Factors Associated With Discontinuation of Subspecialty Diabetes Care During the COVID-19 Pandemic: A Multisite Retrospective Cohort Study

Sarah C. Haynes,[1,2] Tejaswi Kompala,[3,4] Daniel J. Tancredi,[1,5] Aaron B. Neinstein,[3,6] and Stephanie S. Crossen[1,2]

Diabetes Care 2022;45:e34–e36 | https://doi.org/10.2337/dc21-1360

Subspecialty care for people with diabetes (PWD) changed dramatically in 2020, with rapid conversion to telehealth necessitated by the increased burdens and risks associated with in-person care during the coronavirus disease 2019 (COVID-19) pandemic. Although remote care provided an essential lifeline for many patients, overall delivery of ambulatory care decreased during the pandemic despite the expansion of telehealth (1), suggesting that many PWD did not receive care during this time. We conducted a retrospective analysis to determine the proportion of established diabetes patients at two academic medical centers who did not continue care during the first 6 months of the pandemic and to identify factors associated with discontinuation of care during this time.

UC Davis Health (UCDH) and UC San Francisco (UCSF) are two of the largest medical centers serving Northern California, and both had telehealth infrastructure in place prior to the COVID-19 pandemic. On 19 March 2020, California issued a statewide shelter-in-place order, at which time diabetes clinics at both centers transitioned heavily to telehealth. At UCDH, telehealth use increased from $<$1% of diabetes visits in February 2020 to 90% of diabetes visits in April 2020; at UCSF, telehealth use increased from 8% of diabetes visits in February 2020 to $>$99% of diabetes visits in April 2020. During the subsequent 6 months, both centers continued to use telehealth for diabetes care, with UCSF exhibiting more persistent use than UCDH (93% vs. 47% of diabetes visits, respectively, between April and September 2020).

Our cohort included 4,523 individuals who received endocrinology care at UCDH or UCSF for a diagnosis of type 1 or type 2 diabetes between 19 September 2019 and 18 March 2020 (6-month baseline period). Our primary outcome was the completion of one or more subspecialty diabetes visits between 19 March 2020 and 18 September 2020 (6-month pandemic period). We used multiple Poisson regression to estimate adjusted incidence rate ratios (IRRs) for continuation of care in the pandemic period, adjusting for age, diabetes type, mean baseline hemoglobin A_{1c} (HbA_{1c}), rural residence (2), primary language, insurance status, site of care, sex, and race/ethnicity. Mean baseline HbA_{1c} was calculated from laboratory and point-of-care values available in the electronic health record during the baseline period. We also adjusted for prepandemic receipt of care by including the natural logarithm of the total number of visits during the baseline period as a covariate in our model.

Overall, 23.4% of established diabetes patients did not continue to receive subspecialty care during the 6-month pandemic period. Continuation of care was less likely among individuals with type 2 diabetes (IRR 0.90, 95% CI 0.86–0.94, $P < 0.001$), adults of traditional working ages - 25–29 years (IRR 0.88, 95% CI 0.83–0.93, $P < 0.001$) or 50–65 years (IRR 0.93, 95% CI 0.88–0.98, $P = 0.011$) - compared with patients aged 1–24 years, and patients with missing baseline compared with patients aged 1–24 years and patients with missing baseline HbA_{1c} data (IRR 0.93, 95% CI 0.87–0.98, $P = 0.011$). Patients at the site of care with relatively more in-person encounters during the pandemic (UCDH) were more likely to continue care (IRR 1.07, 95% CI 1.03–1.12, $P = 0.002$).

Prior research has demonstrated disparities in telehealth use among PWD during the pandemic (3), but this is the first published study to evaluate who among PWD has foregone subspecialty care during this time, which has important implications for health equity. This study's strengths include a large patient cohort managed at multiple sites and

[1]Department of Pediatrics, University of California, Davis, Davis, CA
[2]Center for Health and Technology, University of California, Davis, Davis, CA
[3]Department of Medicine, University of California, San Francisco, San Francisco, CA
[4]Teladoc Health, Harrison, NY
[5]Center for Healthcare Policy and Research, University of California, Davis, Davis, CA
[6]Center for Digital Health Innovation, University of California, San Francisco, San Francisco, CA

Corresponding author: Stephanie Crossen, scrossen@ucdavis.edu

Received 29 June 2021 and accepted 11 November 2021

This article is part of a special article collection available at https://diabetesjournals.org/journals/collection/52/Diabetes-and-COVID-19.

Table 1—Demographic and clinical characteristics of the study cohort with associated adjusted IRRs for continuation of subspecialty diabetes care during the pandemic

	N (%)	IRR	95% CI	*P* value
Age, years				
1–24	1,237 (27.4)	1		
25–49	763 (16.9)	0.88	0.83–0.93	<0.001
50–65	1,069 (23.7)	0.93	0.88–0.98	0.011
>65	1,454 (32.2)	0.99	0.94–1.05	0.766
Diabetes type				
1	2,074 (45.9)	1		
2	2,449 (54.2)	0.9	0.86–0.94	<0.001
Mean HbA_{1c}				
<8% or <64 mmol/mol	744 (16.5)	1		
>8% or >64 mmol/mol	444 (9.8)	0.94	0.88–1.01	0.091
No data available	3,335 (73.7)	0.93	0.87–0.98	0.011
Sex				
Female	2,234 (49.4)	1		
Male	2,289 (50.6)	0.99	0.96–1.02	0.448
Urban/rural residence				
Urban	4,061 (89.8)	1		
Rural	462 (10.2)	0.96	0.91–1.01	0.119
Primary language				
English	4,117 (91.0)	1		
Other	406 (9.0)	0.95	0.90–1.02	0.148
Insurance				
Private	2,138 (47.3)	1		
Public/uninsured	2,385 (52.7)	1.02	0.98–1.06	0.382
Site of care				
UCSF	2,137 (47.3)	1		
UCDH	2,386 (52.8)	1.07	1.03–1.12	0.002
Race/ethnicity				
White	2,472 (54.7)	1		
Hispanic	6,391 (14.0)	1	0.95–1.05	0.96
Asian	615 (13.6)	0.98	0.92–1.03	0.368
Black	344 (7.6)	1.02	0.96–1.08	0.498
Native Hawaiian or Pacific Islander	54 (1.2)	0.97	0.82–1.15	0.713
Native American or Alaska Native	39 (0.9)	1.05	0.90–1.23	0.538
Other/unknown	368 (8.1)	0.95	0.88–1.01	0.074
Total *N*	4,523			

a robust multivariable analysis. Key limitations are the low availability of HbA_{1c} data and lack of clinical details, such as use of diabetes technology, comorbid conditions, receipt of care at other facilities, and unscheduled encounters, like electronic messaging, which may have enabled ongoing care. Finally, although continuation of subspecialty care has been associated with glycemic control and incidence of diabetic ketoacidosis in prior studies (4,5), further research is needed to determine whether the care gaps we identified are associated with health outcomes of interest.

Our findings highlight the impact of health system and local factors, including site of care, local policies, and decisions about care delivery, on the receipt of care by PWD. This analysis should motivate other centers to examine any pandemic-associated lapses in care within their served populations of PWD and to qualitatively evaluate the reasons for these. As our field works to develop postpandemic diabetes care models that involve a hybrid of telehealth and in-person visits, we must design these models with attention to how care modality options may impact ongoing participation in care for various populations of PWD.

Acknowledgments. The authors are grateful to Jeffrey Flack, UCDH, and Anobel Odisho and Ayan Patel, UCSF, for their assistance with data set creation.

Funding. This work was funded by a research award from the Children's Miracle Network in association with UC Davis Children's Hospital. S.S.C. receives support from the National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, through grant number K23DK125671.

The content of this manuscript is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Duality of Interest. T.K. has received consulting fees from Eli Lilly and is currently employed by Teladoc Health. A.B.N. has received research support from Cisco Systems, Inc.; has received consulting fees from Nokia Growth Partners, Grand Rounds, Intuity Medical, Medtronic, Eli Lilly, and Roche; serves as an advisor to Steady Health (received stock options); has received speaking honoraria from Academy Health and Symposia Medicus; has written for WebMD (received compensation); and is a medical advisor and cofounder of Tidepool (for which he has received no

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

Author Contributions. S.C.H. conceptualized and designed the study, conducted the data analyses, and drafted and revised the manuscript. T.K. conceptualized and designed the study and revised the manuscript. D.J.T. supervised the statistical analyses and revised the manuscript. A.B.N. conceptualized and designed the study and revised the manuscript. S.S.C. conceptualized and designed the study and drafted and revised the manuscript. S.C.H. and S.S.C. are the guarantors of this work and, as such, had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

References

1. Cantor JH, McBain RK, Pera MF, Bravata DM, Whaley CM. Who is (and is not) receiving telemedicine care during the COVID-19 pandemic. Am J Prev Med 2021;61:434–438

2. Health Resources & Services Administration. Federal Office of Rural Health Policy eligible ZIP codes 2018 [updated December 2018]. Accessed 1 February 2021. Available from https://www.hrsa.gov/rural-health/about-us/definition/datafiles.html

3. Haynes SC, Kompala T, Neinstein A, Rosenthal J, Crossen S. Disparities in telemedicine use for subspecialty diabetes care during COVID-19 shelter-in-place orders. J Diabetes Sci Technol 2021;15:986–992

4. Holmes-Walker DJ, Llewellyn AC, Farrell K. A transition care programme which improves diabetes control and reduces hospital admission rates in young adults with type 1 diabetes aged 15-25 years. Diabet Med 2007;24:764–769

5. Crossen SS, Wilson DM, Saynina O, Sanders LM. Outpatient care preceding hospitalization for diabetic ketoacidosis. Pediatrics 2016;137:e20153497