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## A Multicenter Evaluation of the Feasibility, Patient/Provider Satisfaction, and Value of Virtual Spine Consultation During the COVID-19 Pandemic

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■ **OBJECTIVE:** To assess the feasibility, patient/provider satisfaction, and perceived value of telehealth spine consultation after rapid conversion from traditional in-office visits during the COVID-19 pandemic.

■ **METHODS:** Data were obtained for patients undergoing telehealth visits with spine surgeons in the first 3 weeks after government restriction of elective surgical care at 4 sites (March 23, 2020, to April 17, 2020). Demographic factors, technique-specific elements of the telehealth experience, provider confidence in diagnostic and therapeutic assessment, patient/surgeon satisfaction, and perceived value were collected.

■ **RESULTS:** A total of 128 unique visits were analyzed. New (74 [58%]), preoperative (26 [20%]), and postoperative (28 [22%]) patients were assessed. A total of 116 (91%) visits had successful connection on the first attempt. Surgeons felt very confident 101 times (79%) when assessing diagnosis and 107 times (84%) when assessing treatment plan. The mean and median patient satisfaction was 89% and 94%, respectively. Patient satisfaction was significantly higher for video over audio-only visits ( $P < 0.05$ ). Patient satisfaction was not significantly different with patient age, location of chief complaint (cervical or thoracolumbar), or visit type (new, preoperative, or postoperative). Providers reported that 76% of the time they would choose to perform the visit again in telehealth

format. Sixty percent of patients valued the visit cost as the same or slightly less than an in-office consultation.

■ **CONCLUSIONS:** This is the first study to demonstrate the feasibility and high patient/provider satisfaction of virtual spine surgical consultation, and appropriate reimbursement and balanced regulation for spine telehealth care is essential to continue this existing work.

### INTRODUCTION

Telehealth is an emerging platform that had relatively limited utilization among spine surgeons before the COVID-19 pandemic and the resultant shutdown of traditional face-to-face care. Reasons for this included the challenge inherent to any transformative change to traditional methods for providing health care, burdensome regulatory restraints such as the need for multistate medical licensure, and inconsistent or uncertain insurance reimbursement. Further, reliability and patient satisfaction of the telehealth evaluation was unknown. All of these created real or perceived prohibitive functional barriers to telehealth care for spine surgeons. Although limitations mentioned above have tempered enthusiasm and acceptance of telehealth among surgical subspecialists in the civilian sector, the military and Veterans Administration have been early adopters.<sup>1-4</sup> Their entrenched hub-and-spoke organizational structure, which covers broad regions with varying degrees of

#### Key words

- COVID-19
- Patient satisfaction
- Spine surgery
- Telehealth
- Virtual consultation

#### Abbreviations and Acronyms

**IQR:** Interquartile range

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resources, makes for a perfect environment to realize the unique benefits of telehealth. Despite the aforementioned challenges, surgical and nonsurgical specialty groups have already reported successful results with telehealth consultation within their fields.<sup>5-9</sup> In addition, telehealth for evaluation and management of patients with spinal cord injuries continues to be increasingly explored by interdisciplinary teams.<sup>10-12</sup> However, the authors are unaware of any studies investigating feasibility, patient/provider satisfaction, or perceived value with telehealth as a vehicle for evaluating and treating spinal disease.

Because of restrictions limiting in-office visits during the COVID-19 pandemic and broadly reduced barriers to practicing telehealth, many health systems quickly adopted telehealth platforms to continue delivering the best care possible to their patients. The mass migration to the telehealth platform was further enabled by Centers for Medicare and Medicaid Services decisions to provide expanded reimbursement and decreased restriction on the format for telehealth services.<sup>13-15</sup> A secondary effect of the changes in telehealth regulations was that video conferences in the patient's home were broadly authorized. This added a level of empathetic connection between the patient and provider at a time when the world was forced to be socially distanced. In some ways, this was a process of clinical care coming full circle. From the original house calls of the past, COVID-19 had ushered in a chance to see patients where and how they live. But questions remained, especially at the provider level, most commonly from spine providers who were naïve to the use of telehealth. Reliably establishing a diagnosis for spinal disease is challenging even with traditional in-office examination. An often-mentioned concern among spine surgeons with telehealth is the inability to perform a physical examination and the possibility that this may result in missed diagnosis and inappropriate treatment. However, Heflin et al<sup>16</sup> showed that physical examination has limited specificity for diagnosis of cervical myelopathy. Likewise, Fogarty et al<sup>17</sup> demonstrated in a systematic review that physical examination, specifically a present Hoffman's sign, adds little to the diagnosis of cervical myelopathy over and above imaging and history. The limited incremental diagnostic value of physical examination has been reported for other common spinal conditions.<sup>18,19</sup> Further, there is no responsible application of telehealth for managing spine surgical disease that does not include an in-person examination before a surgical intervention. Adoption of telehealth as a routine element of outpatient care does not invoke an all-or-nothing condition on physical examination. There are elements of gross neurological assessment that can be replicated virtually, such as gait assessment and single-leg heel rise. Further, the forced experience with telehealth that has arisen from the COVID-19 pandemic may serve to reinforce the fact that spine surgical diagnosis is a multifactorial phenomenon that is most influenced by history and imaging/testing, with physical examination having a greater impact on assessing severity of disease as opposed to presence. In the end, consideration of telehealth as a viable augment to routine clinical practice for the spine surgeon requires an empiric assessment of the ability for this medium to generate usable information that supports clinical decision-making and/or tracking outcomes. Faced with a void in the literature on the topic of virtual spine consultation and a real need to find alternative, effective means for communicating with

and caring for our patients during the COVID-19 experience incidentally created an incubator for a natural experiment on the feasibility of telehealth for assessing spine disease.

The purpose of this study was to assess the feasibility, patient and provider satisfaction, and perceived value of the rapid conversion from traditional in-office to telehealth visits for spine consultation during the COVID-19 pandemic. The life-altering and unprecedented experience associated with this pandemic has produced a call to arms for our medical community, and many have stepped up as heroes and disruptive innovators. Although most spine providers have not been directly involved in care of patients with COVID-19, many have applied this time away from elective surgery to explore telehealth as a new format for delivering care to their patients in need. Coming out of this experience we may better understand the feasibility and eventually best practices for incorporating telehealth as a care platform that can rival traditional in-office visitation for certain patients, conditions, or situations.

## MATERIALS AND METHODS

### Study Design

This study was initiated as an institutional review board exempt quality-improvement project at 4 health care institutions within the first week of restrictions imposed on elective surgical care as a result of the COVID-19 pandemic. Three institutions were in the Midwest and one was a US military medical center on the east coast. Overall, 10 fellowship-trained surgeons including 8 orthopedic spine surgeons and 2 neurosurgeons performed telehealth visits. The data from each site were later deidentified and combined under an institutional review board-approved retrospective observational protocol. Data were retrospectively collected using a standardized data collection tool and surveys for patients undergoing telehealth visits with a spine surgeon between March 23, 2020, and April 17, 2020.

### Inclusion and Exclusion Criteria

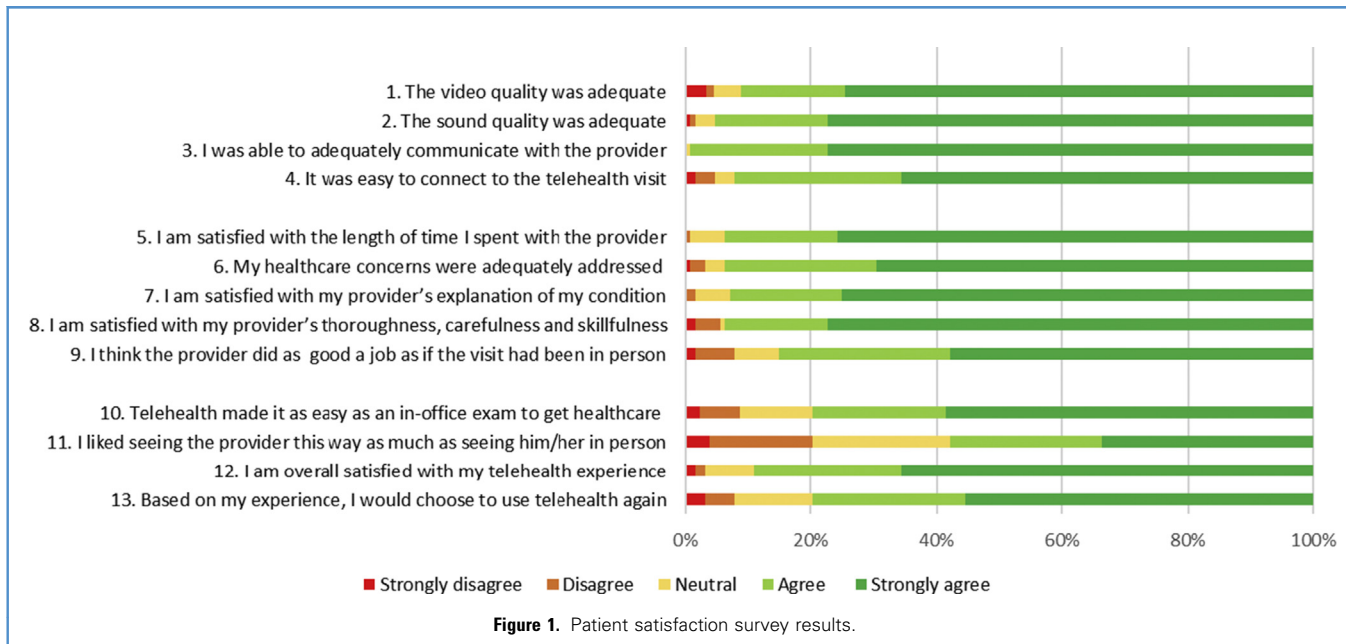
Patients were eligible if they underwent telehealth consultation with a participating spine surgeon via video or phone between March 23, 2020, and April 17, 2020.

### Outcomes

For each telehealth visit, the following elements were recorded: demographic factors, patient satisfaction, surgeon satisfaction, technique-specific elements of the telehealth experience such as audio and video quality, provider confidence in diagnostic and therapeutic assessment, and patient perceived value. Both phone and video telehealth visits were included. Both new and established patient visits were included.

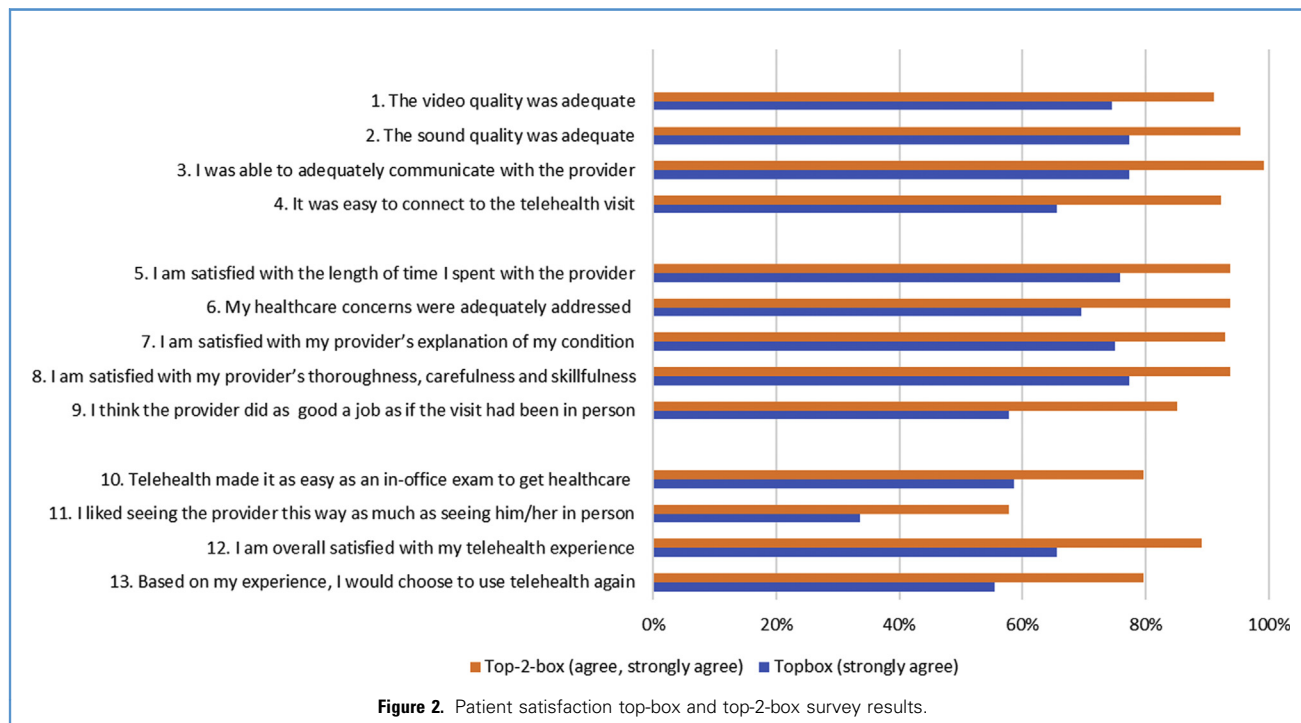
Patient and provider satisfaction was assessed using a modified Agency for Healthcare Research and Quality telehealth questionnaire,<sup>20</sup> which used a 5-point Likert response scale (Figures 1 and 2). A single question regarding the patient perceived value for a telehealth spine consultation visit in comparison to an in-office visit was recorded. The patient survey was conducted via telephone after the visit by a coordinator or resident/fellow.

Each of the 13 patient satisfaction questions was reported as means, and top-box and top-2-box percentages were calculated.



Further, the questions were grouped into 3 domains: technical, provider-specific, and patient experience. Overall satisfaction of each domain was calculated as the sum of score/total score

possible times 100. This method accounted for when a telephone visit was performed and the question regarding video did not apply.



## Statistical Analysis

Descriptive statistics were used to describe the baseline characteristics of the enrolled cohort of patients. Means were reported for all variables, and median and interquartile range (IQR) (25<sup>th</sup> percentile to 75<sup>th</sup> percentile) were reported for the skewed (non-normal) data obtained from the satisfaction survey. To compare patient satisfaction between subgroups, both Mann-Whitney U test and analysis of variance were used for 2- and multiple-mean groups as the data were nonparametric. Statistical analysis was performed using JASP (Amsterdam, the Netherlands).

## RESULTS

### Subject Cohort

A total of 143 unique patient visits were recorded. Of those, 15 were excluded because of incomplete or incorrectly completed patient surveys, resulting in a total of 128 unique visits available for analysis. The mean age was 55.1 (standard deviation, 14.9) years, and 69 (53.9%) were male. Video telehealth visits were used in 90 (70.3%) and audio-only in 38 (29.7%). The telehealth visits were conducted for new patients in 74 (58%), preoperative patients in 26 (20%), and postoperative patients in 28 (22%). The region of disease was cervical in 35 (27.3%) and thoracolumbar in 93 (72.7%).

### Feasibility

Of the 128 visits with provider-reported data, 116 (91%) reported a successful connection on the first attempt and zero reported an unsuccessful connection resulting in cancellation of the visit. Of the remaining 12 visits with initial unsuccessful connections, 7 (58%) resulted in a delay of less than or equal to 15 minutes, 4 (33%) resulted in a delay of greater than 15 minutes, and 1 (8%) visit had to be converted to audio-only from video.

Surgeons self-reported their level of confidence in diagnosis and treatment plan for each patient encounter. Of 128 visits, surgeons answered “>75% confident or as confident as if I had seen the patient in-office” 101 times (79%) when assessing their diagnosis and 107 times (84%) when assessing their treatment plan. For confidence in diagnosis, surgeons reported confidence at less than 75% for 27 visits (21%). Of those, 13 (48%) were attributed to the telehealth-specific format and 14 (52%) were attributed to need for additional information such as imaging or other evaluation, which may have been a similar feature of an in-office visit. For confidence in treatment plan, surgeons reported confidence at less than 75% for 21 visits (16%). Of those, 11 (52%) were attributed to the

telehealth-specific format and 10 (48%) were attributed to the need for additional information such as imaging or other evaluation. Thus, the majority of visits occurred successfully from a technical perspective. For those visits that did not lead to a confident diagnosis and treatment plan, in approximately one-half of cases, this was related to insufficient information, which may have hindered an in-office examination to a similar degree.

### Patient Satisfaction (Figure 1)

**Overall Satisfaction.** The mean overall satisfaction score was 89%, and the median was 94% (IQR: 82%–98%) (Table 1). The mean and median overall satisfaction score for telephonic and video telehealth visits was 86.4%; 91% (IQR: 78%–95%) versus 90.6%; 94% (IQR: 85%–98%), respectively. Patient satisfaction with video was significantly better than telephone for telehealth visits ( $P = 0.02$ ). Mean patient satisfaction was not significantly different with patient age, location of chief complaint (cervical or thoracolumbar), and type of visit (new, preoperative, or postoperative) (Table 2).

Mean patient satisfaction did not significantly vary based on prior use of telehealth or with surgeon experience over the time frame of this study. Patient satisfaction did not differ significantly between surgeons reporting prior experience in telehealth compared with surgeons reporting no prior experience ( $P = 0.192$ ). Further, a significant learning curve effect was not witnessed for surgeons unaccustomed to using a telehealth format. Patient satisfaction did not significantly change between the first 3 patients seen and the final 3 patients seen during the study period.

**Technical Domain.** The 4 questions regarding technical satisfaction (questions 1 through 4) all had a mean score >4.5 out of possible 5 and median of 5 due to right skew of results. The mean and median overall technical result was 93%; 95% (IQR: 87%–100%) (Table 1). The top-2-box analysis (strongly agree and agree) was all greater than 91% (91%–99%) for the 4 questions relating to the technical factor (Figure 2).

**Provider-Specific Domain.** Patients reported at least a mean of 4.3 or greater out of 5 for the 5 provider domain questions (questions 5 through 9). The overall mean score of the 5 provider-related questions was 92% and the median score was 96% (IQR: 84%–100%) (Table 1).

**Patient Experience Domain.** The patient experience domain was based on 4 questions (questions 10 through 13). Patients strongly agreed and agreed >79% for 3 of the questions, 10, 12, and 13. The

**Table 1.** Patient Satisfaction Survey Results Overall and by Domain

	Mean (%)	Median (%)	IQR (%)	Top-Box (%)	Top-2-Box (%)
Overall	89	94	82–98	66	88
Technical domain	93	95	87–100	74	95
Provider-specific domain	92	96	84–100	71	92
Patient experience domain	83	88	75–95	53	77

IQR, interquartile range.

**Table 2.** Summary of Covariate Analyses

	N	Mean	SD	P
Age				
≥40	105	87.8	11.6	0.55
<40	23	85.7	14.0	
Sex				
Male	69	87.3	12.4	0.996
Female	59	87.6	11.7	
Location				
Cervical	34	87.6	14.0	0.509
Lumbar	94	87.3	11.3	
Format				
Audio	38	79.7	11.6	<0.001
Video	90	90.6	10.7	
Visit type				
New	74	88.2	12.3	0.545
Preoperative	26	85.2	11.3	
Postoperative	28	87.3	12.0	

SD, standard deviation.

mean score for these 3 questions was 4.2 or greater out of 5. The question with the lowest top-box and top-2-box for the complete 13-question survey was question 11, a question within the patient experience domain. This question was phrased, “I liked seeing the provider this way as much as seeing him/her in person.” A total of 58% of patients agreed or strongly agreed with this statement (Figure 2). This question was an outlier in terms of top-2-box responses, where all other questions ranged from 80% to 99% for top-2-box (Figure 2). Some patients who had overall excellent satisfaction scores commented during the interview that they simply preferred in-person contact with the provider, despite a productive telehealth experience.

### Provider Satisfaction

The results of the provider satisfaction survey are detailed in Figure 3. In general, the satisfaction was high across the entire survey with 1 notable exception, question 7.

The top-box and top-2-box responses for question 7 were selected 26% and 30%, respectively (Figure 4). This question asked, “I would have preferred to see this patient in person, instead of via telehealth.” A corollary was asked in the patient survey (question 11), and it was an outlier in that survey. However, the wording was substantively different, in that it did not include the word “instead.” Thus, the question asked of the providers created a competition between telehealth and in-office examination, implying a need for determining a superiority of the two. As a result, this question has the furthest deviation from the norm of all questions asked in the provider survey. For purposes of summarizing results, it may be more accurate to report the inverse

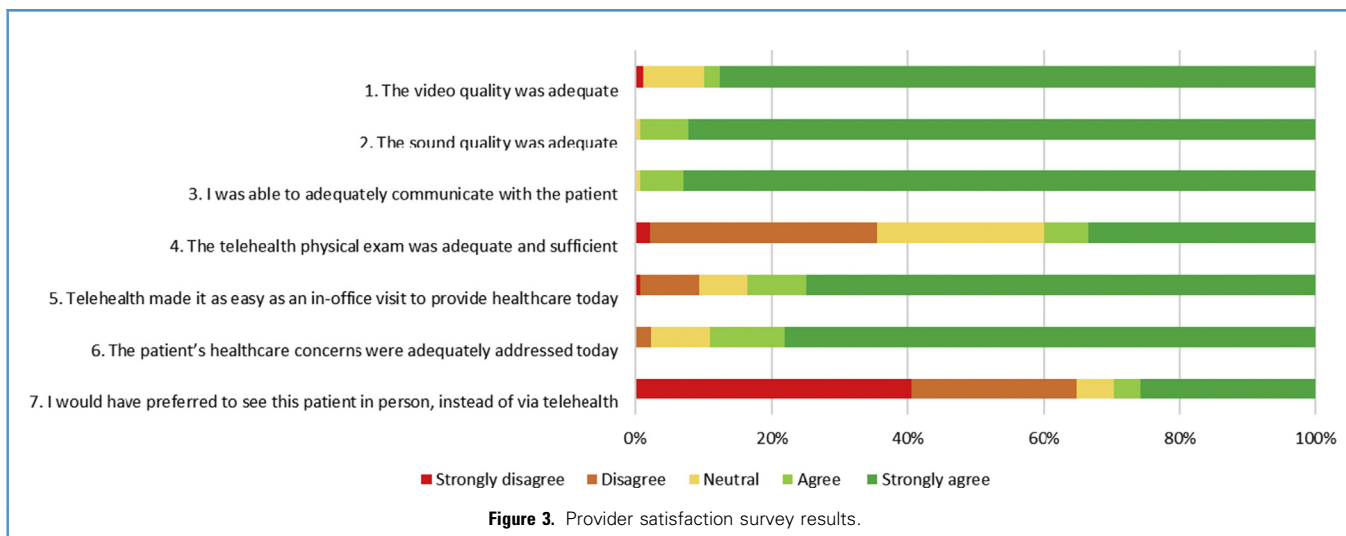
response to this question. A total of 41% of providers selected “Strongly Disagree” and 65% of providers selected “Disagree” or “Strongly Disagree” for this question.

Demonstrating that this deviation was likely an artifact of the question, as opposed to a real concern with the concept of telehealth, a single summary provider survey question asked, “I would choose to perform this visit as a telehealth visit, after the COVID restrictions are lifted.” Answer “Yes” was selected for 74% of visits and “No” for 26%. Similarly, patients were asked on the 5-point Likert scale to answer the question “Based on my experience, I would choose to use telehealth again” (question 13), and 80% selected “Agree” or “Strongly Agree.”

The Mann-Whitney U test was used to assess whether the type of visit affected provider confidence in diagnosis and/or treatment. Postoperative visits were compared with combined new and preoperative visits, and confidence was grouped as either >75% or <75%. No significant difference was noted in provider confidence between postoperative and new/preoperative visits for diagnosis ( $P > 0.005$ ) or treatment ( $P > 0.005$ ).

### Patient Perception of Value

Patients were asked to assess their perception of the value of a telehealth visit, with the question “Compared to an in-office exam, how much do you think a telehealth visit should cost?” Of 128 patients, 14 (11%) replied “Nothing,” 32 (25%) replied “Much less than an in-office visit (less than 50%),” 53 (41%) reported “A little less than an in-office visit (50%–99%),” 24 (19%) reported “Same as an in-office visit,” and 5 (4%) reported “More than an in-office visit” (Figure 4).

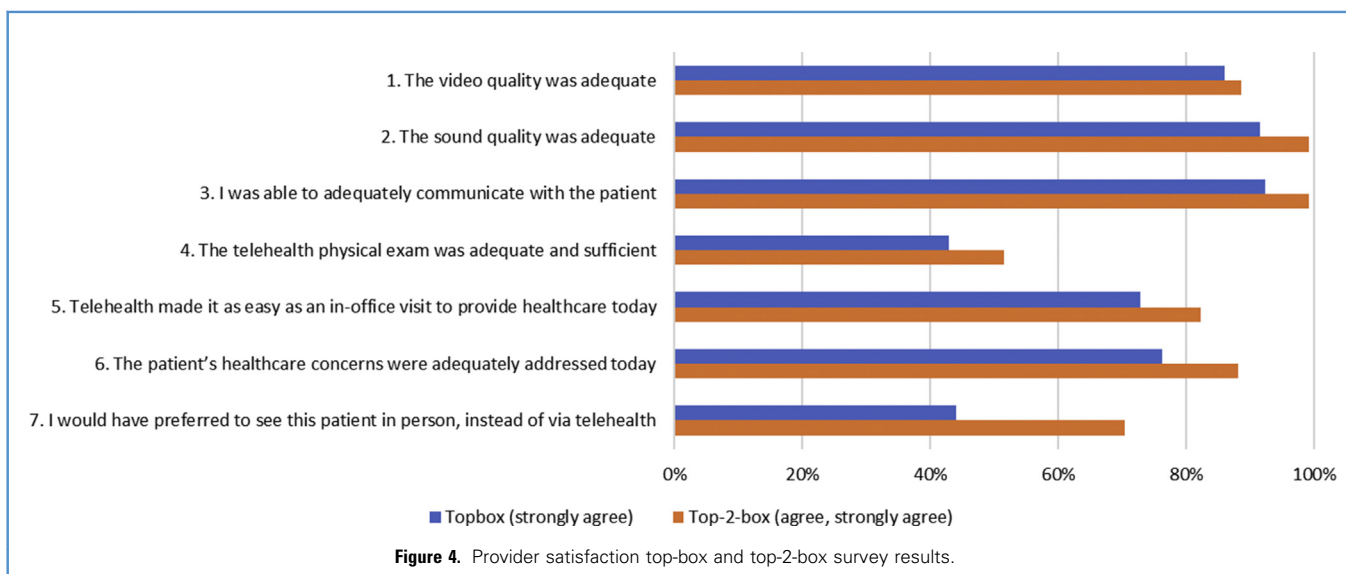


**DISCUSSION**

This is the first study to demonstrate excellent feasibility and high patient/provider satisfaction, as well as perceived value of virtual spine surgical consultation. The COVID-19 pandemic has stressed the global health care system in an unprecedented way. The only comparator to this cataclysmic event is war. Every war, whether the enemy is a military foe or a pathogenic microbe, presents immense opportunities to innovate and educate. The traumatic events are so painful that we owe it to ourselves and our progeny to learn every lesson we can. A lesson learned from the response to the ongoing pandemic is that telehealth is a meaningful platform for spine surgical care. The modifications in regulation and insurance approval, which have greatly deterred the use of this

technology in the past, must be reassessed going forward. The empathetic connection that is fostered by in-home consultation must remain a protected opportunity to realize the maximum benefit from telehealth consultation.

A limitation of telehealth is the lack of the hands-on examination, where further research is needed. Lastly, in regard to physical examination, there is room to look at this as another opportunity to innovate. The rapid assimilation of telehealth consultation across medical specialties was supported in part by the ubiquitous access to technology that supports internet real-time communication. It may be that additional readily available technology can be used to gain unique and better insight into the physical assessment of spinal function in our patients. Wearable



technologies that can monitor gait (e.g., cycle, cadence, step length, and velocity) have been a source of great research interest recently. Traditional elements of physical examination that may or may not have a direct impact on diagnosis and prognosis may be replaced by data from wearable technology that does provide a direct impact.<sup>21-23</sup>

One overarching lesson learned from our COVID-19 pandemic experience is that health care needs to adapt and innovate to remain effective. Spine surgeons are certainly well aware of the need and value of exploring innovative technology in the operating room (i.e., implants, biologics, and imaging modalities), but changes in the basic process of clinical care delivery have not been a focus in the past. Exploration of and ultimate conversion to telehealth as a part of routine clinical practice for spine providers represents a new mandate to innovate. Although the social distancing required by the COVID-19 pandemic induced a nationwide need for alternate means of connecting with patients, in our internet-driven age, there existed other environmental factors, which also may benefit from the ability to access patients at a distance, for instance congested metropolitan areas or sparsely populated rural ones. The prior successful military experience with telehealth for many subspecialized fields serves as a good example of the relevance of this platform of care beyond the unique times in which we now find ourselves.<sup>1,2,4</sup>

Before and even at the beginning of the COVID-19 pandemic, the concept of virtual spine consultation invoked many perceived concerns, especially for those who had previously not engaged in this platform of care. Specific to spine surgery, criticisms, and critiques have included difficulty with physical examination, poor confidence in diagnosis and/or treatment, technical connection issues, and poor patient satisfaction or perceived value. This study empirically assessed each of these concerns. The data collection tools were specifically created to explore the validity of the aforementioned concerns, because they were potent barriers to acceptance of telehealth in the early days of the COVID-19 pandemic—induced restrictions on elective spine surgical care. The results of this study should provide a level of confidence and comfort to providers not familiar with virtual spine consultation. This study provides a cursory assessment of the general feasibility and impact of telehealth-mediated spine care. It demonstrates that patients and surgeons are overwhelmingly capable of effectively communicating in this format and that these visitations result in meaningful benefit to patients as evidenced by high patient satisfaction and provider confidence in the diagnosis and treatment plan. Validation of the accuracy of diagnosis obtained can and should be compared with the “gold standard” in-office clinical examination, and our group plans to perform this follow-on study. Further, we are actively assessing the practicality and utility of virtual physical examination for spine patients. In the end, another name for “perceived concern” is a myth, and the best way to myth-bust is to empirically assess. The results of this study should start to put to rest the myths mentioned above and allay concerns among providers naïve to the concept of virtual consultation for spinal disease.

As a means for assessing satisfaction, we applied a common convention of top-box and top-2-box assessment. Clinic satisfaction surveys often are skewed toward the positive end, and as such industry consulting (e.g., Press-Ganey) on this aspect of patient experience and customer experience, in general, dichotomously

assess satisfaction based on reporting the highest score possible or the highest 2 ratings possible and considering all other scores failure. This convention was applied and reported in our results, and it seems appropriate for most of the patient and provider survey questions asked. However, 1 notable exception was question 11 and question 7 for the patient and provider surveys, respectively. In these questions, despite strongly favorable responses for the other questions, indicating an overall high satisfaction with the technical format and experience, patients and providers retained a relatively strong preference for in-person visitation. This was a new experience for patients and providers, alike. As telehealth becomes a more common platform of care, one would expect that this nostalgic conception will come in line with the other measured elements of the encounter. In testament to this, despite the reduced rate of top-box and top-2-box responses for questions 11 and 7, when patients and providers were asked directly if they would choose to use telehealth again, they responded almost 80% in the affirmative.

This study is certainly subject to limitations. The largest limitation is that during the time period of the study, patients were not able to see the provider for an in-office visit due to mandated guidelines. When in-office visits and telehealth are equally available, patient perception of telehealth may be different. The methods of this study and the reality of the situation do not allow for validation against in-office examination. Further, the variation in technical platforms used, which were largely site-specific, and the organic support (i.e., pre-existing telehealth activities and telehealth on-site experts to participate in “rooming” and addressing patient technical concerns) available are covariants that cannot be independently assessed by our study. Thus, this work is preliminary. It does not establish best practice, but does report several methods, each of which was associated with a high rate of patient/provider satisfaction. Comments from patients, which do not translate to quantifiable metrics for statistical analysis, highlighted that specific elements of the encounter are favored by patients. One specific one is the ability to “share screens” and demonstrate in real-time key imaging findings. Despite this limitation, most patients and providers reported that they would use telehealth again in the future.

## CONCLUSIONS

This work demonstrates that patients new and established to a spine surgeon can adequately be assessed and provided high-quality medical information that supports a definitive diagnosis and treatment plan. As a testament to the feasibility and value of virtual spine consultation, patients who had no other access to spine surgical care during the early days of the COVID-19 pandemic other than going to already overburdened and potentially dangerous emergency rooms have been seen within the context of this quality assurance project and already progressed to successful intervention (e.g., injections and surgery) to address their semiurgent spine needs. Spinal disease is a biopsychosocial phenomenon, and telehealth provided a vehicle for empathetic connection capable of allaying patient concerns during these unprecedented times. Patients very much appreciated the opportunity to have some connection with a care network at this time. Based on the results of this study, myths



that have tempered adoption of telehealth as a part of the routine process of outpatient care have been dispelled. However, at the same time, if virtual spine consultation is to persist as a standard care platform, it is important that insurers and regulators not reinstate restrictions that quench the newfound interest in telehealth.

### CRedit AUTHORSHIP CONTRIBUTION STATEMENT

**Sandra Hobson:** Conceptualization, Methodology, Formal analysis, Investigation, Resources, Data curation, Writing – original draft, Writing – review & editing, Visualization. **Ilyas S. Aleem:** Conceptualization, Investigation, Resources, Data curation, Writing – review & editing. **Miranda J. Bice:** Conceptualization, Investigation, Resources, Data curation, Writing – review & editing. **Bilal B. Butt:** Conceptualization, Investigation, Resources, Data curation, Writing – review & editing. **Mohamad Bydon:** Conceptualization, Methodology, Investigation, Resources, Data curation, Writing – review & editing. **Benjamin D. Elder:**

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