

# Patient and Provider Perceptions of Rapid Telehealth Implementation During the COVID-19 Pandemic

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## Abstract

**Introduction:** Despite unprecedented telehealth adoption during the COVID-19 pandemic, its post-pandemic preservation remains uncertain. Understanding key stakeholders' perspectives on telehealth during the pandemic can inform evidence-based policies and promote effective, sustainable virtual-based care.

**Methods:** Patients and providers who completed telehealth visits during the early pandemic in primary care, subspecialty, and surgical outpatient clinics at a large community-based academic medical center in New England were surveyed via telephone interviews or electronic surveys. Thematic analyses of qualitative comments further characterized experiences.

**Results:** Of 1729 eligible patients called, 969 were contacted and 778 participated (response rate 80.3% among contacted patients). Among 753 eligible providers, 348 participated (response rate 46.2%). Patients were predominantly female (59.1%), White/Caucasian (94.9%), and 65 years or older (58.8%). Most patients and providers reported overall satisfaction (91.2% and 84.5%, respectively) and felt their visit supported a meaningful patient-provider connection (92.2% and 93.9%, respectively) and facilitated careful listening (95.4 and 97.2%, respectively). Less than half (48.0%) of providers who conducted video visits felt video was necessary to achieve visit goals; however, patients were more satisfied with video than telephone-only visits (94.4% vs. 88.4%,  $p = 0.0097$ ). Patients conducting telephone-only visits were older (median age 72 years, IQR 63–80; vs. 63 years, IQR 50–73;  $p = 0.001$ ). Thematic analyses supported the quantitative findings.

**Conclusion:** Telehealth during the COVID-19 pandemic addressed healthcare needs in a highly satisfying and patient-centered manner, though older patients may be at risk of digital disparities. Policies must support equitable access to telephonic and video-based care.

**Keywords:** Telemedicine, Health policy, COVID-19, Public health, Patient satisfaction

## 1. Introduction

The COVID-19 pandemic forced rapid adoption of telehealth to permit the safe continuation of care for patients and to protect healthcare providers and the public. While telehealth has been present in a variety of forms for decades, it was not until the emergence of COVID-19 that virtual care delivery through telephone and video conferencing emerged as a widespread and necessary means of providing primary and specialty care. Historical barriers to

widespread telehealth utilization included limited reimbursement, clinician unwillingness, and need for organizational redesign.<sup>1</sup> By the second quarter of 2020, telemedicine visits had increased to 35 million visits from just 1.4 million quarterly visits in 2018–2019.<sup>2</sup> The shift to telehealth enabled preservation of personal protective equipment, reduced disease exposure, and offloaded patient demand on facilities.<sup>3</sup> Through the course of 2020, healthcare organizations transformed traditional care paradigms to incorporate telehealth as a necessary

*Abbreviations:* APP, Advanced Practice Provider; EMR, Electronic Medical Record; IQR, Interquartile range; LHMC, Lahey Hospital & Medical Center

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response to the ongoing public health emergency,<sup>4</sup> fostered by temporarily revised public policies and payer practices enabling its financial viability.<sup>5,6</sup>

The sustainability of telehealth post-COVID-19 will depend on continued reimbursement through data-informed policies and acceptance among providers and patients as an effective means of care delivery. It was projected that primary care practices, which make up approximately half of the one billion annual office visits in the U.S., would suffer \$15.1 billion in revenue losses during 2020 as a result of the shift from in-person to virtual care.<sup>7</sup> Statistical modeling suggested this loss would have doubled if reimbursement reverted to pre-COVID levels towards the end of the year.<sup>7</sup> This posed an existential threat to a vast number of primary care practices and other ambulatory specialties conducting a high volume of evaluation and management visits.

In the context of the public health emergency, both patients and providers were expected to learn new technologies and transition to a predominantly virtual patient–provider relationship during an unprecedented time of fear and vulnerability. Creating compassionate connections with patients required audiovisual connections and the ability to troubleshoot online, often in isolated settings. The “digital divide,” defined as inequitable access to technology based on societal and social factors,<sup>8</sup> risks exacerbating health disparities among the same groups already struggling to overcome healthcare inequities. Older patients, racial/ethnic minorities, females, and those of lower socioeconomic status were found to utilize telemedicine, and particularly video-based visits, at lower rates during the early part of the COVID-19 pandemic.<sup>9</sup> While several studies have described COVID-19 telehealth implementation strategies,<sup>10–14</sup> studies exploring patient and provider perceptions of telehealth have been limited in scope and restricted to mainly single subspecialty departments or particular disease states.<sup>15,16</sup>

In our study, we measured perceived effectiveness and satisfaction with telehealth among patients and providers across a broad spectrum of primary care and subspecialty departments during the 2020 pandemic. Additionally, we explored whether patient perceptions differed by age, gender, race/ethnicity, or use of voice-only versus video technology to identify opportunities to address technology-mediated health disparities.<sup>8,17</sup> We hypothesized that telehealth would provide a safe, convenient, and highly satisfying form of care capable of meeting the visit goals and supporting a meaningful patient–provider relationship during

one of the most challenging times in modern history.

## 2. Methods

### 2.1. Survey administration

#### 2.1.1. Provider survey

In April and May 2020, electronic surveys were emailed to all physicians and advanced practice providers (APP) employed at Lahey Hospital and Medical Center (LHMC), a large community-based academic medical center in northeastern Massachusetts. LHMC uses a single electronic health record system (Epic, Verona, WI) and conducted approximately 400,000 telehealth visits over a year-long period following rapid implementation in March 2020. Providers were eligible if they reported completion of at least one telehealth visit during the COVID-19 pandemic.

#### 2.1.2. Patient survey

45,225 patients conducted a telehealth visit between March 21, 2020 and April 20, 2020. Among this group, 2400 were randomly selected to participate in the study. Randomization was stratified to achieve an equal number of patients who participated in either telephone-only (n = 1200) or video (n = 1200) visits. Among the 2400 patients, surveyors initiated phone calls to 1,729, of which 969 were reached and invited to participate (Fig. 1).

### 2.2. Patient characteristics

Patient demographics, including self-reported age, gender, and race/ethnicity, were obtained from a limited electronic medical record (EMR) data export and linked to the respondents using their medical record numbers. Department location and telehealth modality were based on encounter information in the EMR.

### 2.3. Survey domains/measures

The patient and provider surveys used 5-point Likert scales to assess survey domains including relationship-based care, technical and operational considerations, COVID-19-related issues, overall satisfaction, and willingness for future telehealth visits (Supplementary Table 1a). Pre-specified sub-analyses were performed to explore the potential impact of age, gender, race/ethnicity, and telehealth modality (e.g., telephone or video) on patient perceptions.

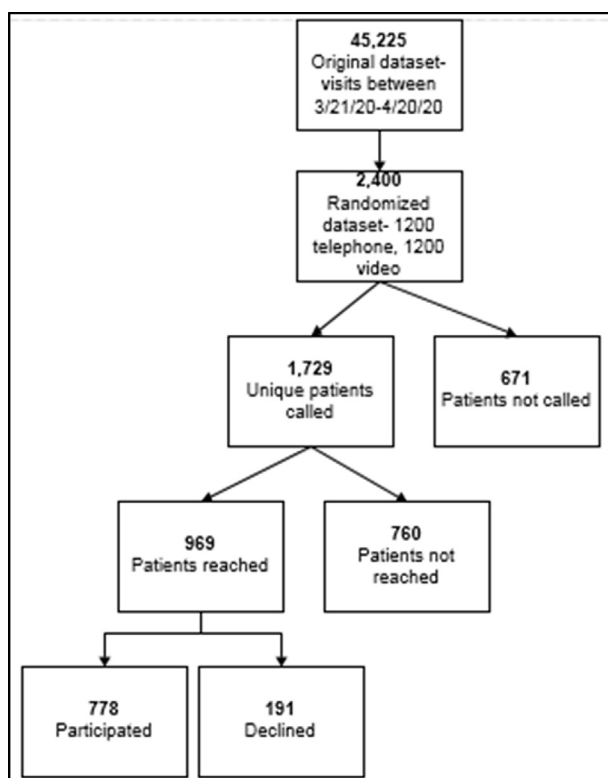


Fig. 1. Flowchart for patient selection and survey administration. Among the 778 who agreed to participate, demographic information was available for 685 for whom medical record numbers could be verified. Subanalyses based on demographic data included the smaller subset ( $n = 685$ ), whereas all other analyses included the full sample ( $n = 778$ ). Respective sample sizes are included in the Results tables as appropriate.

#### 2.4. Qualitative data

Open-ended comments were elicited in the patient and provider surveys regarding ways in which the telehealth visit either improved or diminished the care received. Thematic analyses followed an inductive, semantic approach, allowing the explicit content of the comments to determine the qualitative themes without preconceptions based on the quantitative data. Comments were coded when relevant words or phrases emerged and were collated together to give common meanings throughout the data. Codes were later combined into broader themes to provide useful representations and understanding of the comments. Multiple members of the project team reviewed themes and collapsed them into final groups by consensus. Additionally, access center staff collected comments from patients declining telehealth appointments during scheduling to better understand barriers.

#### 2.5. Statistical analysis

The continuous variables (e.g., age) were tested for the data distribution normality using Shapiro–Wilk test. Normally distributed data within two groups were tested using Student T test and displayed as mean  $\pm$  standard deviation. The skewed data were tested using Wilcoxon Rank–Sum test if the data were distributed within two groups, using ANOVA test if the data were distributed among three or more groups, and displayed as median (interquartile range). The categorical variables were tested using Fisher's Exact test if the variables were dichotomous or Chi–Square test if the variable included more than two categories. The statistical analysis for this study was generated using Statistical Analysis Software (SAS), version 9.4 for Windows.

This study was deemed exempt by the Institutional Review Board at LHMC.

### 3. Results

Of the 969 patients contacted and invited to participate, 778 completed the survey (response rate: 80.3% among contacted patients; Fig. 1). Demographic information used in subanalyses was available for 685 patients who had valid medical record numbers permitting demographic data collection. Among the subset of 685 patients, the majority was female (59.1%), White/Caucasian (94.9%), and had a telephone-only visit (60.6%). Most respondents were over 65 years of age and conducted a telehealth visit in either a primary care or medical subspecialty clinic (Table 1).

The study sample was reflective of both the larger initial data set ( $n = 45,225$ ) and survey non-responders ( $n = 951$ ) in that the majority were female (56% of larger dataset, 55% of non-responders), White/Caucasian (89% of larger dataset, 97% of non-responders), and approximately a third had a telehealth visit in primary care (30.0% of larger dataset, 37.2% of non-responders).

Out of 753 eligible providers, 348 completed the survey (response rate: 46.2%). MD/DOs comprised 73% of respondents and 27% were APPs.

#### 3.1. Patient and provider overall satisfaction and willingness for future telehealth

Most patients (91.2%) and providers (84.5%) reported overall satisfaction with their telehealth visits (Table 2). Patient satisfaction was high across all surveyed departments, though sample size limitations precluded the ability to detect significant

Table 1. Characteristics of patient respondents (n = 685<sup>1</sup>).

Characteristics	Frequency/Percent
<b>Age (years)</b>	
18–29	15 (2.2%)
30–40	41 (6.0%)
41–50	38 (5.5%)
51–65	188 (27.4%)
66–79	268 (39.1%)
80+	135 (19.7%)
<b>Gender</b>	
Female	405 (59.1%)
<b>Race</b>	
White or Caucasian	650 (94.9%)
Asian	14 (2.0%)
Black or African American	5 (0.7%)
Hispanic	3 (0.4%)
Other	4 (0.6%)
Declined to answer	4 (0.6%)
Unavailable or Unknown	3 (0.4%)
<b>Department</b>	
Medicine Subspecialty	337 (49.2%)
Primary Care	250 (36.5%)
Surgery	68 (9.9%)
Cancer Services	26 (3.8%)
Other	4 (0.6%)
<b>Modality</b>	
Video	270 (39.4%)
Telephone	415 (60.6%)

<sup>1</sup> Note: Total patient respondent sample size was 778, though demographics were only available for 685 due to absent medical record numbers.

differences (Supplementary Table 2a). A majority of patients (66.6%) and providers (77.3%) stated they would choose to utilize telehealth appointments in the future.

### 3.2. Relationship-based care and use of telehealth for COVID-19

Nearly all patients and providers felt their telehealth visit supported a meaningful patient-provider

Table 2. Patient and provider telehealth perceptions.

Survey item	Provider (n (%))	Patient (n (%))
<b>Telehealth visit supported a meaningful connection</b>	n = 348	n = 778
Strongly agree	156 (44.8%)	351 (45.0%)
Agree	171 (49.1%)	366 (47.0%)
Neutral	13 (3.7%)	37 (4.8%)
Disagree	6 (1.7%)	15 (1.9%)
Strongly disagree	2 (0.6%)	5 (0.6%)
Declined to answer	0 (0.0%)	4 (0.5%)
<b>Telehealth visit allowed careful listening to questions and concerns</b>	n = 348	n = 778

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Table 2. (continued)

Survey item	Provider (n (%))	Patient (n (%))
<b>Strongly agree</b>	176 (50.6%)	463 (59.5%)
<b>Agree</b>	162 (46.6%)	279 (35.9%)
<b>Neutral</b>	8 (2.3%)	21 (2.7%)
<b>Disagree</b>	1 (0.3%)	8 (1.0%)
<b>Strongly disagree</b>	1 (0.3%)	1 (0.1%)
<b>Declined to answer</b>	0 (0.0%)	6 (0.8%)
<b>Enough time spent in visit to get questions and concerns addressed</b>	n = 348	n = 778
<b>Strongly agree</b>	192 (55.2%)	478 (61.4%)
<b>Agree</b>	143 (41.1%)	256 (32.9%)
<b>Neutral</b>	12 (3.4%)	22 (2.8%)
<b>Disagree</b>	1 (0.3%)	12 (1.5%)
<b>Strongly disagree</b>	0 (0.0%)	3 (0.4%)
<b>Declined to answer</b>	0 (0.0%)	7 (0.9%)
<b>The telehealth visit addressed questions and concerns related to the COVID-19 crisis.</b>	n = 311	n = 244
<b>Strongly agree</b>	115 (37.0%)	103 (42.2%)
<b>Agree</b>	173 (55.6%)	117 (48.0%)
<b>Neutral</b>	23 (7.4%)	18 (7.4%)
<b>Disagree</b>	0 (0.0%)	5 (2.0%)
<b>Strongly disagree</b>	0 (0.0%)	0 (0.0%)
<b>Declined to answer</b>	0 (0.0%)	1 (0.4%)
<b>The telehealth visit decreased patients' sense of isolation in the COVID-19 crisis.</b>	n = 348	n = 778
<b>Strongly agree</b>	123 (35.3%)	67 (8.6%)
<b>Agree</b>	167 (48.0%)	283 (36.4%)
<b>Neutral</b>	50 (14.4%)	224 (28.8%)
<b>Disagree</b>	6 (1.7%)	162 (20.8%)
<b>Strongly disagree</b>	2 (0.6%)	9 (1.2%)
<b>Declined to answer</b>	0 (0.0%)	33 (4.2%)
<b>The use of telehealth is a helpful way to address the COVID crisis.</b>	n = 348	n = 778
<b>Strongly agree</b>	209 (60.1%)	277 (35.6%)
<b>Agree</b>	127 (36.5%)	392 (50.4%)
<b>Neutral</b>	10 (2.9%)	61 (7.8%)
<b>Disagree</b>	1 (0.3%)	24 (3.1%)
<b>Strongly disagree</b>	1 (0.3%)	7 (0.9%)
<b>Declined to answer</b>	0 (0.0%)	17 (2.2%)
<b>Overall, how satisfied are you with the quality of the telehealth visit?</b>	n = 348	n = 778
<b>Very satisfied</b>	97 (27.9%)	475 (61.1%)
<b>Satisfied</b>	197 (56.6%)	234 (30.1%)
<b>Neutral</b>	39 (11.2%)	43 (5.5%)
<b>Dissatisfied</b>	13 (3.7%)	14 (1.8%)
<b>Very Dissatisfied</b>	2 (0.6%)	5 (0.6%)
<b>Declined to answer</b>	0 (0.0%)	7 (0.9%)
<b>I would choose to utilize telehealth appointments in the future.</b>	n = 348	n = 778
<b>Strongly agree</b>	141 (40.5%)	140 (18.0%)
<b>Agree</b>	128 (36.8%)	378 (48.6%)
<b>Neutral</b>	52 (14.9%)	121 (15.6%)
<b>Disagree</b>	20 (5.7%)	106 (13.6%)
<b>Strongly disagree</b>	7 (2.0%)	18 (2.3%)
<b>Declined to answer</b>	0 (0.0%)	15 (1.9%)

connection (92.2% and 93.9%, respectively), facilitated careful listening (95.4% and 97.2%, respectively), and that enough time was spent addressing patient questions and concerns (94.3% and 96.3%, respectively). A large majority of both patients (86.0%) and providers (96.6%) felt telehealth was effective in addressing the COVID-19 crisis and reported that questions or concerns related to COVID-19 were addressed during the visit. Among providers, 83.3% perceived telehealth was able to

decrease patients' sense of isolation related to COVID-19 compared to 45.0% of patients.

### 3.3. Comfort with technology

Among the 778 surveyed patients, 12.6% reported technical difficulties during their telehealth visit (Supplementary Table 4a). A majority of patients (92.9%) conducted their visit from home and participated in the visit on their own (87.1%).

Table 3. Representative patient and provider qualitative survey comments.

Theme	Patient Comments	Provider Comments
Care Continuity	<p>"Telehealth provided the opportunity to get answers quickly and it was very thorough."</p> <p>"Gave peace of mind instead of cancelling [the] appointment- worthwhile being able to touch base with doctor."</p>	<p>"I am getting an increasing number of patients wanting continued support as an outpatient and I will be working with my department to offer continuity of care ... with use of video telehealth ... my patients are appreciative, feel less isolated and appear to open up more with telehealth. There are less distractions and the patients are not feeling the "process pressure" of moving through the medical system."</p>
COVID-19	<p>"It was helpful because I didn't get exposed to anything by going into an office at this time."</p>	<p>"The most important positive of telehealth is that it decreases isolation in this public health crisis. My patients have been profoundly grateful for my being there for them at a time when they feel alone and disconnected in so many other ways."</p>
Flexibility/Convenience	<p>"Logistics were better. I didn't have to worry about the 25 min commute or get daycare for my kids."</p>	<p>"For some patients, if under normal circumstances burden of taking time from work, coming to Lahey, may have ultimately led them to cancel their appointment or no show. However, the ease of telehealth possibly made them more likely to attend. Much easier way to facilitate a follow-up visit to assess targeted treatment for a problem that was previously evaluated."</p>
Value of interactive technology	<p>"It was nice to have Epic because other physicians can see my photos of the surgery."</p> <p>"Being able to talk to the doctor directly and being able to visually see you made it feel more like a face-to-face visit and was glad to be able to get answers to questions and was happy didn't need to go."</p>	<p>"I think video allows us to get a visual check on our patients that phone doesn't allow for. It's also less mentally tasking to stay focused when you're able to see your patient and interact with them."</p> <p>"Streamlining experience for the patient is extremely important. Video visit should be as easy to initiate/accept as a phone call."</p>
Laboratory/ancillary testing and physical examination	<p>"My telehealth visit was for an annual physical exam but many assessments couldn't be done over video and I couldn't have labs drawn."</p>	
Value of telehealth as a "home visit"		<p>"Patients at home have access to their current medications, while at appointments are more often using their (sometimes unreliable) memory."</p>
Access		<p>"Other benefits to telehealth- increasing accessibility to patients who are normally limited by mobility, health issues, financial constraints (if they have to pay for transportation/gas), otherwise inconsistent transportation, or long commutes (especially those in more rural areas). Maintaining some degree of telehealth will help continue providing greater access of care to patients ..."</p> <p>"I miss the close one on one but love the concept of providing care in the future for patients, elderly, busy moms and dads, people 'too sick' to come if insurance providers allowed this to be an option."</p>



Nearly 80% of patients felt their telehealth visit was a convenient alternative to an in-person visit, while 41.0% stated that the virtual visit made them feel more comfortable compared to an in-person visit.

### 3.4. Telephone-only versus video visit

Among providers who engaged in a telephone-only visit ( $n = 231$ ), 64.5% felt a telephone encounter was able to achieve most of the visit's clinical goals (Supplementary Table 3a). Among providers who conducted a video visit, less than half (48.0%) felt video technology was needed to achieve the visit goals.

In subanalyses, patients with a video visit were more satisfied with the quality of their visit than those with a telephone-only visit (94.4% vs. 88.4%,  $p = 0.0097$ ). Patients using telephone-only visits were older than patients having video visits (median age 72 years, IQR 63–80; vs. 63 years, IQR 50–73;  $p = 0.001$ , respectively).

### 3.5. Gender and age-related perceptions

In subanalyses exploring differences by patient demographics, males were more likely than females to choose to have a telehealth appointment in the future (71.8% vs. 62.5%,  $p = 0.014$ ). Older participants were more likely to have someone else in the room with them during the visit while younger participants were more likely to be alone (alone median age = 68 years, IQR 58–77; vs. accompanied median age = 73 years, IQR 61–81;  $p = 0.032$ ). There were no other significant differences based on age or gender for the remainder of the survey items. Due to small numbers of non-white participants, we were unable to perform subanalyses based on race/ethnicity.

### 3.6. Open-ended comments from patient and provider surveys

Four prominent themes were identified in open-ended comments from both patients and providers about their care experience: 1) telehealth's facilitation of care continuity, 2) telehealth as a response to the COVID-19 public health crisis, 3) flexibility/convenience of virtual visits, and 4) value of interactive technology.

In the patient survey, an additional theme emerged regarding inability to have a physical examination or testing within a telehealth visit. Additional themes from the provider survey included the value of the visit being in the home

setting and improved access for patients and populations that might otherwise have barriers to in-person care. Selected representative quotations to illustrate these themes are shown in Table 3.

### 3.7. Access center staff recording of barriers for patient's opting out of telehealth

Access center staff provided a list of patient-reported barriers when opting out of telehealth services. Themes included concerns about technology (access to or ability to navigate), perceptions that their condition could not be assessed via telehealth, need for in-person services such as physical examination or laboratories, and the desire to delay non-urgent care until after the pandemic.

## 4. Conclusion

In this large survey exploring both patient and provider perceptions of telehealth implementation during the COVID-19 pandemic across multiple ambulatory settings using quantitative and qualitative methods, overall satisfaction was extremely high for patients and providers. Patient perceptions remained positive regardless of age, gender, specialty of their visit, or modality (telephone or video). The majority of patients and providers expressed a desire to engage in future telehealth visits regardless of the modality used. Telehealth was perceived as convenient, supported relationship-based care, and was an effective tool in addressing the public health crisis. While high proportions of patients reported satisfaction with telephone or video visits, patients having video visits reported significantly higher levels of satisfaction and both patients and providers praised the elements of clinical examination and interpersonal connection that were possible with a video component. Nonetheless, telephone-only visits were important options for older patients; patients utilizing telephone visits had a median age of nearly 10 years older than those using video visits. Both providers and patients reported that they were able to adequately accomplish most of the clinical goals in the absence of video. Furthermore, for certain patients this was the only way a remote visit could be done.

Studies of COVID-19 telehealth use among patients and providers from various medicine and surgical subspecialty departments, including gastroenterology, oncology, orthopedic surgery, and otolaryngology,<sup>10,18–20</sup> showed similarly high levels of patient satisfaction and a desire for conducting telehealth in the future.<sup>15</sup> Our findings reinforce this positive experience using an expanded and diverse

group of respondents, including in primary care. Despite the inability to conduct an in-person physical examination, a majority of providers felt they could achieve the visit goals either telephonically or using video. A survey of oncologists conducting telemedicine visits similarly reported that lack of exam did not affect the care provided,<sup>19</sup> though this could differ by specialty or the reason for visit. Lifestyle and behavioral counseling, medication management, and use of home monitoring devices, such as blood pressure cuffs, can facilitate effective virtual chronic disease management, while careful history-taking can sufficiently triage and diagnose many conditions in the absence of in-person examinations.

Despite providers affirming the ability to accomplish most visit goals virtually, it has been shown that the content of primary care telehealth visits differed from in-person visits as a result of COVID-19. In a study of more than 125 million primary care visits between 2018 and the second calendar quarter of 2020, there was a 50.1% decrease in blood pressure assessments and 36.9% decrease in cholesterol assessments, and significantly fewer of these assessments took place during telemedicine compared to office-based visits.<sup>2</sup> Differences in patient and provider access to home monitoring devices, the conditions addressed, and provider training may contribute to variations in the content of telehealth visits.

While acknowledging certain limitations of virtual visits, policy makers should continue supporting high-value applications of telehealth-based care given its demonstrated effectiveness and ability to overcome many access barriers unique to in-person care.<sup>21</sup> Transportation issues, conflicting work schedules, and childcare or eldercare needs can broaden health disparities and limit access to care for underserved populations, while having a virtual option has shown to reduce no-show rates.<sup>22</sup> Both patients and providers in our survey celebrated the flexibility and convenience of virtual visits and noted enhanced access to be a distinct benefit of telehealth.

Reimbursement parity for telephone-only visits is needed to enable ongoing care for older patients lacking video technology without compromising the quality and usefulness of the interaction as illustrated in our study. Financially favoring video-based visits will potentially incentivize virtual care aimed at younger, healthier patients and those with greater access to video technology risking further exacerbation of the digital divide. Only 55–60% of adults over 65 years old reported owning a smartphone or having access to home broadband internet according to 2019 survey data,<sup>23,24</sup> similar

to a 2018 nationally representative sample of US adults over 65 years in which nearly 40% were deemed unready to conduct a video visit mostly due to technological inexperience.<sup>25</sup> Kruse et al. identified several additional barriers to telehealth among older patients including lack of desire, cost, visual and auditory acuity, lack of technical support, privacy and security, trust of the internet, and computer anxiety.<sup>26</sup> Our qualitative findings support these observed barriers, particularly related to the need for pre-visit technical support and a reliable video platform to reduce disruption. If we can address these barriers, our results show telehealth visits can be equally satisfying and support meaningful connections regardless of age. While we were unable to explore the impact of race or other socioeconomic variables on telehealth perceptions due to small numbers of non-white patients in our sample, the impact of the digital divide on the ability for these groups to realize the full benefit of technology-mediated care during COVID-19 has been studied previously with similar barriers as described for older patients and lower rates of telemedicine use.<sup>8,9,17</sup>

Strengths of this study include the relatively large sample sizes and favorable response rates. Characteristics of patient respondents were reflective of non-respondents as well as the larger data set of eligible patients with telehealth visits, reducing the likelihood of participation bias. Surveyed patients conducted visits across 29 different medical and surgical departments, while a mix of MD/DO and APPs further contributed to a wide spectrum of experience and perspectives. The mixed methods approach adds important qualitative context to enhance the understanding of our quantitative findings.

#### 4.1. Limitations

Our study has limitations. First, we did not have access to provider demographics to determine whether age, gender, or other characteristics may influence the perceived effectiveness and acceptance of telehealth by clinicians. Second, the lack of complete demographic data for a subset of patient respondents that were missing an accurate medical record number limited some of our subanalyses; however, this is unlikely to introduce bias as there is no reason to believe that patients with missing data were inherently different from patients with complete data. Third, the patient sample was predominantly White/Caucasian limiting the ability to detect differences based on race/ethnicity, possibly limiting the generalizability of our findings to non-white patient populations. Fourth, providers may

have had multiple telehealth encounters to draw from when responding to the survey questions, whereas patients were instructed to base responses on a specific visit. This may lead to recall bias depending on the positive or negative nature of their cumulative, respective experiences.

In summary, despite historical barriers to widespread telehealth utilization, health systems responded to the public health crisis, swiftly reconfiguring care delivery models in extraordinary and necessary ways to support telehealth. Telehealth effectively addressed individual and public health needs during the COVID-19 pandemic in a highly satisfying, convenient, and patient-centered manner. Both clinicians and patients have demonstrated a desire to participate in ongoing virtual-based care. State and federal regulators and payers must permanently remove barriers and support virtual care to ensure equitable access to telephonic and video-based technologies moving forward. The Federal Communications Commission's Emergency Broadband Benefit program, aiding struggling households with internet service during the pandemic, is a step in the right direction.<sup>27</sup> Future studies should continue exploring ways to overcome the digital divide and enable the delivery of high-value virtual care options to all populations.

### Meeting presentation

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### Conflicts of interest

The authors declare that there is no conflict of interest.

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