
Race/ethnicity						
Non-Hispanic White	878 (80.9)	6,221 (82.4)	6,154 (79.7)	1,273 (79.1)	13,648 (80.8)	Reference
Non-Hispanic Black	110 (10.1)	823 (10.9)	887 (11.5)	166 (10.3)	1,876 (11.1)	0.83 (0.69–1.01)
Hispanic	20 (1.8)	169 (2.24)	166 (2.2)	39 (2.4)	374 (2.2)	0.72 (0.45–1.18)
Non-English-speaker visits	18 (1.7)	191 (2.5)	215 (2.8)	57 (3.5)	463 (2.7)	0.46 (0.26–0.81)
Rural home ZIP Code	415 (38.2)	2,965 (39.3)	3,023 (39.1)	628 (39.0)	6,616 (39.2)	0.88 (0.78–1.00)
Medicaid as primary insurance	348 (32.0)	2,669 (35.4)	2,781 (36.0)	607 (37.7)	6,057 (35.9)	0.83 (0.73–0.94)
Total adult visits	785	4,115	4,448	1,028	9,591	
Age, years, mean (SD)	39.1 (29.0)	44.2 (16.9)	43.5 (17.1)	42.6 (17.1)	43.7 (17.0)	
<30	248 (31.6)	1,102 (26.8)	1,293 (29.1)	327 (31.8)	2,722 (28.4)	Reference
30 to <40	166 (21.2)	880 (21.4)	937 (21.1)	207 (20.1)	2,024 (21.1)	0.92 (0.74–1.13)
40 to <50	103 (13.1)	649 (15.8)	653 (14.7)	149 (14.5)	1,451 (15.1)	0.82 (0.65–1.03)
50 to <60	97 (12.4)	586 (14.2)	606 (13.6)	140 (13.6)	1,332 (13.8)	0.88 (0.70–1.11)
>60	171 (21.8)	898 (21.8)	959 (21.6)	205 (19.9)	2,062 (21.6)	1.02 (0.84–1.24)
Female sex	437 (55.7)	2,234 (54.3)	2,458 (55.3)	568 (55.3)	5,260 (54.8)	0.99 (0.85–1.14)
Race/ethnicity						
Non-Hispanic White	687 (87.5)	3,693 (89.7)	3,988 (89.7)	915 (89.0)	8,596 (89.6)	Reference
Non-Hispanic Black	50 (6.4)	275 (6.7)	268 (6.0)	61 (5.9)	604 (6.3)	1.02 (0.76–1.37)
Hispanic	19 (2.4)	58 (1.4)	64 (1.2)	16 (1.6)	138 (1.4)	1.70 (0.89–3.23)
Non-English-speaker visits	1 (0.1)	11 (0.3)	8 (0.2)	4 (0.4)	23 (0.3)	0.36 (0.07–1.84)
Rural home ZIP Code	204 (26.0)	1,164 (28.3)	1,258 (28.3)	287 (27.9)	2,709 (28.3)	0.92 (0.79–1.08)
Medicaid as primary insurance	41 (5.2)	223 (5.4)	243 (5.5)	70 (6.8)	536 (5.6)	1.01 (0.69–1.47)

Data are presented as *n* (%) unless otherwise indicated.

true effect of the telemedicine implementation on these groups. Additionally, our data did not include canceled or rescheduled visits during the study period, which may provide significant additional information about access to care. Finally, we do not know the clinical impact of these visits; a preliminary but limited analysis of those patients with A1C data through 31 January 2021 suggests that in-person and telemedicine visits were equally effective at sustaining diabetes management (Supplementary Fig. 1). However, the role of

key clinical interactions, such as whether providers had timely access to blood glucose, insulin pump data, or HgbA<sub>1c</sub> data at the time of the visit, is not discernible from our data.

The current study is one of the first to comprehensively examine the impact on access to diabetes care during the transition to telemedicine during the COVID-19 pandemic. This study provides a useful starting point for improvement of processes for implementation of telemedicine. Further work is needed to understand how to

optimize clinical care delivery, through rigorously obtained quantitative measures such as A1C and subjective measures such as patient and provider satisfaction. By addressing these knowledge gaps early in the implementation of this technology, we can help ensure that the improved access to care and convenience of telemedicine is available to all of our patients.

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study and take responsibility for the integrity of the data and the accuracy of the data analysis.

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