Social Determinants of Pediatric Primary Care Telehealth and In-Office Visits During the Severe Acute Respiratory Syndrome Coronavirus 2 Pandemic

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Abstract

Objective: To describe the use of primary care telehealth following the rapid reduction of in-person pediatric primary care availability during the severe acute respiratory syndrome coronavirus 2 pandemic and how this varied by community-level social determinants and individual-level social needs.

Methods: We conducted a retrospective cohort study of children 0 to 17 years across 16 sites within Nationwide Children's Hospital Primary Care Network from March 22 to July 31, 2020, and a preceding comparator period (2019). The study population includes 107,629 patient encounters. We compared visit type (in-person vs telehealth), demographics, presence of individual social needs, and community social determinants using the Child Opportunity Index 2.0 (COI). To assess telehealth utilization, we compared the ratio of 2019 to 2020 primary care visits across levels of COI. We trained a linear regression model predicting the number of telehealth encounters in 2020 using individual patient characteristics and COI.

Results: Patients in census tracts with high and very high levels of opportunity maintained the highest relative encounter volume (2020:2019) at the beginning of the pandemic (0.78 and 0.73, respectively, compared to 65% for children living in very low opportunity neighborhoods; $P < 0.001$). Patients with caregiver-reported social needs (housing, transportation, utilities, food) had relatively greater telehealth use following the start of the public health emergency.

Conclusions: Volume of primary care visits decreased least for high and very high-opportunity neighborhoods yet individual social needs were associated with higher relative use of telemedicine. Findings suggest that telehealth was an important modality to deliver care to children with social needs but does not overcome community-level barriers.

Keywords: primary care; severe acute respiratory syndrome coronavirus 2; social determinants of health; telehealth

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What's New

Non-Hispanic White children, primarily English-speaking, those in census tracts with higher opportunity, and patients with identified social needs through prior screening had greater utilization of telehealth services and in-person office visits.

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) global pandemic was declared on March 11, 2020 by the World Health Organization.[1] The SARS-CoV-2 pandemic brought about rapid adoption of telehealth, the use of technology to deliver health care remotely, to preserve access to medical services amid sweeping public health efforts in the United States to curb disease transmission.[2–4] While telehealth services offered a viable alternative to in-person office visits following social distancing-based reductions in access to elective primary care, they could not fully replace in-person encounters. It also may have led to inequitable access for patients with low resources, technology availability, or rural broadband access.[5,6] These factors fall into the broad concepts of social determinants of health (SDH) (at the community level) and health-related social needs (at the individual level).

Current literature on the relationship between SDH and the adoption of pediatric telehealth services during the SARS-CoV-2 pandemic in the United States has largely

focused on pediatric subspecialty care.[7–11] Pediatric primary care focusing on annual wellness visits and immunizations is less amenable to telehealth than some subspecialty care. However, telehealth services may be appropriate for certain visit types, including simple acute visits with visual exam findings and chronic disease follow-up. As telehealth practice standards are evolving, an improved understanding of the best-suited visit types, patterns of use, and measures of equitable access is needed. The aims of this study are to describe trajectories in the use of telehealth following the rapid adoption of telehealth services within a pediatric primary care network during the SARS-CoV-2 pandemic and to determine how those trajectories varied by race and ethnicity, community-level SDH, primary language spoken, and individual-level social needs. We also explore overall primary care use and the degree to which telehealth was able to support the maintenance of visit volume.

METHODS

STUDY DESIGN AND PROCEDURE

We conducted a retrospective cohort study using data from the Nationwide Children's Hospital Primary Care Network in Columbus, OH. This multisite network, including 16 primary care locations, serves primarily publicly insured patients (83%) in the Columbus metropolitan area. We included all patient encounters for children 0 to 17 years old from March 22 to July 31, 2020, and the preceding comparator year period from March 22 to July 31, 2019. When studying neighborhood-level opportunity (described below), this population was reduced to 93% of patients whose home address was successfully geocoded (ArcMap 10.8.1, Esri, Redlands, Calif) in order to assign patients to census tracts for use of the Child Opportunity Index 2.0 (COI).[12] We compared encounter volumes by demographic groups from March 22 to July 31, 2019 to the same dates in 2020. From March 22 to July 31, 2020, we also compare the proportion of primary care encounters conducted via telehealth among various demographic slices to compare telehealth adoption rates by group. This study was approved by the Institutional Review Board at Nationwide Children's Hospital.

TELEHEALTH ROLLOUT

In March 2020, telehealth was efficiently rolled out to primary care to maintain access during the pandemic. All sites of primary care pivoted to offering telehealth visits for amenable conditions, especially sick visits and chronic disease management, with interpretive services available. Office visits continued to be offered, with an emphasis on maintaining well visits and vaccinations for infants and young children. When choosing telehealth, families were offered instructions through a webpage, which was translated into our 7 most common languages. If patients needed additional support, technical assistance through our IT service desk was offered. Telehealth was delivered via patient portal and integration with Zoom, and patients could use a tablet, smartphone, or computer if it was connected to the internet and had audio/video capabilities.

DEMOGRAPHIC INFORMATION

Demographic characteristics for each patient encounter included age, sex, self-reported race, primary language, and ethnicity (non-Hispanic White, non-Hispanic Black or African American, Hispanic or Latino, Multiple Races, Asian, or other), encounter type (in-person vs telehealth), and payor (public, private, or other). Telehealth visits type included both telephone and video visits. Race is used as a proxy measure for racism and racialized barriers to health and health care. The presence of individual social needs was determined based on the patient's most recent social needs screening responses. The social needs screening tool is administered to patients annually, at their first in-person well-child visit in each 12-month period, assessing housing, food, utility, and transportation needs. Social needs screenings were not conducted via telemedicine. Each patient's need was dichotomized to "Need" or "No need." Screening data were included in our study if completed at any time in 2019 or 2020. Patients without social needs screening data were included in all bivariate and multivariable analyses not pertaining to social needs to maximize our sample size for these analyses and prevent limiting our study to patients with an in-office social needs screening.

Community (census tract-level) SDH were represented using the COI, which includes 29 indicators across 3 domains of neighborhood characteristics that impact children's healthy development: education, health and environment, and social and economic opportunities.[12] Child opportunity categories are created by ranking all US census tracts by overall score and dividing them into equally sized quintiles by population: very low, low, moderate, high, and very high. The lower opportunity index reflects the lower availability of health-enhancing resources in the community.

STATISTICAL ANALYSIS

To assess changes in primary care visit volume, overall and by community-level SDH, we calculated the ratio of 2019 to 2020 visit volume. A ratio of one reflects an equal number of primary care encounters in the 2 years. A ratio below one would reflect lower use in 2020 in the context of SARS-CoV-2. We used Pearson's chi-square test when comparing proportions (eg, proportion of telehealth encounters), tests for equality of proportions without continuity correction were used to compare annual encounter volume ratios between COI groups, and exact Poisson test to test for a significant change in encounter volume from 2019 to 2020. For multivariable analysis of telehealth use, we trained a linear regression model with the number of telemedicine visits during the 2020 study months as the dependent variable, with caregiver-reported race, ethnicity, age, gender, primary language spoken (English vs all others), insurance type, presence of any identified social needs, and COI as independent variables. Patients' demographics, insurance type,

COI classification, and social needs at the time of their last visit in the study period were used for regression modeling to retain a single observation per child, though these could have technically changed in the 2020 study months. All comparisons were 2-sided and *P*-values less than 0.05 were considered statistically significant.

All data analyses were conducted using R (v. 3.6.0, R Core Team, 2019), RStudio Server (RStudio PBC, 2021), and the *tidyverse* family of libraries.[13]

RESULTS

Sample characteristics and demographic data are presented in Table 1. The total study population includes 107,629 patient encounters among 57,551 patients during the study months. Social needs questionnaires were completed for 48,679 (85%) patients within this population since 2019.

VISIT VOLUME

Total visit volumes in the comparison periods of March to July decreased from 64,198 in 2019 to 43,431 in 2020 (ratio 0.68, $P < 0.001$; Figs. 1 and 2). Census tracts with high and very high levels of opportunity maintained the highest relative encounter volume from 2019 to 2020 (2020:2019 ratio: 0.78 and 0.73, respectively). This was followed by areas of moderate (0.72), low (0.69), and very low (0.65) child opportunity, in descending order (Table 2; *P*-value testing for equality of all proportions < 0.001). Stratifying by race and COI, we observed our non-Hispanic White patient population maintained a higher relative encounter volume than non-Hispanic Black and Asian patients across each COI group (Fig. 2; *P*-value testing for equality of all proportions < 0.001).

TELEHEALTH UTILIZATION

Primary care encounters among non-Hispanic White patients were significantly more likely to be held as telehealth visits in the early months of the SARS-COV-2 pandemic than among other populations (38% of encounters in April 2020, $P < 0.001$ for all pairwise comparisons between White patients and other races; Fig. 3A), followed by patients of multiple races (30%), non-Hispanic Black (25%), and Hispanic or Latino patients (22%). Each group showed growth from March to April, declines between April and June, followed by leveling. Telehealth visits made up just 9% of Asian

Table 1. Patient and Encounter Characteristics

	March 22–July 31, 2019	March 22–July 31, 2020 Overall	March 22–July 31, 2020 Office Visits	March 22–July 31, 2020 Telehealth
Encounter volume, N (%)	64,198	43,431	36,786 (85)	6645 (15)
Unique patients, N	42,433	29,138	25,858	4641
Age in years, median (range)	3.9 (0–17.9)	3.0 (0–17.9)	1.8 (0–17.9)	10.6 (0–17.9)
Gender, N (%)				
Female	20,823 (49)	14,166 (49)	12,918 (50)	1856 (40)
Male	21,609 (51)	14,971 (51)	12,939 (50)	2785 (60)
Unknown	1 (0)	1 (0)	1 (0)	0 (0)
Race, N (%)				
Black or African American	22,256 (52)	14,720 (51)	13,034 (50)	2270 (49)
White	8961 (21)	6541 (22)	5566 (22)	1422 (31)
Multiple races	3329 (8)	2390 (8)	2062 (8)	453 (10)
Asian	2820 (7)	2067 (7)	1991 (8)	127 (3)
Native Hawaiian or Other Pacific Islander	85 (0)	41 (0)	38 (0)	- (0)
American Indian or Alaska Native	37 (0)	30 (0)	30 (0)	- (0)
Unknown	4945 (12)	3349 (11)	3137 (12)	365 (8)
Ethnicity, N (%)				
Hispanic or Latino	(16)	4630 (16)	4317 (17)	528 (11)
Preferred language, N (%)				
English	27,744 (65)	19,603 (67)	16,819 (65)	3850 (83)
Spanish	5791 (14)	3742 (13)	3514 (14)	402 (9)
Somali	3745 (9)	2228 (8)	2093 (8)	182 (4)
Nepali	1900 (4)	1393 (5)	1350 (5)	71 (2)
Arabic	673 (2)	469 (2)	441 (2)	41 (1)
Other	2580 (6)	1703 (6)	1641 (6)	95 (2)
Insurance type, N (encounter-level, %)				
Public	53,030 (83)	34,925 (80)	29,582 (80)	5343 (80)
Commercial	7051 (11)	5359 (12)	4346 (12)	1013 (15)
None or missing	4117 (6)	3147 (7)	2858 (8)	289 (4)
Child Opportunity Index 2.0 (%)				
Very high	3218 (8)	2416 (8)	2156 (8)	374 (8)
High	3548 (8)	2805 (10)	2501 (10)	447 (10)
Moderate	4945 (12)	3531 (12)	3137 (12)	557 (12)
Low	8243 (19)	5914 (20)	5282 (20)	883 (19)
Very low	20,927 (49)	14,037 (48)	12,396 (48)	2261 (49)
Missing	1552 (4)	435 (1)	386 (1)	119 (3)

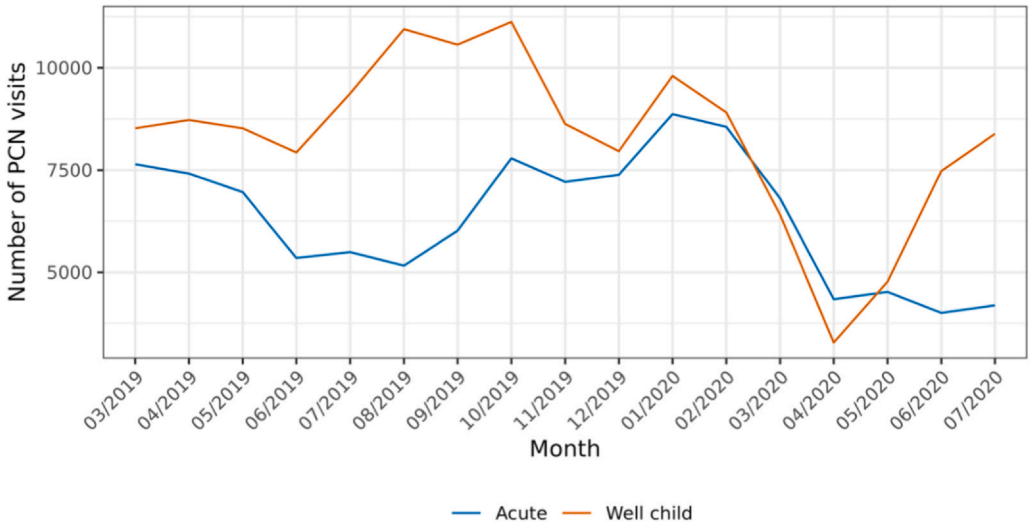

Figure 1. *Primary care network visit volume. At the onset of the pandemic in March 2020, well-child visits were drastically reduced for patient safety. Because of their importance in patient care, well-child visit volume rebounded in later months, while the number of acute care visits in our primary care network remained low through July 2020.*

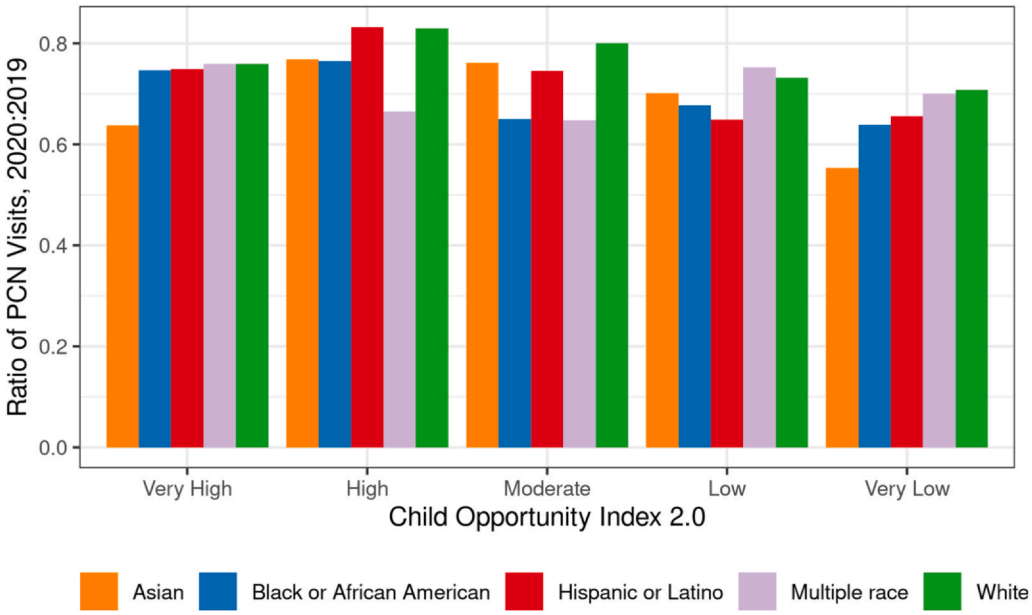

Figure 2. *Ratio of primary care network visits 2020:2019 by race and Child Opportunity Index 2.0. Ratio of 2020:2019 total primary care network visit volume from, where a ratio of one equates to equal or sustained visit volumes and a ratio less than one represents fewer total visits in 2020 study months than comparative months in 2019. Patients are stratified by race and the patients' neighborhood-level Child Opportunity Index 2.0 to demonstrate the intersectionality between race and neighborhood-level opportunity. PCN, primary care*

patient encounters in April, and this rate remained largely flat across the studied period. Differences in telemedicine utilization by race and ethnicity were further supported in multivariable analysis, with White children having not only a higher ratio of telemedicine visits (as demonstrated in bivariate analyses) but also a significantly higher number of total telehealth visits compared to Asian, Black or African American, and Native Hawaiian or Other Pacific Islander children and non-Hispanic children also being significantly more likely to have more telehealth visits than Hispanic children (Table 3).

We observed a significant difference in the proportion of primary care visits conducted as telehealth by language, with primarily English-speaking patient adopting telehealth at significantly higher rates than other groups from April to July 2020 ($P < 0.05$ for all pairwise comparisons between English and other languages; Fig. 3B).

Table 2. Relative Encounter Volume (2019 vs 2020) by Child Opportunity Index 2.0

COI 2.0	March 22–July 31, 2019	March 22–July 31, 2020	2020:2019
Very high	4825	3598	0.75
High	5084	4115	0.81
Moderate	7582	5077	0.67
Low	12,271	8654	0.71
Very low	31,073	20,383	0.66

COI indicates Child Opportunity Index 2.0.

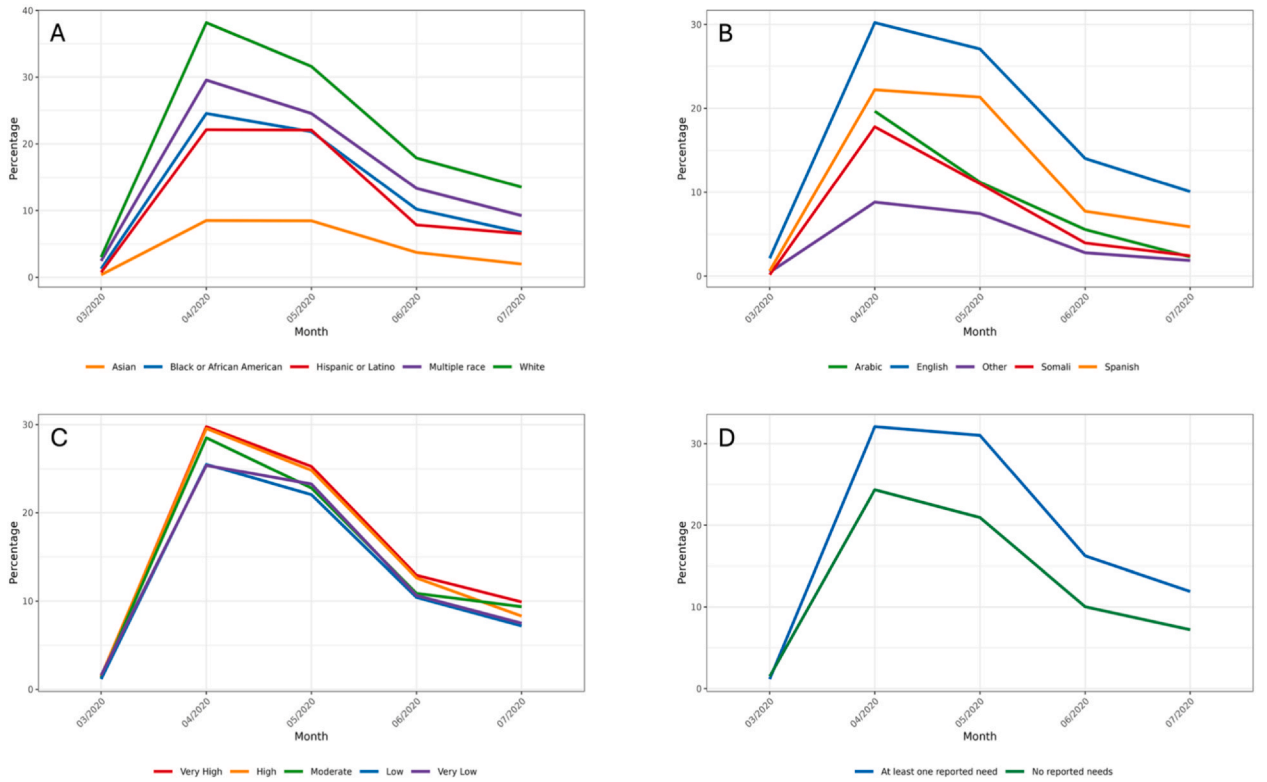

Figure 3. *Percentage of telehealth visits among all primary care visits. Percentage of telehealth visits among all primary care visits by patients' race (A), preferred language (B), neighborhood-level Child Opportunity Index 2.0 (C), and presence of reported social needs (D).*

Table 3. Multivariable Analysis Investigating Patient Factors Associated With Increased Telehealth Utilization

	Coefficient	*P* value
Gender male (ref.=Female)	0.070	< 0.001
Race (ref.=White)		
American Indian or Alaska Native	−0.214	0.157
Asian	−0.122	< 0.001
Black or African American	−0.101	< 0.001
Multiple race	−0.034	0.083
Native Hawaiian or Other Pacific Islander	−0.354	0.004
Unknown	0.022	0.382
Ethnicity (ref=Not Hispanic or Latino)		
Hispanic or Latino	−0.067	0.004
Unknown	−0.051	0.327
Language (English vs non-English)	0.137	< 0.001
Age (years)	0.035	< 0.001
Child Opportunity Index (ref=very high)		
High	0.012	0.588
Moderate	−0.010	0.650
Low	−0.021	0.297
Very low	−0.034	0.064
Any social need (ref=no identified needs)	0.060	< 0.001
Insurance (ref=public)		
Private	−0.057	< 0.001
Intercept	−0.008	0.721

Spanish-speaking patients had the second highest telehealth appointment rates, followed by Somali and Arabic-speaking patients, who had similar rates. Once again, this was supported by multivariable analysis, with patients who primarily speak English being significantly more likely than non-English speakers to have more telemedicine appointments.

In April of 2020, patients in very high COI areas were significantly more likely to utilize telehealth (as a percentage of all primary care encounters) than patients in very low COI areas (30% vs 25%, $P = 0.02$; Fig. 3C). From May 2020 onward, during our study period, group rates between very high and very low had similar telehealth encounter rates ($P > 0.05$ across each monthly comparison). This leveling was supported by multivariable analysis: When controlling for individual-level patient demographics, the neighborhood-level opportunity was not observed to be a significant predictor of the number of patients' total telehealth visits in 2020 (Table 3).

Conversely, greater telehealth use as both the proportion of all primary care encounters and as total visit count could be seen in those with self-reported social needs across the study months ($P < 0.001$, Fig. 3D and Table 3). This trend was also observed among specific self-reported needs, including housing, transportation, utilities, and food (data not presented). Additional patient factors associated with increased telehealth visits included being male, non-Hispanic, or Latino, having public insurance (compared to private), and older patients (Table 3). Controlling for individual-level patient demographic factors, the neighborhood-level COI was not a significant predictor of telehealth encounter volume.

DISCUSSION

Overall pediatric primary care patient encounters within the studied primary care network substantially declined at the onset of the SARS-CoV-2 pandemic. Utilization of telehealth services was unable to fully replace encounter volumes for in-person office visits in the early months of the pandemic, but well-child visits nearly returned to prepandemic levels by July 2020. The degree of decline in overall pediatric primary care visits during the SARS-CoV-2 pandemic is likely multifactorial and consistent with prior studies.[14–17] The primary care network reduced office visit capacity to emphasize safety and families experienced many barriers to accessing care. Our data demonstrate that higher community-level social opportunity and non-Hispanic White race were associated significantly with a lower reduction in primary care utilization at the onset of the pandemic surge (comparing 2020 visit volumes to 2019). However, we did not observe an effect of neighborhood opportunity on telehealth-specific utilization (as total telehealth visits) after controlling for individual-level patient demographics.

One of the most important aspects of pediatric primary care visits includes developmental, educational, and social screening.[18] Interestingly, self-reported social needs, including food insecurity, housing instability, utility and transportation needs, were associated with greater uptake of telehealth. This study continues to expand the knowledge of the impact of the pandemic onset on pediatric primary care visits and, to our knowledge, is one of the earliest to evaluate the impact of SDH on the utilization of primary care telehealth services.[19] This was further supported by multivariable analyses, which found White race and non-Hispanic ethnicity to be significant predictors of increased telehealth visit volume in 2020, controlling for other patient demographic factors. We hypothesize that youth on Medicaid or those with caregiver-reported health-related social needs may have either had fewer alternatives to telehealth to receive health care or that telehealth was a preferred option to receive health care because it circumvented other barriers to care, including transportation or childcare.

With rapid adoption, there are risks of patients falling through the cracks and finding it difficult to access needed preventive services.[14] Our study found that primarily English-speaking patients had greater telehealth utilization than patients whose primary language was not English. This finding aligns with current literature showing differences in accessing telehealth services due to financial strain, transportation, and language barriers.[20,21] Language is one of the most challenges to overcome in the telehealth space and has been a longstanding telehealth concern.[21] The top 3 non-English languages utilized within our primary care network include Spanish, Somali, and Arabic, and all had poor utilization of telehealth services during the onset of the pandemic. Interpreter services were available to support non-English-speaking patients with telehealth visits. However, many of the initial steps needed to sign onto the video platform remained in English, likely creating an added barrier for these patients.

Our study also found significant differences in primary care telehealth use by race and ethnicity. Consistent with prior literature, non-Hispanic White populations had greater use of telehealth services at the start of the pandemic compared to non-Hispanic Black and Hispanic or Latino populations.[14,19,22] Asian populations had the lowest relative utilization of telehealth services compared to other groups. Consistent with prior studies, Asian populations had lower health care-seeking patterns compared to other groups for both primary care services and emergency medical services.[23] The precipitous drop-off of patients within this population prompts the exploration of culturally-appropriate outreach to reduce the opportunity for gaps in care.

It is important to underscore that primary care telehealth functions best when complementing, not replacing, office-based care. Office-based visits remain the best practice for many visits, including those emphasizing growth parameters, immunizations, and seeking diagnostic or screening procedures. However, telehealth added important access during the elective health care "shutdown," and among other services, addressed perceived risk of contracting SARS-COV-2.[24] The rapid adoption of telehealth services in primary care for many practices enabled safe quality care to be delivered for telehealth appropriate conditions during ever-changing pandemic conditions.[3]

The findings of our study must be interpreted within the context of its limitations. Limitations include retrospective design, single network study, and limited telehealth capabilities prior to the onset of the SARS-CoV-2 pandemic. The social needs screening responses completed in 2019 or 2020 may not have been completely representative of the short-term needs of families as a result of the COVID-19 pandemic, which threatens the internal validity of our findings. Analyses requiring successful geocoding results required the exclusion of vulnerable patients experiencing homelessness or wards of the state. Further, the COI was developed using population data from 2015, and it is not known how opportunity may have shifted from 2015 to 2020. Also related to opportunity and health equity, our analysis of the ratio of visits from 2019 to 2020 studied differential shifts in health care utilization but, by its nature, does not account for existing disparities. This analysis, therefore, more accurately asked whether existing disparities were improved or worsened at the onset of the SARS-CoV-2 pandemic. Our findings assessing social needs were limited only to those patients with an office visit who completed the social needs questionnaire. Many of our most vulnerable patients may have either declined to answer these questions or not accessed care at all, thus excluding them from our sample. Although we recognize the database limitations, we chose to evaluate this process as many primary care networks across the globe had to make quick and decisive efforts to provide care to patients in its many forms.

CONCLUSION

Pediatric primary care networks saw a dramatic decline in patient encounters during the onset of the SARS-CoV-2 pandemic. Although visits declined across a broad population, non-Hispanic White children and primarily English-speaking had greater utilization of telehealth services and in-person office visits. As primary care networks plan to provide equitable care to children during future pandemics, there must be strong consideration for language equity and individual social needs. Equitable access to care includes optimizing telehealth. System improvements should include enhanced technical support to address low digital literacy and culturally competent interpreter services. When gaps in care exist, outreach should consider telehealth when clinically appropriate to support families with social needs and transportation issues. Additional studies will inform best practices as our community develops strategies to enhance access to care, combining office-based care with telehealth.

DECLARATION OF COMPETING INTEREST

The other authors have no conflicts of interest to disclose.

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