The Disproportionate Impact of Primary Care Disruption and Telehealth Utilization During COVID-19

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VISUAL ABSTRACT

ABSTRACT

PURPOSE The COVID-19 pandemic not only exacerbated existing disparities in health care in general but likely worsened disparities in access to primary care. Our objective was to quantify the nationwide decrease in primary care visits and increase in telehealth utilization during the pandemic and explore whether certain groups of patients were disproportionately affected.

METHODS We used a geographically diverse primary care electronic health record data set to examine the following 3 outcomes: (1) change in total visit volume, (2) change in in-person visit volume, and (3) the telehealth conversion ratio defined as the number of pandemic telehealth visits divided by the total number of prepandemic visits. We assessed whether these outcomes were associated with patient characteristics including age, gender, race, ethnicity, comorbidities, rurality, and area-level social deprivation.

RESULTS Our primary sample included 1,652,871 patients from 408 practices. During the pandemic we observed decreases of 7% and 17% in total and in-person visit volume and a 10% telehealth conversion ratio. The greatest decreases in visit volume were observed among pediatric patients (−24%), Asian patients (−11%), and those with more comorbidities (−9%). Telehealth usage was greatest among Hispanic or Latino patients (17%) and those living in urban areas (12%).

CONCLUSIONS Decreases in primary care visit volume were partially offset by increasing telehealth use for all patients during the COVID-19 pandemic, but the magnitude of these changes varied significantly across all patient characteristics. These variations have implications not only for the long-term consequences of the COVID-19 pandemic, but also for planners seeking to ready the primary care delivery system for any future systematic disruptions.

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INTRODUCTION

Primary care is the largest platform for health care delivery in the United States,[1] and an adequate supply of primary care physicians is associated with positive and more equitable health outcomes.[2,3] Research has found that racial and ethnic minority individuals are disadvantaged in accessing primary care. For example, they are less likely to report a usual source of care and are more likely to be uninsured.[4] These racial inequities are particularly notable among pediatric populations[5] and among those with chronic conditions.[6] Geographically speaking, rural populations are disadvantaged in some dimensions of access,[7] and populations living in areas with greater levels of social deprivation have less access to care.[8]

The COVID-19 pandemic exacerbated existing and well-documented disparities in health care in general[9,10] and likely worsened disparities in access to primary care for the above-mentioned groups for reasons including patients choosing to forgo or delay necessary medical care[11,12] or possibly differential access to technology and bandwidth amidst the rapid shift from in-person to telehealth visits.[9,13,14] Varying decreases in primary care visit volume within different time frames during the COVID-19 pandemic have been reported. The reported decreases ranged from 22% in the first months of the pandemic to 10% through the end of 2020.[15,16] Estimates suggest that decreases might have been steeper for pediatric patients, as high as 27%.[16] Decreases in office visits were accompanied by surges in telehealth usage, reported to range from 28% to 35% of total primary care visits.[15,17]

Whereas new information continues to emerge concerning increasing inequities as a result of the pandemic, little has been done to quantify how nationwide decreases in primary care visit volume and increases in telehealth utilization differed across different groups of patients during the pandemic. It is unknown whether and to what proportion these rapid shifts in care delivery affected vulnerable patient populations and whether existing disparities in access to primary care specifically were worsened during the pandemic. Using a unique data resource specific to primary care,[18] we examined changes in utilization of primary care during the COVID-19 pandemic relative to prepandemic levels. We did so by comparing total and in-person visit volumes, in the process creating a novel telehealth conversion ratio (TCR) as an innovative method for quantifying the shift to telehealth, and assessing whether and how these changes were associated with patient characteristics that can inform disparities.

METHODS

Data Source

We used primary care electronic health record data from the American Family Cohort,[18] a unique and geographically diverse research data set derived from the American Board of Family Medicine's PRIME Registry.[19] The data set contains data for >6.6 million patients of all ages, from all 50 states, and with private insurance, Medicaid, and Medicare. Frequently underserved populations, such as rural and racial and ethnic minority groups, are also reflected in the data.

Sample

We constructed our primary sample using daily patient encounter data from March 15, 2019 through March 14, 2021 to cover 1 full year of encounters before and after the start of the pandemic. These data were combined with patient diagnosis codes and demographic variables including date of birth, gender, race, ethnicity, and zip code. We restricted our sample to primary care clinicians who met the following inclusion criteria: visit data spanning the entire date range, ≥500 visits in each of the calendar years of our sample, and >50% completeness of all patient demographic variables. In addition, we constructed an extended longitudinal sample from January 1, 2019 through December 31, 2022 using the same inclusion criteria for examining trends over time.

Independent Variables

Patient age was calculated as of March 15, 2020. Patient gender, race, and ethnicity required extraction and harmonization across different practice and electronic health record coding schemes. Patient gender was categorized as female or male; no other gender identities could be consistently extracted. For race, we categorized patients as American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, and White. Owing to sample size limitations, the American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, and other categories were combined into a single "other" category. For ethnicity, we determined whether patients identified as Hispanic or Latino. Using zip code, we linked to rural-urban commuting area[20] codes to classify patient rurality as urban, large rural, small rural, or isolated.[21] We also used a zip code-to-zip code tabulation area crosswalk[22] to determine area-level social deprivation using the Social Deprivation Index (SDI).[8,23] In addition to patient demographic variables, we used available *International Classification of Diseases, Ninth Revision* (*ICD-9*) and *International Classification of Diseases, Tenth Revision* (*ICD-10*) diagnosis codes to compute the Charlson Comorbidity Index[24] for each patient.

Outcomes

We examined the following 3 outcomes: percent change in total visit volume, percent change in in-person visit volume, and the novel TCR, all relative to prepandemic levels. We classified encounters as pre- or postpandemic by their date of occurrence, using March 15, 2020 as a cutoff date between the 2 time periods. We identified telehealth encounters as encounters having a procedure code reserved for telehealth encounters, those having codes with a "GT" or "95" modifier, or those with "telehealth" in the encounter description. All other encounters were classified as in-person. For each date in our pandemic period, we calculated the percent change in total and in-person visit volume relative to the same date from the 12 months before the pandemic. We similarly defined the TCR for each date as the number of telehealth encounters during the pandemic divided by the total number of prepandemic visits on the same date 12 months prior. The TCR allowed us to estimate the percentage of prepandemic visit volume that was converted to telehealth during the pandemic.

Analysis

To examine associations with the 3 outcomes in our primary sample, we stratified by each patient characteristic and calculated the outcomes within each stratum. We started by aggregating over the pandemic period of March 15, 2020 to March 14, 2021 to take a broader look at the changes over the course of the pandemic. To account for the numerically complex and multilevel nature of the data, we used cluster bootstrapping at the practice level to estimate 95% CIs for our 3 outcomes within each stratum. For determining significance, we similarly constructed 95% CIs for the pairwise differences in outcomes between categories of our patient-level variables. Taking patient age as an example, we calculated the difference in TCR between patients aged <18 years and patients aged 18 to 29 years and considered that difference significant if 0 was not included within the CI. In addition, we examined the distribution of our outcomes at the practice level to better understand the effect of that variation.

We then took a more granular look at how visit volume and TCR varied over the course of the pandemic using our longitudinal sample through the end of 2022. We calculated 7-day moving averages of visit volume changes and TCR relative to corresponding prepandemic dates. We also computed 95% confidence limits for the moving averages using the same cluster bootstrapping technique used in our primary sample. Extreme outliers around major holidays were removed from the moving averages, and a locally estimated scatterplot smoothing technique was applied to provide a clearer look at the changes over time. Analysis was performed using SAS version 9.4 (SAS Institute Inc). The American Academy of Family Physicians Institutional Review Board approved this study.

RESULTS

Our primary sample included 1,652,871 patients with 8,833,434 visits from 408 practices and 2,328 clinicians. During the pandemic we observed decreases of −7% and −17% in the average number of total and in-person visits, respectively, as well as a 10% TCR (Table 1). There were significant pairwise associations between patient characteristics and our outcomes (Supplemental Table). The largest decreases in overall and in-person visit volume were observed for pediatric (−24% total, −31% in-person) and Asian patients (−11%, −24%) and for those with a Charlson Comorbidity Index score of ≥3 (−9%, −20%). The smallest decreases in total visit volume were observed for patients aged 18 to 64 years (mean −2%) and Black or African American patients (−2%). Telehealth utilization (TCR) was lowest among rural (6%) and pediatric (7%) patients and highest among Hispanic

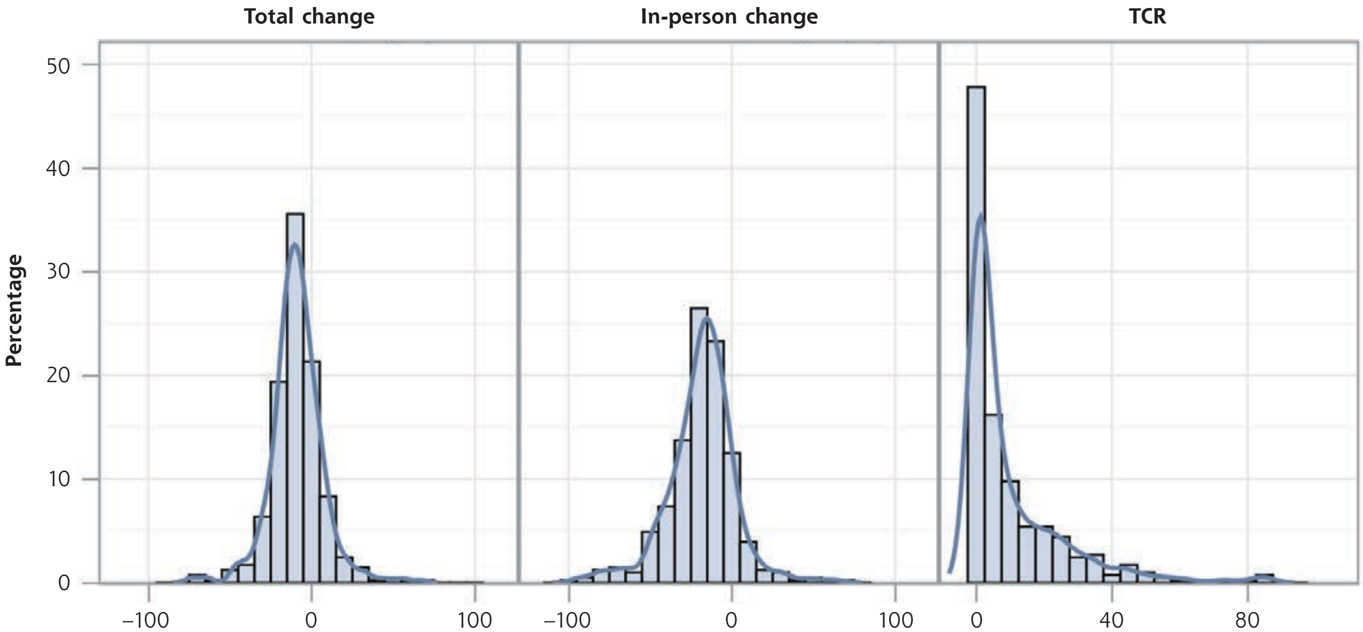
Table 1. Visit Volume Changes and TCR by Patient Characteristic Relative to Prepandemic Levels, March 15, 2020 to March 14, 2021

	No. of Patients	Δ Total Visits, % (95% CI)	Δ In-Person, % (95% CI)	TCR, % (95% CI)
Total	1,652,871	−7.4 (−9.6 to −5.3)	−17.0 (−19.7 to −14.3)	9.8 (8.3 to 11.4)
Age, y (n = 1,639,831)				
<18	205,999	−24.0 (−26.5 to −21.3)[a]	−30.5 (−34.8 to −26.1)[a]	6.5 (4.0 to 9.4)[a]
18-29	195,194	−1.6 (−6.6 to 3.5)[a]	−11.7 (−17.7 to −5.8)[a]	10.3 (8.5 to 12.5)[a]
30-49	380,584	−1.2 (−3.4 to 0.9)[a]	−13.2 (−16.3 to −10.3)[a]	12.3 (10.2 to 14.6)[a]
50-64	396,070	−3.3 (−5.3 to −1.1)[a]	−13.8 (−16.4 to −11.1)[a]	10.8 (9.0 to 12.8)[a]
≥65	461,984	−9.5 (−11.7 to −7.0)[a]	−18.1 (−20.8 to −15.1)[a]	8.9 (7.4 to 10.7)[a]
Gender (n = 1,638,561)				
Female	926,585	−6.8 (−9.1 to −4.5)[a]	−17.0 (−20.0 to −14.0)	10.5 (8.9 to 12.3)[a]
Male	711,976	−8.5 (−10.5 to −6.4)[a]	−17.1 (−19.7 to −14.6)	8.9 (7.5 to 10.5)[a]
Race (n = 1,415,650)				
Asian	29,629	−10.6 (−13.3 to −7.5)[a]	−24.4 (−34.3 to −16.9)[a]	14.0 (6.9 to 24.1)
Black or African American	130,845	−1.7 (−5.4 to 2.1)[a]	−13.9 (−19.0 to −8.6)[a]	12.4 (9.1 to 16.1)
White	1,233,648	−7.6 (−9.7 to −5.4)[a]	−16.8 (−19.4 to −14.1)[a]	9.5 (8.0 to 11.1)
Other	21,528	−3.5 (−11.4 to 2.6)	−11.3 (−19.8 to −3.6)[a]	7.9 (4.2 to 13.3)
Ethnicity (n = 1,365,581)				
Not Hispanic or Latino	1,229,706	−7.1 (−9.3 to −4.8)	−16.1 (−18.7 to −13.3)[a]	9.3 (7.8 to 10.9)[a]
Hispanic or Latino	135,875	−6.9 (−10.6 to −3.4)	−23.4 (−28.8 to −17.8)[a]	16.7 (11.5 to 22.4)[a]
CCI (n = 1,639,033)				
0	958,112	−7.2 (−9.7 to −4.7)[a]	−15.7 (−18.8 to −12.7)[a]	8.7 (7.3 to 10.2)[a]
1	276,821	−6.1 (−8.3 to −3.9)[a]	−16.6 (−19.4 to −13.8)[a]	10.7 (9.1 to 12.5)[a]
2	115,060	−5.8 (−8.1 to −3.3)[a]	−15.9 (−18.8 to −12.8)[a]	10.5 (8.7 to 12.5)[a]
≥3	289,040	−9.4 (−11.7 to −7.1)[a]	−19.8 (−22.7 to −16.9)[a]	10.7 (8.8 to 12.8[a]
RUCA (n = 1,627,662)				
Urban	1,105,412	−6.5 (−8.8 to −4.0)[a]	−18.0 (−21.1 to −14.9)	11.8 (9.8 to 13.9)[a]
Large rural	274,207	−10.1 (−13.2 to −7.0)[a]	−16.3 (−20.3 to −12.4)	6.4 (4.7 to 8.4)[a]
Small rural	163,173	−8.0 (−13.9 to −2.0)	−13.8 (−19.9 to −7.2)	6.2 (4.2 to 8.8)[a]
Isolated	84,870	−8.9 (−13.6 to −3.7)	−14.6 (−20.0 to −8.5)	6.1 (4.1 to 8.6)[a]
SDI (n = 1,627,930)				
0-25	422,332	−8.8 (−11.2 to −6.4)[a]	−17.8 (−20.7 to −14.9)	9.3 (7.7 to 11.1)[a]
26-50	476,946	−7.2 (−10.1 to −4.1)	−15.7 (−19.0 to −12.2)[a]	8.8 (7.3 to 10.5)[a]
51-75	490,478	−7.8 (−10.2 to −5.5)	−16.0 (−19.0 to −13.2)[a]	8.5 (6.9 to 10.3)[a]
76-100	238,174	−5.2 (−8.3 to −2.1)[a]	−20.7 (−25.9 to −15.6)[a]	15.7 (11.6 to 20.2)[a]

CCI = Charlson Comorbidity Index; RUCA = rural-urban commuting area; SDI = Social Deprivation Index; TCR = telehealth conversion ratio.

[a] Value differs significantly (with 95% confidence) from ≥1 other category.

Figure 1. Distribution of practice-level visit volume changes and TCR relative to prepandemic levels (n = 408), March 15, 2020 to March 14, 2021.



TCR = telehealth conversion ratio.

or Latino (17%), those with high SDI (16%), and urban (12%) patients.

The distributions of visit volume changes and TCR varied at the practice level (Figure 1). Whereas most practices experienced a decrease in overall visit volume, 94 (23%) had an increase in overall visit volume. In addition, the distribution of TCR was right-skewed, with 71 (17%) practices for which no telehealth encounters were observed and an additional 71 with a TCR of <1%. Meanwhile, the 75th percentile for TCR at the practice level was 14%, and there were 12 practices with a TCR >50%.

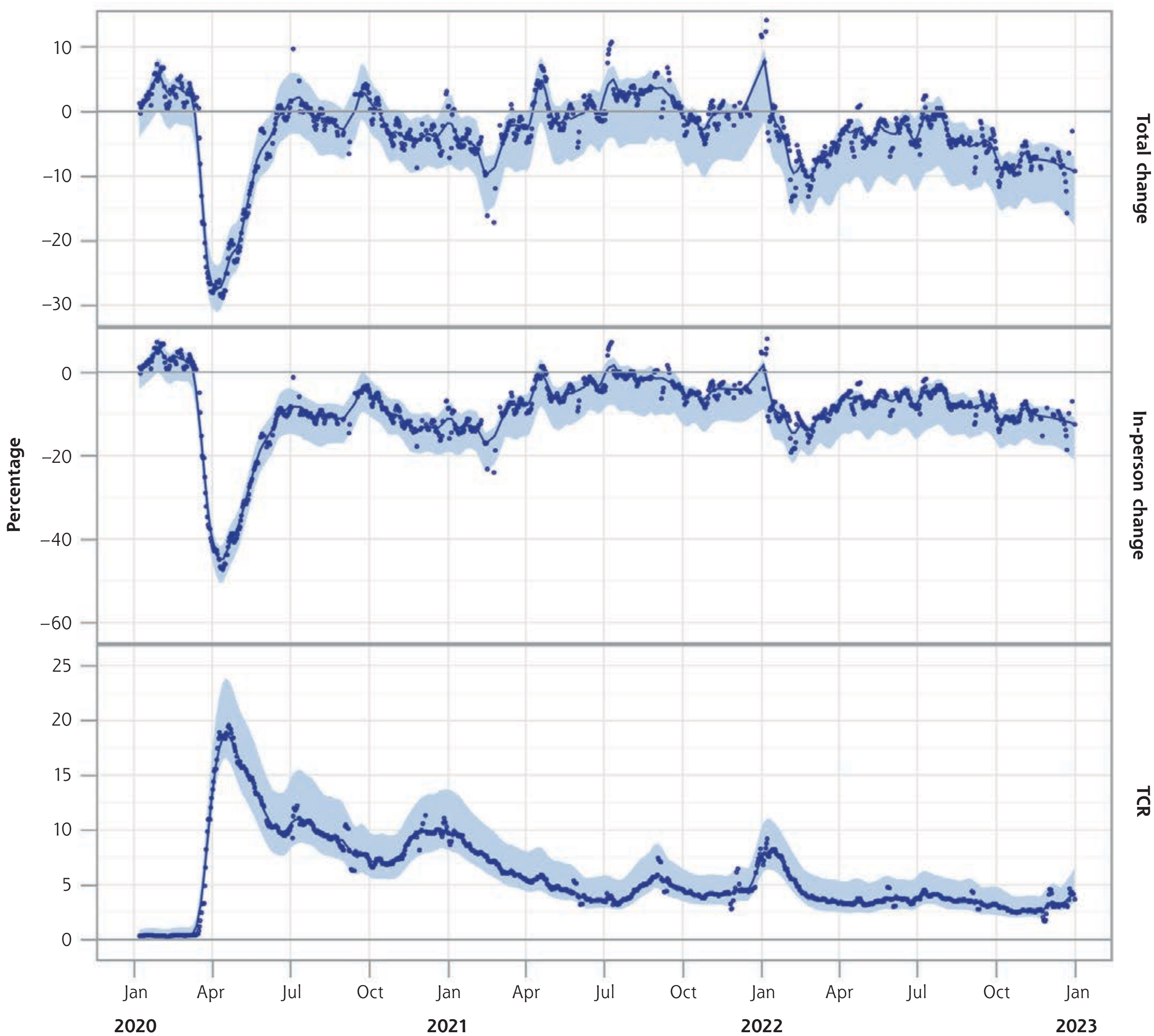
Our assessment of how visit volume and TCR varied throughout the pandemic used our longitudinal sample, which had 1,630,883 patients with 13,925,591 visits from 318 practices and 1,303 clinicians (Figure 2). This sample had more visits than our primary sample, owing to the 24 additional months of data, but fewer practices and clinicians because fewer met the inclusion criteria over that extended timespan. Total primary care visits reached a nadir in April 2020, down 29% relative to the same point in 2019. Telehealth visits peaked the following week, with a TCR of 20%. Other fluctuations corresponded to national increases in COVID-19 cases. We identified increases in TCR around the beginning of the third wave in December 2020, and we identified the effect of the Omicron wave in early 2022, with decreases in visit volume and a corresponding uptick in TCR. Neither overall visit volume nor telehealth utilization returned to prepandemic levels on a consistent basis before the end of our longitudinal study period in December 2022.

DISCUSSION

In the present study using a geographically diverse research data set, we quantified primary care disruptions and telehealth utilization during the COVID-19 pandemic and explored how certain groups of patients were disproportionately affected. In-person visits in our sample decreased 17% during the first year of the pandemic relative to the previous 12 months. Though this steep decrease was partially offset by a rapid shift to telehealth, it is hard to understate the potential effect of this decrease on patients and practices alike. Patients with chronic care needs might be faced with more long-term complications, owing to missed care during the pandemic,[25] whereas others might experience increases in cancer rates and mortality as a result of missed screenings.[26,27] Clinicians and practice staff dealt with increased levels of anxiety and stress,[28] and practices were faced with large decreases in revenue, with small and independent practices being especially hard hit.[29]

The TCR allows us to quantify both the volume of primary care that was delivered via telehealth as well as the potential mitigating effect on the decrease in overall visit volume. Though telehealth visits are not a perfect substitute for in-person visits,[15,30,31] they proved to be a crucial means of maintaining access to primary care during the pandemic. The 10% of prepandemic visit volume that was converted to telehealth during the pandemic represents a substantial proportion of care, which patients might have otherwise gone without were it not for the availability of telehealth. Whereas early evidence suggests the quality of telehealth visits might

Figure 2. Trends in 7-day moving average of visit volume changes and TCR.



TCR = telehealth conversion ratio.

be comparable in many areas to in-person visits,[31-33] it is also important to note that any potential gap in quality could disproportionately affect those with higher utilization of telehealth.

Some groups of patients had significantly greater decreases in visit volume and greater telehealth use than others. Pediatric visits decreased by 24%, by far the largest decrease observed in our analysis. Decreases in well-child visits have been linked to lower vaccination rates and increases in mental health crises,[34] though it is unclear whether well-child visits were affected as much as other types of pediatric care. The greater decrease among patients with more comorbidities is especially concerning, given the complex care needs and greater mortality risk for those patients. The significantly lower TCR in rural areas suggests potential barriers for telehealth use, such as limited broadband access, for patients in those areas.[35]

We observed less of a decrease in visit volume among Black or African American patients during the pandemic compared with White and Asian patients. Interestingly, Hispanic patients experienced a significantly greater decrease in in-person visit volume and simultaneous increase in telehealth use (significantly greater TCR) than non-Hispanic patients, with no significant difference in total visit volume. This suggests that telehealth availability might have helped to mitigate what would have otherwise been a significant equity gap. Another possibility is that patients in need of language translation services might have had an easier time accessing those services using telehealth. Whereas our analysis did not generate evidence of racial or ethnic disparities in access to primary care worsening during the pandemic, those disparities still might have been exacerbated directly and indirectly by several factors including, for example, the disproportionately greater prevalence and effect of chronic conditions for racial and ethnic minority individuals.[36-38]

We observed a large amount of variation in visit volume changes and telehealth usage between practices. Whereas some practices had a visit volume decrease of more than one-half, others experienced an increase in total volume. Similarly, we observed many practices with little to no utilization of telehealth during the pandemic, yet it was used for the majority of visits for some practices. Potential reasons for practices not adopting telehealth might involve technological or other obstacles that hindered the transition, or it is possible that these practices did not recognize the value of offering telehealth services for their patients. Further research is needed to explore the varying effects of the pandemic on different practices, as well as to gain insights into how practices adapted differently to the rapidly changing health care landscape.

There was significant week-to-week variation in visit volume and telehealth usage throughout the pandemic. Some of this variation might have been driven by the number of COVID-19 cases in each community—which can be seen with the fluctuations aligning with the timing of surges in cases—as well as local policies and guidelines. Whereas telehealth helped maintain access to primary care during the pandemic, total visit volume had yet to consistently return to prepandemic levels by December 2022.

The present study has a few limitations. Whereas the American Family Cohort data set contains data from a geographically diverse set of practices, these might not be representative of all primary care practices. In addition, the large variation in telehealth utilization and visit volume changes between practices adds to our uncertainty, contributing to the relatively broader CIs we observed. We also cannot rule out the possibility that some practices might have used incorrect billing codes for telehealth, resulting in a potential undercount of telehealth utilization. The absence of race or ethnicity values for 14% and 17% of patients, respectively, might have affected differences in utilization in a nonrandom fashion. This, combined with the need to collapse some racial categories into a singular "other" category limited our ability to detect more nuanced associations with race and ethnicity. Finally, this study was designed to describe the direct impact to patients of decreases in access to care; it was not intended to draw causal inferences.

CONCLUSION

Total primary care visit volume decreased and was partially offset by an increase in telehealth utilization for all groups of patients during the COVID-19 pandemic, but the magnitude of these changes varied significantly across all patient characteristics. The greatest decreases in overall visit volume were observed among pediatric patients, those with more comorbidities, and Asian patients, in contrast to patients aged 18 to 64 years and Black or African American patients, who had the smallest decreases. Telehealth utilization was greater among Hispanic than non-Hispanic patients and greater for those living in an urban area than for rurally located patients. These variations have implications not only for the long-term consequences of the COVID-19 pandemic, but also for planners seeking to ready the primary care delivery system for any future systematic disruptions and to mitigate any potential exacerbation of existing disparities.

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Key words: COVID-19; access to primary care; telemedicine; primary health care

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Supplemental materials

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