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## ■ GENERAL ORTHOPAEDICS

# Telemedicine in orthopaedic surgery during the COVID-19 pandemic

## PATIENT ATTITUDES AND BARRIERS

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### Aims

This study assesses patient barriers to successful telemedicine care in orthopaedic practices in a large academic practice in the COVID-19 era.

### Methods

In all, 381 patients scheduled for telemedicine visits with three orthopaedic surgeons in a large academic practice from 1 April 2020 to 12 June 2020 were asked to participate in a telephone survey using a standardized Institutional Review Board-approved script. An unsuccessful telemedicine visit was defined as patient-reported difficulty of use or reported dissatisfaction with teleconferencing. Patient barriers were defined as explicitly reported barriers of unsatisfactory visit using a process-based satisfaction metric. Statistical analyses were conducted using analysis of variances (ANOVAs), ranked ANOVAs, post-hoc pairwise testing, and chi-squared independent analysis with 95% confidence interval.

### Results

The survey response rate was 39.9% (n = 152). The mean age of patients was 51.1 years (17 to 85), and 55 patients (38%) were male. Of 146 respondents with completion of survey, 27 (18.5%) reported a barrier to completing their telemedicine visit. The majority of patients were satisfied with using telemedicine for their orthopaedic appointment (88.8%), and found the experience to be easy (86.6%). Patient-reported barriers included lack of proper equipment/internet connection (n = 13; 8.6%), scheduling difficulty (n = 2; 1.3%), difficulty following directions (n = 10; 6.6%), and patient-reported discomfort (n = 2; 1.3%). Barriers based on patient characteristics were age > 61 years, non-English primary language, inexperience with video conferencing, and unwillingness to try telemedicine prior to COVID-19.

### Conclusion

The barriers identified in this study could be used to screen patients who would potentially have an unsuccessful telemedicine visit, allowing practices to provide assistance to patients to reduce the risk of an unsuccessful visit.

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### Introduction

COVID-19 brought the world to a halt in early 2020, spreading around the globe within months. In the USA, the Centers for Disease Control and Prevention (CDC) recommended that healthcare systems adjust healthcare delivery and optimize telehealth use in order to safely care for patients and personnel, and to minimize potential COVID-19 exposure.<sup>1</sup> This led to the rapid adoption of telemedicine as a mean of providing healthcare

to patients across all specialties, without allowing healthcare systems, practitioners, or patients the adequate time to prepare for this change. While the use of telemedicine has started to slowly decrease since peaking during the onset of the COVID-19 pandemic, it is expected that telemedicine will continue to be used in a much larger capacity than in the pre-COVID-19 era.<sup>2,3</sup>

Telemedicine is defined by the World Health Organization (WHO) as the delivery

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of healthcare services by healthcare professionals using information and communication technologies. While telemedicine had been growing in use prior to 2020, it had not been readily adopted due to several issues.<sup>4,5</sup> A systematic review of barriers to telemedicine use globally by Kruse et al<sup>5</sup> describes barriers by categorizing into organizational barriers, patient-specific barriers, and medical-staff barriers. The most common barriers within organizations were cost, reimbursement, and legal/privacy concerns. Patient barriers to effective telemedicine use included age and education level, computer literacy, bandwidth, and unawareness of telemedicine alternatives to healthcare. Barriers from medical staff were most frequently due to technologically challenged staff and resistance to change.<sup>5</sup>

COVID-19 necessitated the rapid migration of non-emergent patient care to the virtual setting without appropriately evaluating the barriers to access, specifically among patients. Organizational barriers were addressed through legal changes made under the Coronavirus Aid, Relief, and Economic Security (CARES) Act, and the emergency declaration under the Stafford Act and National Emergencies Act that addressed some existing barriers to telehealth use.<sup>3</sup> These changes included expansion of telehealth-eligible services, expansion of the types of providers eligible to provide care via telehealth, removal of certain geographical and healthcare site restrictions, and easing Health Insurance Portability and Accountability Act (HIPAA) sanctions in cases of providers using encrypted and closed loop technology for telehealth services in good faith.<sup>3</sup> It is expected that the use of telemedicine will account for 21% of primary care visits moving forward, as compared to less than 1% of visits in the pre-COVID-19 era.<sup>3</sup> Moving forward, it is imperative that physicians and healthcare providers recognize and understand patient barriers to effective telemedicine use in order to better care for patients.

In this study, we sought to assess patient barriers to successful telemedicine use, as well as patient attitudes and satisfaction with telemedicine in the COVID-19 era in an orthopaedic surgery practice. To the authors knowledge, this is the first study to evaluate patient barriers to telemedicine in the orthopaedic telemedicine setting in the COVID-19 era. We hypothesized that the following factors would lead to a patient barrier with regards to successful telemedicine visits: older age, non-English speakers, lack of equipment (computer, smartphone), lack of familiarity with video conferencing, poor internet connection, and patient unwillingness to try telemedicine. To assess this, we asked: 1) are age, language preference, access to appropriate equipment, experience with video conferencing software, and willingness to try telemedicine before COVID-19 correlated to patient satisfaction with the process of using telemedicine for their orthopaedic appointment?; and 2) what did patients

that reported dissatisfaction with telemedicine via video conferencing consider to be a barrier to an effective telemedicine visit?

## Methods

A cross-sectional telephonic survey study was performed for all patients that were scheduled for evaluation via telemedicine (video conferencing and phone call) in the clinics of three orthopaedic surgeons (one foot and ankle surgeon (AA) and two hand surgeons (SD, PO)) in a large academic practice from 1 April 2020 to 12 June 2020. Video conferencing was carried out via the Zoom video conferencing platform (Zoom Video Communications, USA), integrated within the home institution electronic medical record, approved by the home institution for use. A total of 381 patients were scheduled for telemedicine visit in the identified time period. All patients were verbally consented for the survey using a standardized Institutional Review Board (IRB)-approved survey script. Patients who required interpreter services were contacted using a HIPAA-compliant translator service. Additionally, three attempts on different days and time were made to contact patients who were non-responsive to initial calls. A barrier was defined as an unsatisfactory visit, difficulty of use of telemedicine interface, or lack of access. A patient barrier was identified in two ways: if patient explicitly reported a barrier during the interview; or correlation of a report of unsatisfactory visit or difficulty of use with patient characteristics such as demographics, availability of equipment, prior experience of computer, smartphone or video conferencing use, primary language, and willingness to try medicine.

The survey was developed in-house and a final version was approved by all authors and the IRB. The survey recorded basic demographic data, as well as assessing a patient's baseline technology use, including frequency of video conferencing use among other things. The survey focused on identifying barriers that restricted patients from accessing or adequately interacting with the interface and surgeon. To answer our study questions, we: 1) asked patients to confirm language preference and asked for their age, average phone and computer use, per day previous experience with video conferencing software, and willingness to try telemedicine prior to the COVID-19 pandemic as well as their satisfaction level with the process of using telemedicine for their orthopaedic appointment on a scale of 1 to 5; and 2) included a specific question to directly assess any patient's self-reported barriers. A process-based satisfaction metric was used to elicit patient-reported satisfaction level with the process of using the video conferencing platform for their orthopaedic sub-specialty visit, regardless of treatment or outcomes of the visit.

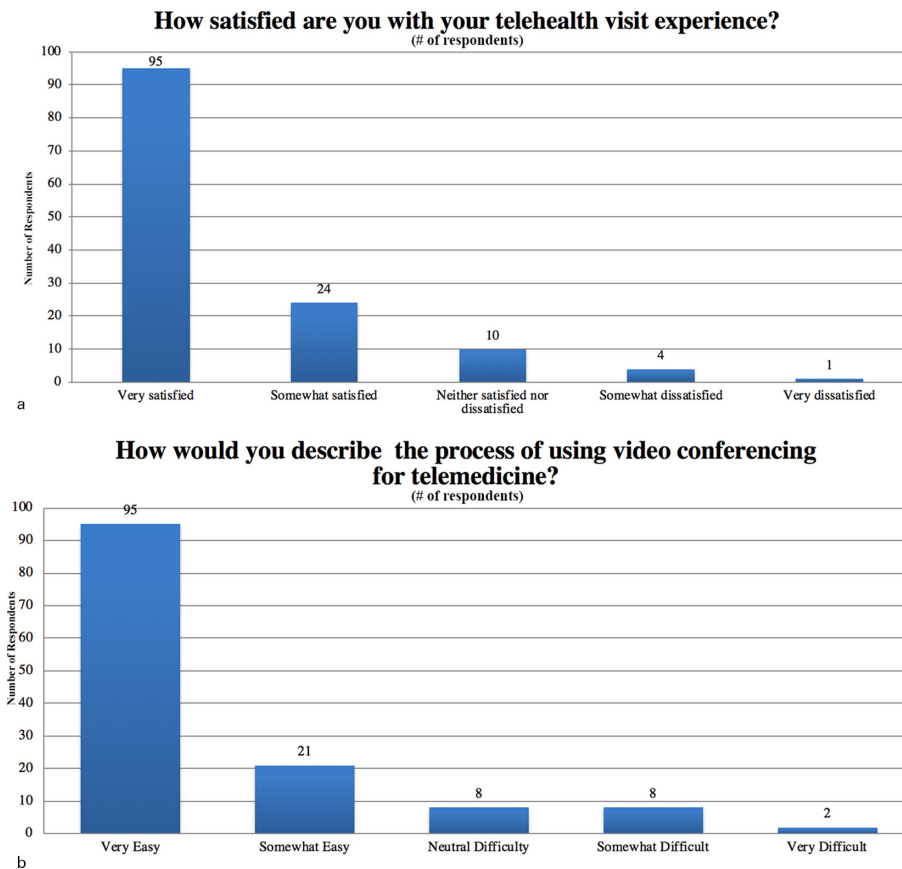


Fig. 1

Patient satisfaction.

**Statistical analysis.** Statistical analyses were conducted using analysis of variances (ANOVAs), ranked ANOVAs, post-hoc pairwise testing, and chi-squared independent analysis with a 95% confidence interval. All analyses were conducted on JMP SPSS v.26 (IBM, USA).

## Results

A total 378 patients were evaluated through telemedicine during the given study period. Of all patients evaluated during the study period, 75 (19.9%) were new patients and 303 (80.1%) were follow-up patients. The survey response rate was 40.2% ( $n = 152$ ); however, only 146 respondents were used for final analysis due to lack of complete survey by six of the respondents. Of the 146 patients analyzed, 55 (38%) were male, 20 (13%) were new patients, and 126 (87%) were follow-up patients. Of the respondents, 119 (81.5%) did not report any barriers with their telemedicine visit, whereas 27 (18.5%) had a barrier (self-reported). Out of the patients who reported barriers, 12/27 (44%) were unsuccessful in using the video conferencing platform and had to resort to telemedicine via a telephone call, while the remaining 15 (56%) were able to use videoconferencing, but had a reported difficulty with use.

In all, 134 patients who successfully completed the telemedicine visit via video conferencing were further analyzed. The majority of the patients were very (70.9%) or somewhat satisfied (17.9%) with the process of using video conferencing for their visit, and found the experience to be easy (86.6%) (Figure 1). The remaining 11.2% of patients reported that they felt neutral about their satisfaction, with telemedicine ten (7.5%), somewhat dissatisfied four (3%), and very dissatisfied one (0.7%). In all, 75 of patients (50%) were willing to try telemedicine prior to COVID-19, 48 (32%) were unwilling, and 27 (18%) were neutral. Overall, 64 of patients (85.1%) who were unwilling or neutral to trying telemedicine were satisfied with their experience.

The barriers below were identified from the analysis of the 134 patients who were able to use video conferencing telemedicine. The results listed are from an data analysis acquired from the survey responses. These barriers were identified either due to statistically significant correlated variables, or due to strong trends identified in the data.

1.) Age > 61 years, language preference, access to appropriate equipment, experience with videoconferencing software, and willingness to try telemedicine before COVID-19 correlated to patient satisfaction

## Barriers to Telemedicine Demographics

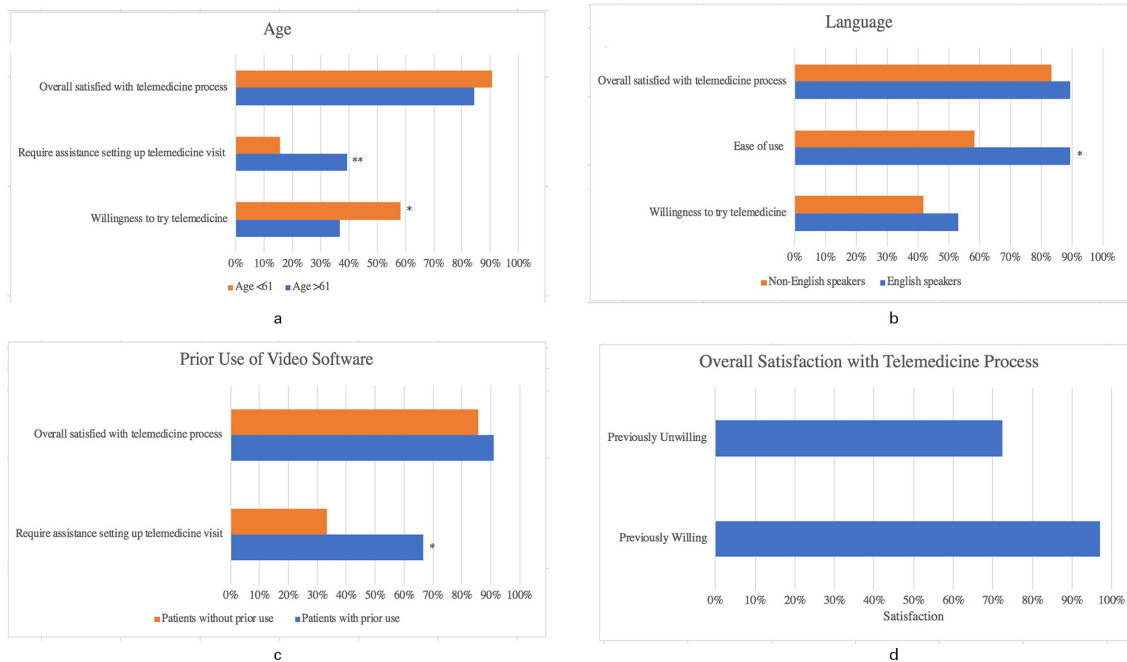


Fig. 2

Barriers to telemedicine demographics.

with the process of using telemedicine for their visit (Figure 2).

**Age.** Mean age of patients was 51.1 years (SD 15.8; 17 to 85). In comparing the patient's age to their willingness to try telemedicine, ANOVA with post-hoc analysis revealed that patients aged > 61 years were 51.5% less willing to try telemedicine than those aged < 45 years ( $p = 0.027$ ). However, ranked ANOVA analysis comparing a patient's age against their overall satisfaction showed no differences between a patient's age and overall satisfaction using telemedicine for their visit ( $p = 0.46$ ). Respondents aged > 61 years were 12.5% more likely to require the assistance of others while setting up their telemedicine visit ( $p = 0.009$ ).

**Language.** Of all respondents, 137 (90.1%) of patients were English speaking, 14 (9.2%) spoke Spanish, and one patient spoke Haitian Creole. Of the English speakers, 109 (89.3%) found the video conferencing platform easy to use, whereas only seven (58.3%) non-English speakers felt the same ( $p = 0.012$ , unpaired  $t$ -test). Further ANOVA and post-hoc analysis revealed no relationships between a respondent's primary language and willingness to try telemedicine ( $p = 0.151$ , unpaired  $t$ -test), or overall satisfaction with telemedicine ( $p = 0.876$ , unpaired  $t$ -test), despite almost 40% of non-English speaking patients feeling that the video conferencing platform was not easy to use.

**Equipment.** Among all respondents, 144 (94.6%) owned a smartphone, 142 (98.5%) of whom reported daily use, and 32 (22.6%) of smartphone users

have never used video conferencing software on their smartphone. Of all respondents, 134 (88.5%) owned a computer, 106 (79.5%) of those patients reported at least daily computer use, and 29 (22.1%) of these respondents have never used a computer-based video conferencing software. Additional statistical analysis did not reveal any relationship between computer or smart phone ownership and reported ease of use, willingness to try, or overall satisfaction with telemedicine.

**Prior use of video conferencing software.** Of all respondents, 36 (24.4%) had never used videoconferencing software and 30 of these patients (83.3%) were satisfied with their telemedicine visit. Of the patients who used video conferencing in the past ( $n = 115$ ; 75.6%), 104 (90.9%) of them were satisfied with their telemedicine visit. Furthermore, 12 (33.3%) of those who have never used video conferencing software required assistance from others in setting up their telemedicine visit, as compared to only 12 (10.7%) with those who used videoconferencing software daily ( $p = 0.032$ , one tailed  $t$ -test).

**Willingness to try telemedicine.** Of all respondents, 46 (30.6%) stated that they were unwilling to try telemedicine prior to the COVID-19 pandemic, 79 (52.2%) stated that they were willing, and 27 (17.2%) stated that they were neutral. Chi-squared test of independence revealed a significant relationship between a patient's willingness to try telemedicine before COVID-19 and how satisfied they were with teleconferencing for their visit ( $n = 113$ ; degrees of freedom ( $df$ ) = 4;  $p = 0.0003$ ). Of the patients who were willing to try telemedicine prior to COVID-19,

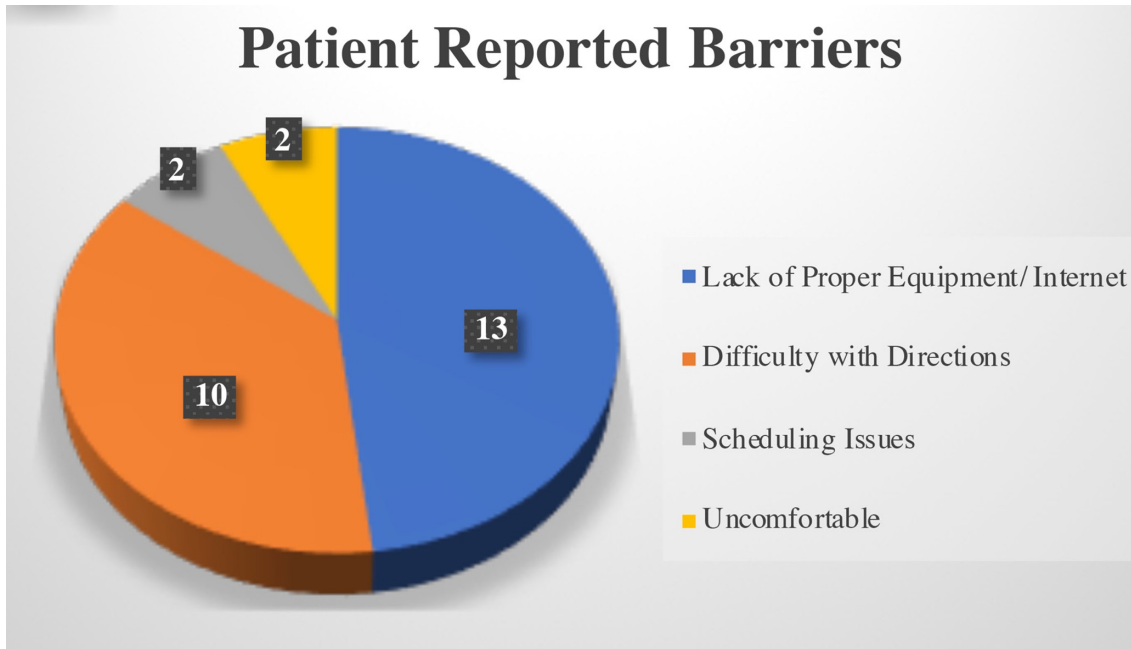


Fig. 3  
Patient-reported barriers.

76 (97.1%) were satisfied. Of those who were unwilling to try telemedicine before COVID-19, 33 (72.3%) were satisfied with teleconferencing for their visit.

2. What did patients that reported dissatisfaction with telemedicine via videoconferencing for their visit consider to be a barrier to an effective telemedicine visit?

Patient reported barriers to video conferencing included lack of proper equipment/internet connection ( $n = 13$ ), scheduling difficulty ( $n = 2$ ), difficulty following directions ( $n = 10$ ), and discomfort/awkwardness during visit ( $n = 2$ ) (Figure 3).

### Discussion

It is likely that a significant number of outpatient orthopaedic visits will continue to use telemedicine for the foreseeable future, even beyond the COVID-19 pandemic.<sup>5</sup> Many patients and providers have become familiar with the telemedicine platform, and are gaining an appreciation for its value in certain clinical settings. Very few studies in the current literature discuss barriers specifically related to patients, and no known studies identify the patient barriers to video conferencing telemedicine, specifically in an orthopaedic setting in the COVID-19 era.<sup>5</sup> In this study, we identified two sets of patient barriers to video conferencing telemedicine: one specifically reported by patients in response to a specific survey question.

The first study question was assessed with a set identified based on patient characteristics of those patients who completed a videoconferencing visit, but either were dissatisfied with the process or found some degree

of difficulty with use. Barriers based on patient characteristics included: age > 61 years, non-English primary language, inexperience with video-conferencing software and unwillingness to try telemedicine prior to COVID-19.

To answer the second study question, we asked patients that reported dissatisfaction with using teleconferencing for their visit to specify barriers to a effective telemedicine visit from their perspective. The patient identified barriers included lack of proper equipment/internet connection ( $n = 13$ ), scheduling difficulty ( $n = 2$ ), difficulty following directions ( $n = 10$ ), and discomfort/awkwardness during visit ( $n = 2$ ) (Figure 1).

Due to COVID-19 pandemic and ensuing adoption of telemedicine, adjustments have been made through legislation to address some institutional and legal barriers; however, patient barriers have not been addressed. The barriers identified in this study could be useful in informing decision-making to improve quality and accessibility of care provided virtually. Barriers such as lack of proper equipment/internet connection, which make up 55% of the patient-reported barriers, should be proactively addressed. Inquiry about the details of the computer equipment/internet connection available at a patient's home should be made prior to scheduling a telemedicine visit. If inadequate equipment is suspected, proper directions should be provided to patients in order to secure appropriate equipment. However, if patients are unable to acquire the appropriate equipment, efforts should be made to provide in-person visits. Another addressable patient-reported barrier is difficulty following directions; efforts could be taken to provide more robust

directions or having IT staff available to assist for patients at risk of finding the directions difficult to follow.

The key in addressing this problem is identifying patient characteristics that are predictive of patients that would be at risk for having difficulty of use. A breakdown of characteristics showed that age > 61 years, being a non-English speaker, and lack of prior experience using video conferencing software are predictive of increased difficulty with use of the telemedicine platform. Interestingly, patients aged over 61 years reported that they are significantly less willing to try telemedicine compared to younger patients; however, there was no difference in overall satisfaction between the two groups. This is likely due to simple preference for in-person visits for those aged older than 61 years, but at this time they chose a telemedicine visit given the circumstances in the beginning of the COVID-19 pandemic. This is further supported by the finding that age greater than 61 years is predictive of a higher likelihood of patient's needing assistance for set up of video conferencing platform (39.5%;  $n = 32$ ) when compared to patients aged < 61 years (15.6%;  $n = 11$ ), and these patients most often asked assistance from their children (51.5%). Needing assistance for set-up translates to difficulty with use and likely contributes to why patients in this age group report unwillingness to try telemedicine. It would therefore be beneficial in this age group to have a family member/friend who has experience with video conferencing be available in order to facilitate the use of the platform, especially considering that satisfaction levels do not vary with age once the patient actually uses the telemedicine platform.

A patient's primary language not being English also increases the likelihood that the patient will experience difficulty using videoconferencing software. Only four (58.3%) of non-English speakers found the video conferencing platform to be easy to use, whereas 120 (83%) of English speakers found it easy to use ( $p = 0.012$ , unpaired  $t$ -test). Despite this, there were no differences in satisfaction or willingness to use telemedicine between English speakers and non-English speakers. It is also possible that, in this case, that the software used is biased towards English speakers. This demonstrates the need for language and cultural differences to be taken into account when creating and developing software that will be used by a diverse population. Additionally, it is imperative to have trained interpreters to help patients use their telemedicine video conferencing interface appropriately.

Another key barrier identified was lack of prior experience using a video conferencing software. Trends were seen with lack of prior experience and difference in ease of use and satisfaction. Among patients who have never used video conferencing software, 12 (33.3%) required assistance from others in setting up their telemedicine visit, compared to only 11 (10.7%) with those who used video conferencing software daily. Additionally, 104

patients (90.9%) who had experience using video conferencing software were satisfied with using teleconferencing for their visit versus only 30 patients (83.3%) who had no experience. This trend, although not statistically significant in this cohort, might be significant in studies with larger sample sizes. This suggests a potential association, that lack of experience both increases the likelihood of needing extra help to set up the visit, as well as could increase the likelihood of being less satisfied with using teleconferencing for a visit.

Another important component of a successful telemedicine visit is patient satisfaction. Analysis of patients who completed video conferencing visits helped us identify patient characteristics that are predictive of patient satisfaction with using teleconferencing. Patients who were unwilling to try telemedicine prior to the COVID-19 pandemic, and lack prior experience using video conferencing software, have lower satisfaction using teleconferencing for visits compared to their respective counterparts. After understanding that patients aged over 61 years were statistically more likely to be unwilling to try telemedicine, there could be a higher rate of dissatisfaction with using teleconferencing for visits in this population, as willingness to try is linked to satisfaction.

In light of the above-mentioned patient barriers, we recommend the use of a routine screening script prior to scheduling a patient for a telemedicine visit. The screening involves questions about willingness to use telemedicine, availability of equipment that could facilitate a smooth video conferencing experience, familiarity with videoconferencing, and language of choice. Patients could be screened for or against telemedicine based on the patient characteristics. In addition, efforts can be made to have IT personnel available, trained interpreters available, or have a technologically savvy family member/friend available during the visit for specific patients based on their characteristics.

There are a few inherent limitations to the design of survey-based studies, most notably recall bias. Due to the recency of the COVID-19 pandemic, we were limited in our sample size, which further limited our capacity to draw stronger conclusions. However, given the prevalence of telemedicine in today's medical landscape, a timely study needed to be conducted to best understand the limitations affecting patients in this climate. Our response rate, although reasonable for a survey, is not near a more desirable level. The lower than ideal response rate likely introduces a bias, which potentially underplays the barriers that were present. This bias is likely due to the fact that patients who were more conversant with technology and more satisfied might be more willing to respond to the survey than those who are not. The poor response rate may be due to a number of factors which are difficult to assess in the setting of the COVID-19 pandemic. We were also only able to include patients who scheduled

a telemedicine visit; patients who declined a telemedicine visit for any reason were unable to be included, and data about these patients is unavailable for analysis. Inclusion of only foot and ankle and hand subspecialties limit effectiveness of conclusions, both in terms of actual numbers and potential applicability to other subspecialties; however, these subspecialties are robust in the outpatient setting, had video conferencing available, and had adequate clinical volume during this time period to warrant analysis. Future studies would benefit with inclusion of other subspecialties. Subsequent studies would further benefit from analysis of differences in satisfaction for new patients versus follow-up patients. Lastly, we understand that there may be multiple factors affecting patient barriers, and while this research sheds light on barriers to effective patient care via telemedicine, future research would benefit from further analysis of these barriers and their interactions.

Only one video conferencing software used at our institution was used to assess patient barriers. Although there are minor differences among the different video conferencing softwares available, a majority require a similar baseline technological knowledge and equipment from the patients, making these results generalizable to other platforms.

In conclusion, our study offers institutions and orthopaedic surgeons an opportunity to understand factors influencing patient barriers to access, satisfaction, and ease of use regarding telemedicine. Lack of proper equipment or adequate internet connection speed, and difficulty following directions are the most common patient-reported barriers. Patients aged older than 61 years, non-English speakers, patient without video conferencing experience, and patients who were unwilling to try telemedicine, may experience more difficulty while using a video conferencing platform, and may be less satisfied with their telemedicine experience. Efforts such as a screening tools implemented via a scheduler could be invaluable in identifying patients who potentially would not have a successful telemedicine outcome, or in identifying patients in need of extra assistance in the form of interpreters, technical support, or family/friend support in order to make the telemedicine experience more successful.



### Take home message

- Telemedicine use has increased in the COVID-19 era, yet little is known about barriers affecting patients' access, ease of use, or satisfaction with telemedicine in the orthopaedic setting.
- Identified barriers, including lack of equipment and/or internet connection, difficulty with directions, older age, non-English primary language, and discomfort with video conferencing should be considered when scheduling patients for telemedicine visits.

### Twitter

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- A. B. Sedani: Data curation, Formal analysis, Investigation, Writing – original draft.
- L. C. Baker: Data curation, Investigation, Writing – original draft, Writing – review & editing.
- P. W. Owens: Project administration.
- S. D. Dodds: Project administration.
- A. A. Aiyer: Project administration.

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