

**ORIGINAL RESEARCH**

# Associations between Patient- and Provider Level Factors, and Telemedicine Use in Family Medicine Clinics

Omolola E. Adepoju, PhD, MPH, Luan Tran, Rosemary Agwuncha, Minji Chae, MS, Jason Franco-Castano, MS, Tracy Angelocci, MD, and Winston Liaw, MD, MPH

**Introduction:** Increased telemedicine implementation may promote primary care access. However, gaps in telemedicine uptake may perpetuate existing disparities in primary care access. This study assessed provider- and patient-level factors associated with telemedicine use in community-based family practice clinics.

**Methods:** This retrospective study used electronic medical records data from a large Federally Qualified Health Center. A 3-level mixed-effects logistic regression model explored predictors of telemedicine use, with provider and patient as random effects.

**Results:** The analytic sample included 37,428 unique patients with 106,567 primary care encounters with 42 family medicine providers. Fifty-seven percent of the sample identified as Hispanic, 28% non-Hispanic White, and 11% non-Hispanic Black. Compared to Hispanics, non-Hispanic White patients had 61% higher odds of a telemedicine visit, and non-Hispanic Black patients had 32% higher odds of a telemedicine visit. The odds of telemedicine use were lower for those who were uninsured. Those residing in metropolitan areas or medically underserved areas had greater odds of a telemedicine appointment. Commute time exhibited a dose-response relationship with telemedicine use. Provider characteristics were not significantly associated with telemedicine use.

**Discussion:** While provider characteristics were not associated with telemedicine use, greater focus on patient characteristics specific to the population served is necessary. (J Am Board Fam Med 2022;35:457–464.)

**Keywords:** Electronic Health Records, Family Medicine, Health Services Accessibility, Logistic Models, Medically Underserved Area, Medically Uninsured, Primary Health Care, Retrospective Studies, Telemedicine

## Introduction

The COVID-19 pandemic highlighted longstanding disparities in access. Similar to the broader US workforce, the health care system transitioned from in-person physician-patient interactions to virtual ones. A major catalyst in this expansion of

telemedicine was stay-at-home orders and fear of contracting COVID-19 during in-person visits.<sup>1</sup> Telemedicine refers to a multitude of methods used to deliver care at a distance: synchronous telemedicine methods, such as visits via telephone, virtual chats, and real-time video visits; asynchronous telemedicine methods, such as electronic consults between clinicians; and many other virtual activities, though two-way video is considered the dominant form of telemedicine administration.<sup>2</sup> This change in delivery of care especially affected the continuity of care for persons with chronic illnesses, as well as health care organizations, where declines in visits have threatened financial viability. However, despite the fact that limited insurance coverage of telemedicine services contributed to the low adoption in prior years, as time progressed, waivers in Medicare policies and the enactment of certain CARES Act policies in 2020 have created greater

This article was externally peer reviewed.  
Submitted 20 October 2021; revised 18 November 2021; accepted 19 November 2021.

From University of Houston College of Medicine, Houston, TX (OA, LT, RA, WL); Humana Integrated Health System Sciences Institute at the University of Houston, Houston, TX (OA, MC, JFC); Lone Star Circle of Care, Georgetown, TX (TA).

**Funding:** This study was unfunded.

**Conflict of interest:** The authors have no conflicts of interest.

**Corresponding author:** Omolola E. Adepoju, PhD, MPH, Department of Health Systems and Population Health Sciences, University of Houston College of Medicine, Houston, TX 77004, (E-mail: oadepoju@uh.edu).

access and stability by prompting increased coverage and flexibility in reimbursement for telehealth visits provided for beneficiaries.<sup>3,4</sup> State insurance programs, such as Medicaid, and other commercial insurers followed suit, allowing most clinics to bill Medicare, Medicaid, and private insurers for telemedicine services. Despite this transition, telemedicine availability is still policy dependent; some plans limit the type of services provided, whereas others limit the network of providers allowed to offer such services.<sup>5</sup>

Primary care providers, such as family physicians, have long served as an entry point into the health care system, coordinating care and providing continuity of care that lowers overall health care costs for the patient and the system.<sup>6,7</sup> Patients value the role of a family physician as a point of first contact and prefer to initially seek care from them.<sup>8</sup> Though the need for more family physicians has been continuously touted in literature, estimates by the American Academy of Family Physicians projected a 2020 shortage of 149,000 family physicians nationwide.<sup>9,10</sup> These shortages are particularly pronounced in rural areas, medically underserved areas (MUAs), and health professional shortage areas (HPSAs).<sup>11</sup> In addition, access to primary care in Texas is particularly poor, as the state ranks 47th in the nation for its primary care physician-to-population ratio.<sup>12</sup> Federally Qualified Health Centers (FQHCs) are a particularly important source of access and, compared with other primary care clinics, demonstrate higher rates of new patient appointments and lower costs regardless of insurance status.<sup>13,14</sup> However, the majority of FQHC expansions in the past decades have been near urban areas, indicating geographic access to care remains a crucial concern in primary care delivery.<sup>13,14</sup>

In light of the COVID-19 pandemic, there has been an immense surge in telemedicine use by about 154% from March 2019 to March 2020.<sup>1</sup> A 2020 survey revealed that approximately 4.5 million Texas residents began using telemedicine services after the onset of the COVID-19 pandemic.<sup>15</sup> Reasons for the increase include the ease of access<sup>16</sup> as well as additional flexibility for providers and patients,<sup>17</sup> and from the clinic perspective, the convenience of telemedicine offers the potential to reduce the rates of appointment no-shows.<sup>18</sup> For example, patients could access care even when outpatient offices had limited hours,

which proved valuable for patients reluctant to seek in-person care because of COVID-19, those who had difficulty seeking care due to the pandemic, or high-risk patients with chronic diseases who were taking measures to avoid contracting COVID-19.<sup>1</sup>

While several studies have focused on telemedicine use across different physician specialties, few have focused on primary care providers and the adoption of telemedicine. For example, Gomez and colleagues conducted a qualitative assessment of primary care physicians' perspective of telemedicine and reported improved patient access to care through its convenience, increased time with patients, and ability to evaluate patients' home environments. They, however noted concerns including a lack of physical touch (and with it, challenges to physical examinations), which may inadvertently affect the closeness of physician-patient relationships.<sup>19</sup> Sinsky, on the other hand, suggested that telemedicine may prioritize and even enhance relationships between primary care physicians and their patients, and having remote visits may allow providers to be more attentive.<sup>20</sup> In this study, we assess provider- and patient-level factors associated with telemedicine use in a large FQHC in Texas. Considering this recent increase in uptake of telemedicine services, studies of this nature are important because gaps in telemedicine adoption may perpetuate existing disparities in primary care access.

## Methods

### *Study Design and Data*

This is a retrospective cohort study to assess provider- and patient-level factors associated with telemedicine use in community-based family practice clinics. Data were compiled from electronic medical records at 36 family practice clinic locations within a large FQHC serving rural and urban areas across Texas. In 2020, the FQHC served 95,000 unduplicated patients across the following service lines: family practice, pediatrics, dentistry, geriatrics, behavioral health, and obstetrics and gynecology. Appointment-level data on all patients spanned an 11-month period (from January 1, 2020 to November 30, 2020), including the patterns of telemedicine use before and during the COVID-19 pandemic. Deidentified data included demographic information as well as encounter-level information for family practice patients.

### **Measurement**

The outcome of interest was telemedicine use [no (0), yes (1)]. Telemedicine was defined as an audiovisual consultation that was started and finalized via a telemedicine platform that the FQHC contracted with. The independent variables of interest included patient sociodemographic variables (eg, age, race/ethnicity, sex, insurance coverage type), patient geographic classifications (eg, metropolitan/nonmetropolitan status, residence in a MUA as defined by the Health Resources & Services Administration (HRSA), and commute time to clinic (calculated using “traveltime3” program in Stata, which accesses the Google Maps application programming interface, to calculate driving distance in miles between patients’ zip codes and facility zip codes, and represents the average time it takes to travel from patient’s address to the clinic). Other independent variables included provider characteristics, for example, provider type (MD vs non-MD), provider language (English only vs English and Spanish), and years in practice (0 to 5 years vs 6 to 10 years vs 11 to 20 years vs 20+ years).

### **Analysis**

Descriptive analyses employing frequencies and proportions were used to describe patient demographic characteristics and provider characteristics as well as appointment type (in-person vs telemedicine) patterns over time. Because the unit of analysis for our multivariate model was telemedicine use, a mixed-effects logistic regression model was employed to explore the relationship between telemedicine and predictor variables, adjusting for provider- and patient-level differences in telemedicine use. This analysis method allowed the investigators to account for repeated appointments within each patient and within each family practice provider. Provider project-assigned identification numbers and patient project-assigned identification numbers were included in the model as separate random effects. The fixed effects included all aforementioned independent variables. This study was approved by an independent institutional review board in October 2020. All data management and analyses were performed using Stata 16. All findings were considered statistically significant at  $P < .05$ .

## **Results**

### **Patient Characteristics**

Overall, the sample represented a total of 106,567 family practice encounters for 37,428 unique patients from January 1, 2020 to November 30, 2020 (Table 1). The majority of patients were female (67%), 57% of the sample identified as Hispanic, 28% was non-Hispanic White, and 15% represented other racial/ethnic minorities. These subgroups included non-Hispanic Black (10%), Asian (3%), and mixed race (0.8%). Eighty-seven percent of patients were between 18 and 64 years of age; 5% were younger than 18 years old and 7% were 65 years or older. Twenty percent of the sample had private insurance, 57% Medicare, 8% Medicaid, and 15% were uninsured. Ninety-five percent of the patients lived in a metropolitan area and 45% lived in a MUA. Commute time was 10 minutes or less for 27% of patients, 11 to 20 minutes for 39% of the sample, 21 to 30 minutes to commute for 21% of the sample, and more than 30 minutes for 13% of the patients.

### **Provider Characteristics**

There were a total of 42 unique providers (Table 1). Forty-four percent of providers were MD/DOs, 53% were advanced practice registered nurses (37%), family nurse practitioners (5%), or certified physician assistants (12%). Most providers spoke only English (62%); 38% spoke both English and Spanish. Regarding years of experience, 17% of providers had 0 to 5 years in practice, 29% had 6 to 10 years, 29% had 11 to 20 years, and 26% had more than 20 years of experience.

### **Telemedicine Use over Time**

Table 2 shows the change in telemedicine use over time from January 2020 to November 2020. Telemedicine use rate increased from 3% in March 2020 to 37% in April 2020 and decreased from 39% in May 2020 to 36% in June and July 2020. By November 2020, telemedicine use rate reduced to 31%. Telemedicine use rate is calculated as the total number of telemedicine appointments divided by the total number of appointments (in-person and telemedicine) within the same month. On average, there were 0.3 telemedicine visits per patient per provider.

**Table 1. Unique Patient Baseline Characteristics (n = 37,428)**

Variables	Total	
	N	(%)
Age		
< 18	1891	(5.1)
18 to 64	32,759	(87.5)
> 64	2778	(7.4)
Sex		
Female	24,983	(66.8)
Male	12,445	(33.2)
Race/ethnicity		
Hispanic	20,109	(57.1)
Non-Hispanic White	9916	(28.1)
Non-Hispanic Black	3630	(10.3)
Asian	1142	(3.2)
Other	165	(0.5)
Mixed race	280	(0.8)
Insurance coverage		
Private insurance	7317	(19.8)
Medicare	21,195	(57.3)
Medicaid	3065	(8.3)
Uninsured	5441	(14.7)
Metropolitan status of patient residence		
Nonmetropolitan	1758	(4.7)
Metropolitan	35,658	(95.3)
MUA status of patient residence		
Non-MUA	20,779	(55.5)
MUA	16,637	(44.5)
Commute time to clinic		
0 to 10 minutes	10,051	(26.9)
11 to 20 minutes	14,588	(39.0)
21 to 30 minutes	7873	(21.0)
30 to 300 minutes	4916	(13.1)
Provider characteristics (n = 42)		
Provider type		
Non-MD (APRN, FNP, PAC)	23	(54.8)
MD	19	(25.2)
Provider language		
English only	26	(61.9)
English and Spanish	16	(38.1)
Years in practice		
0 to 5 years	7	(16.6)
6 to 10 years	12	(28.6)
11 to 20 years	12	(28.6)
21 + years	11	(26.2)

Abbreviations: APRN, advanced practice registered nurse; FNP, family nurse practitioner; MUA, medically underserved area; PAC, certified physician assistant.

### Mixed-Effects Regression Model

Results from the mixed-effects regression model are shown in Table 3. Compared with adults 18 to

64 years, children were less likely to have a telemedicine appointment (OR=0.22;  $P < .001$ ) as were older adults (OR=0.89,  $P = .013$ ). Telemedicine use varied by patient race/ethnicity. When compared with Hispanic patients, non-Hispanic White patients had 61% higher odds of a telemedicine appointment (OR=1.61;  $P < .001$ ), and non-Hispanic Black patients had 37% higher odds (OR=1.37;  $P < .001$ ). The odds of telemedicine use were 19% lower for those who were uninsured (OR=0.81;  $P < .001$ ), compared with patients with private insurance. Those who resided in a metropolitan area were more likely to have a telemedicine appointment (OR=1.25;  $P = .004$ ) as well as those who resided in a MUA (OR=1.19;  $P < .001$ ). As commute time increased, the odds of having a telemedicine appointment also increased. (11 to 20 minutes OR 1.04;  $P = .14$ ; 21 to 30 minutes OR=1.14;  $P < .001$ ; >30 minutes OR=1.28;  $P < .001$ ).

### Intraclass Correlation Coefficient

Table 3 also shows weak intraclass correlation coefficients for provider and patient random effects. Patient random effects compose approximately 31% of the total residual variance, whereas patient and provider random effects compose approximately 38% of the total residual variance, conditional on the fixed-effects covariates.

### Discussion

This study assessed provider- and patient-level factors associated with telemedicine use in community-based family practice clinics between January and November 2020. To the best of our knowledge, this is the first study to assess telemedicine use in a large FQHC network consisting of more than 30 family practice clinics. Although our analyses revealed that specific provider characteristics were not statistically significant drivers of telemedicine use, several patient characteristics were strongly associated with telemedicine use. This emphasizes the need to focus on patient characteristics when designing interventions to improve telemedicine adoption. For example, our findings suggest that telemedicine may play an important role in promoting greater access to primary care particularly for populations residing in MUAs. Considering that MUAs are designated by HRSA as areas with a

**Table 2. Telehealth Use over Time (January 2020–November 2020)**

Month	In-Person Appointment (n = 81,296)		Telehealth Appointment (n = 25,309)	
	N	Rate (%)	N	Rate (%)
January 2020	11,087	100	2	0
February 2020	10,429	100	2	0
March 2020	10,222	97	361	3
April 2020	4761	63	2807	37
May 2020	4992	61	3178	39
June 2020	6798	64	3764	36
July 2020	7085	64	3917	36
August 2020	6870	69	3042	31
September 2020	6504	69	2956	31
October 2020	6667	71	2686	29
November 2020	5881	69	2594	31

shortage of primary care providers, this finding is promising and suggests access to care gap closures for underserved populations. Patients with longer commute times to the clinic were also more likely to use telemedicine services, and the likelihood of having a telemedicine appointment grew with increasing commute times. These results align with previous literature, highlighting the importance of patient characteristics such as distance and travel time to clinic, so that individuals can visit physicians at much greater distances and, in some cases, even across state lines.<sup>3,4</sup>

It is, however, important to note that our finding of a weak correlation within the same patient indicates there is no consistent pattern of telemedicine use within patients. This suggests that patients use telemedicine for occasional care delivery. A recent study found that few patients using telemedicine used it as a substitute for either retail clinics (where they may go for minor concerns) or urgent care facilities for acute issues.<sup>21</sup> A vast majority of encounters resulted in obtaining antibiotic prescriptions, and less than one third of patients stated that they would have gone to a doctor's office if telemedicine had not been available,<sup>21</sup> thus indicating these encounters as a primarily convenient way to obtain the medication that patients were specifically seeking at that moment. Another study comparing telemedicine to in-office visits during 2020 and 2018 to 2019 noted that there was an approximate 50% decrease in blood pressure assessment, about 37% decrease in cholesterol assessment, and a 26%

decrease in the absolute numbers of new prescription medications.<sup>22</sup> This demonstrates that telemedicine, by itself, may not adequately address chronic disease management, which is a core component of family medicine.

While telemedicine may remove some barriers in accessing health care, it does not come without its own additional barriers. Importantly, barriers such as low digital literacy or a lack of access to technology required for telemedicine use<sup>23</sup> can make certain populations to be at an unfair disadvantage. The findings of this study show that uninsured individuals and those residing in non-metropolitan areas, where there tends to be poorer access to care, were less likely to use telemedicine. In addition, Hispanic patients were significantly less likely to use telemedicine, compared with non-Hispanic patients. Two telemedicine studies conducted at ambulatory clinics of large medical centers found similar results as our study.<sup>24,25</sup> Both studies reported that older adults, females, Hispanics, and individuals enrolled in Medicaid were less likely to use telemedicine. These findings highlight the potential for technology-driven disparities in health care use so that telemedicine access to care benefits accrues for only privileged groups. This exacerbation of existing health disparities has been demonstrated in earlier studies. For example, in a clinic where all visits were in person before the pandemic, Hispanic patients composed only 8% of patients, but this percentage cut nearly in half when telemedicine visits were the only option in 2020.<sup>26</sup> Access to

**Table 3. Mixed-Effects Logistic Regression Model of the Relationship Between Telehealth Use in Family Practice Clinics, Patient and Provider Characteristics**

Variables	MV-Adjusted OR				P value
	OR	95% CI			
<b>Patient characteristics</b>					
Age					
18 to 64	Ref.				
<18	0.22	0.19	-	0.26	0.001
>65	0.89	0.81	-	0.98	0.013
Sex					
Female	Ref.				
Male	1.01	0.87		1.03	0.87
Race/ethnicity					
Hispanic	Ref.				
Non-Hispanic White	1.61	1.53	-	1.69	0.001
Non-Hispanic Black	1.37	1.27	-	1.47	0.001
Asian	1.05	0.92	-	1.20	0.920
Other	1.31	0.95		1.81	0.097
Mixed race	1.88	1.50	-	2.36	0.001
Insurance coverage					
Private insurance	Ref.				
Medicare	0.91	0.83	-	1.01	0.068
Medicaid	1.03	0.96	-	1.12	0.068
Uninsured	0.81	0.77	-	0.86	0.001
Metropolitan status					
Nonmetropolitan	Ref.				
Metropolitan	1.25	1.08	-	1.46	0.004
MUA status					
Non-MUA	Ref.				
MUA	1.19	1.13	-	1.27	0.001
Commute time to clinic					
0 to 10 minutes	Ref.				
11 to 20 minutes	1.04	0.99	-	1.10	0.135
21 to 30 minutes	1.14	1.07	-	1.21	0.001
>30 minutes	1.28	1.19	-	1.38	0.001
<b>Provider characteristics</b>					
Provider type					
Non-MD (APRN, FNP, PAC)	Ref.				
MD	1.05	0.64	-	1.73	0.86
Provider language					
English only	Ref.				
English and Spanish	1.35	0.84	-	2.17	0.22
Years in practice					
0 to 5 years	Ref.				
6 to 10 years	1.78	0.93	-	3.41	0.08
11 to 20 years	1.42	0.73	-	2.78	0.30
21 + years	1.00	0.47	-	2.13	0.99
<b>Intraclass correlation coefficient for provider and patient random effects</b>					
	Variance estimate	95% CI		Std Err	
Patient (variance estimate, CI)	0.31	0.26	-	0.38	0.21
Patient   provider (variance estimate, CI)	0.38	0.35	-	0.41	0.02

Abbreviations: MV-Adjusted OR, Multi-variable-adjusted odds ratio; CI, confidence interval; APRN, advanced practice registered nurse; FNP, family nurse practitioner; MUA, medically underserved area; PAC, certified physician assistant.

online patient portals was also markedly low in this patient population. Another study demonstrated that telemedicine access was lower among Black and Hispanic patients who already experience health inequities.<sup>27</sup> Ryskina and colleagues found that even in a population where Black patients had higher odds of using telemedicine, compared with White patients, they were still more likely to end up in the hospital, which highlights the health inequities that pervade even when innovative ways to access care are available.<sup>28</sup> The critical importance of recognizing and addressing these inequities cannot be overemphasized.

Family providers' uptake for telemedicine during the pandemic, regardless of provider type, language, and years in practice, is laudable. The finding that these provider characteristics were not significantly associated with telemedicine use highlights the adaptability of family providers to quickly transition during a time of uncertainty. This is particularly important because family physicians play crucial roles in primary care, overseeing preventative care, promoting healthy practices, ensuring continuity of care, and coordinating care to manage a patient's medical condition.<sup>6,7,29,30</sup> The principles that exemplify family practice include the commitment to treating people of all ages and conditions and the provider's role as the first point of contact for all health concerns,<sup>31</sup> so that interventions designed to promote access to care in turn improve overall population health. This broad-spectrum skill set is particularly important in the discussion of access for underserved populations, such as MUAs and HPSAs, where generalists may be the only point of care.<sup>32</sup>

This study is not without limitations. Because we use data from a large FQHC network in Texas, consisting of 36 clinic locations, our findings may not be generalizable to other types of clinics or clinics in other US states. While telemedicine implementation during the current pandemic has increased access to care for those who seek care from FQHCs, there are several challenges and barriers to virtual health that are not captured in this study. Information on patient medical conditions, language spoken, and other patient- and provider-level variables that could also inform telemedicine use were not included in the data obtained. Finally, it is unclear whether these results will persist when COVID-19 transmission rates are lower. Despite these limitations,

findings from this large study shed light into the uptake of telemedicine services in family practice clinics.

---

We are thankful to Ms. Rebecca Mak for editorial assistance.

To see this article online, please go to: <http://jabfm.org/content/35/3/457.full>.

## References

1. Wosik J, Fudim M, Cameron B, et al. Telehealth transformation: COVID-19 and the rise of virtual care. *J Am Med Inform Assoc* 2020;27:957–62.
2. American Medical Association [Internet]. CARES Act: AMA COVID-19 pandemic telehealth fact sheet; 2020. Available from: <https://www.ama-assn.org/delivering-care/public-health/cares-act-ama-covid-19-pandemic-telehealth-fact-sheet>.
3. Koonin LM, Hoots B, Tsang CA, et al. Trends in the use of telehealth during the emergence of the COVID-19 pandemic—United States, January–March 2020. *MMWR Morb Mortal Wkly Rep* 2020;69:1595–9.
4. Health Resources & Services Administration [Internet]. Medicare payment policies during COVID-19; 2020. Available from: <https://telehealth.hhs.gov/providers/billing-and-reimbursement/medicare-payment-policies-during-covid-19>.
5. Ray DE, Topol EJ. State of telehealth. *N Engl J Med* 2016;375:154–61.
6. Bodenheimer T, Lo B, Casalino L. Primary care physicians should be coordinators, not gatekeepers. *JAMA* 1999;281:2045–9.
7. Weiss LJ, Blustein J. Faithful patients: the effect of long-term physician-patient relationships on the costs and use of health care by older Americans. *Am J Public Health* 1996;86:1742–7.
8. Grumbach K, Selby JV, Damberg C, et al. Resolving the gatekeeper conundrum: what patients value in primary care and referrals to specialists. *JAMA* 1999;282:261–6.
9. Worth T. Agencies warn of coming doctor shortage. *Los Angeles Times*. 2010 June 7.
10. Association of American Medical Colleges (AAMC). Recent studies and reports on physician shortages in the U.S. 2009.
11. Agency for Healthcare Research and Quality [Internet]. The number of practicing primary care physicians in the United States; 2018. Available from: <https://www.ahrq.gov/research/findings/factsheets/primary/pcwork1/index.html>.
12. Association of American Medical Colleges (AAMC). Texas physician workforce profile. 2017.
13. Richards MR, Saloner B, Kenney GM, Rhodes K, Polsky D. Access points for the underserved. *Med Care* 2014;52:818–25.

14. Chang C-H, Bynum JP, Lurie JD. Geographic expansion of Federally Qualified Health Centers 2007–2014. *J Rural Health* 2019;35:385–94.
15. Houston Chronicle [Internet]. 4.5 million Texans used telehealth during the pandemic; 2020. Available from: <https://www.houstonchronicle.com/business/bizfeed/article/survey-texas-telehealth-pandemic-4-million-survey-15406812.php>.
16. Hoffman DA. Increasing access to care: telehealth during COVID-19. *J Law Biosci* 2020;7:lsaa043.
17. Hasselfeld BW [Internet]. Benefits of telemedicine. Johns Hopkins Medicine; 2020. Available from: <https://www.hopkinsmedicine.org/health/treatment-tests-and-therapies/benefits-of-telemedicine>.
18. Drerup B, Espenschied J, Wiedemer J, Hamilton L. Reduced no-show rates and sustained patient satisfaction of telehealth during the COVID-19 pandemic. *Telemedicine J E Health* 2021;27:1409–15.
19. Gomez T, Anaya YB, Shih KJ, Tarn DM. A qualitative study of primary care physicians' experiences with telemedicine during COVID-19. *J Am Board Fam Med* 2021;34:S61–S70.
20. Sinksy CA. Implementing telemedicine in primary care: learning lessons from electronic health records. *Mayo Clinic Proc* 2020;95:1835–7.
21. Martinez KA, Rood M, Jhangiani N, et al. Patterns of use and correlates of patient satisfaction with a large nationwide direct to consumer telemedicine service. *J Gen Intern Med* 2018;33:1768–73.
22. Alexander GC, Tajanlangit M, Heyward J, Mansour O, Qato DM, Stafford RS. Use and content of primary care office-based vs telemedicine care visits during the COVID-19 pandemic in the US. *JAMA Netw Open* 2020;3:e2021476.
23. Lyles CR, Sarkar U. Health literacy, vulnerable patients, and health information technology use: where do we go from here? *J Gen Intern Med* 2015;30:271–2.
24. Eberly LA, Kallan MJ, Julien HM, et al. Patient characteristics associated with telemedicine access for primary and specialty ambulatory care during the COVID-19 pandemic. *JAMA Netw Open* 2020;3:e2031640.
25. Ye S, Kronish I, Fleck E, et al. Telemedicine expansion during the COVID-19 pandemic and the potential for technology-driven disparities. *J Gen Intern Med* 2021;36:256–8.
26. Blundell AR, Kroshinsky D, Hawryluk EB, Das S. Disparities in telemedicine access for Spanish-speaking patients during the COVID-19 crisis. *Pediatr Dermatol* 2021;38:947–9.
27. Jacobs M, Ellis C. Telemedicine disparities during COVID-19: provider offering and individual technology availability. *J Am Geriatr Soc* 2021;69:2432–4.
28. Ryskina K, Shultz K, Zhou Y, Lautenbach G, Brown R. Older adults' access to primary care: gender, racial, and ethnic disparities in telemedicine. *J Am Geriatr Soc* 2021;69:2732–40.
29. Chipidza FE, Wallwork RS, Stern TA. Impact of the doctor-patient relationship. *Prim Care Companion CNS Disord* 2015;17(5).
30. Ha JF, Longnecker N. Doctor-patient communication: a review. *Ochsner J* 2010;10:38–43.
31. Phillips RLJ, Brundgardt S, Lesko SE, et al. The future role of the family physician in the United States: a rigorous exercise in definition. *Ann Fam Med* 2014;12:250–5.
32. Cashman SB, Savageau JA, Ferguson W, Lasser D. Community dimensions and HPSA practice location: 30 years of family medicine training. *Fam Med* 2009;41:255–61.