Spine Patient Satisfaction With Telemedicine During the COVID-19 Pandemic: A Cross-Sectional Study

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Abstract

Study Design: Original research, cross-sectional study.

Objectives: Evaluate patient satisfaction with spine care delivered via telemedicine. Identify patient- and visit-based factors associated with increased satisfaction and visit preference.

Methods: Telemedicine visits with a spine surgeon at 2 practices in the United States between March and May 2020 were eligible for inclusion in the study. Patients were sent an electronic survey recording overall satisfaction, technical or clinical issues encountered, and preference for a telemedicine versus an in-person visit. Factors associated with poor satisfaction and preference of telemedicine over an in-person visit were identified using multivariate logistic regression.

Results: A total of 772 responses were collected. Overall, 87.7% of patients were satisfied with their telemedicine visit and 45% indicated a preference for a telemedicine visit over an in-person visit if given the option. Patients with technical or clinical issues were significantly less likely to achieve 5 out of 5 satisfaction scores and were significantly more likely to prefer an in-person visit. Patients who live less than 5 miles from their surgeon’s office and patients older than 60 years were also significantly more likely to prefer in-person visits.

Conclusions: Spine telemedicine visits during the COVID-19 pandemic were associated with high patient satisfaction. Additionally, 45% of respondents indicated a preference for telemedicine versus an in-patient visit in the future. In light of these findings, telemedicine for spine care may be a preferable option for a subset of patients into the future.

Keywords
COVID-19, telemedicine, patient satisfaction, telehealth, spine surgery

Introduction

On March 11, 2020 the World Health Organization (WHO) declared COVID-19 a global pandemic.1 Shortly thereafter, the United States federal government issued a proclamation reinforcing the immediate threat posed by COVID-19 and the need to enact safety measures.2 Overnight, clinicians were tasked with providing routine care while avoiding direct contact with patients. To that end, orthopedic and spine providers rapidly introduced and expanded telemedicine programs through previously underutilized digital communication platforms.3-10

Prior to the COVID-19 pandemic, in-person visits were the standard in the United States for orthopedic care. However, in-person clinical visits can be impractical for patients who...
struggle with mobility or live in remote areas. The potential for telemedicine to improve access to care and reduce costs lead some practices to investigate telemedicine for orthopedic outpatient care, consultation, and rehabilitation even before the COVID-19 pandemic.11-24 These studies demonstrated that telemedicine visits are safe, feasible, associated with high patient satisfaction, and cost-effective in patients with orthopedic concerns.11,15-24

Previous studies included general orthopedic, pediatric orthopedic, sports medicine, arthroplasty, and trauma practices without large numbers of adult patients presenting to spine surgeons. The majority of these investigations focused on one aspect of clinical practice (ie, postoperative rehabilitation, remote consultation with provider present, postoperative visit, etc). Furthermore, some authors have questioned whether telemedicine would be well tolerated by adult spine patients and providers.13,15

Given that telemedicine offerings may persist into the future, it is important to assess spine patient satisfaction with the platform and identify related factors. Patient satisfaction is important to maintaining a successful practice and increases orthopedic patient follow-up.25 As our outpatient spine practices shifted to telemedicine during the COVID-19 pandemic, we sought to investigate patient satisfaction with telemedicine and identify factors associated with satisfaction and preference for future telemedicine visits.

**Materials and Methods**

Each site individually obtained institutional review board (IRB) approval prior to contacting patients and initiating data collection. This study included patients from 2 private practices based in Philadelphia, Pennsylvania and Plano, Texas. Patients who had a telemedicine visit with a spine surgeon from March 16, 2020 through May 16, 2020 were identified from the electronic medical record. Visits were conducted by telephone or webcam-based platform at the discretion of the treating surgeon. A total of 27 spine surgeons provided telemedicine visits. Each patient was contacted electronically (email or text) via an IRB-approved message containing a link to a voluntary and anonymous web-based survey (Alphabet Inc). After obtaining informed consent, patients were instructed to complete the survey for their telemedicine visit(s) during the study period. The survey consisted of 8 questions based on prior telemedicine survey-based studies.16 Patient satisfaction was measured using a 5-point Likert-type scale. Additional questions were designed to assess patient demographics and preference for future visits (Figure 1).

Statistical analysis was performed using Stata version 13.1 (StataCorp LP). Chi-square analyses were used to compare patients based on site, overall satisfaction score 4 out of 5 and below versus 5 out of 5), and on the preference of a telemedicine visit over an in-person visit. Patient and telemedicine
visit characteristics were tested for association with satisfaction and telemedicine preference using multivariate regression models, which selected variables in a backward stepwise fashion. Variables with the highest $P$ value were sequentially removed until only those with $P$ values $<.200$ remained in the model. Multivariate regressions controlled for potential confounding variables to identify independent risk factors for each outcome. All tests were 2-tailed, and the statistical difference was established at a 2-sided alpha level of .05 ($P < .05$).

No outside funding was utilized to perform this study.

### Results

During the first 2 months of the COVID-19 stay at home order, a total of 3120 patients had 3510 telemedicine visits at the 2 institutions included in the study. Final analysis included 772 responses (21.9% response rate) with a similar response rate at both institutions (23% vs 20%, $P = .12$). The median age range of the survey cohort was 60 to 69 years with the majority of the patients being female (53.8%). There was a relatively even distribution of patients by age category and visit type (Table 1). Primary outcomes included failure to achieve 5 out of 5 satisfaction with telemedicine and a preference to use telemedicine for future visits.

Overall, 87.7% of patients reported that they were satisfied with their telemedicine visit with 70% reporting a score of 5 out of 5 ("very satisfied") (Figure 2), and 45% of patients stated that they preferred a telemedicine visit compared with an in-person visit (Figure 3). One-third of patients reported an issue with their telemedicine encounter—difficulty with exam was the most common issue, followed by problems with video and audio (13.5%, 11.5%, and 9.7%, respectively). With regard to mileage saved by a telemedicine visit, the majority of patients (56.9%) were within 25 miles round trip of their doctor’s office with a smaller subset of patients traveling over 100 miles (16.6%).

### Table 1. Patient and visit characteristics by site.

|                     | All patients | Site A | Site B |
|---------------------|--------------|--------|--------|
| n %                 | n %          | n %    | n %    | $P$    |
| Overall             | 772 100.0    | 501 64.9 | 271 35.1 |       |
| Visit type          |              |        |        |        |
| New                 | 183 23.7     | 116 23.2 | 67 24.7 | .625   |
| Follow-up           | 267 34.6     | 201 40.1 | 66 24.4 | <.001  |
| Postoperative       | 322 41.7     | 184 36.7 | 138 50.9 | <.001  |
| Audio only          | 253 32.8     | 46 9.2  | 207 76.4 | <.001  |
| Miles               |              |        |        |        |
| 0-10                | 210 27.2     | 137 27.4 | 73 26.9 | .903   |
| 10-25               | 229 29.7     | 136 27.2 | 93 34.3 | .037   |
| 25-50               | 128 16.6     | 79 15.8  | 49 18.1 | .410   |
| 50-100              | 75 9.7       | 48 9.6  | 27 10.0 | .864   |
| 100+                | 128 16.6     | 99 19.8  | 29 10.7 | .001   |
| Age, years          |              |        |        |        |
| <50                 | 151 19.6     | 100 20.0 | 51 18.8 | .703   |
| 50-59               | 173 22.4     | 117 23.4 | 56 20.7 | .392   |
| 60-69               | 235 30.4     | 155 30.9 | 80 29.5 | .683   |
| 70+                 | 204 26.4     | 121 24.2 | 83 30.6 | .051   |
| Male sex            | 356 46.1     | 219 43.7 | 137 50.6 | .069   |
| Problems            |              |        |        |        |
| Audio               | 75 9.7       | 67 13.4  | 8 3.0  | <.001  |
| Video               | 89 11.5      | 51 10.2  | 38 14.0 | .111   |
| History             | 38 4.9       | 18 3.6   | 20 7.4  | .020   |
| Exam                | 104 13.5     | 56 11.2  | 48 17.7 | .011   |
| Imaging             | 33 4.3       | 13 2.6   | 20 7.4  | .002   |
| Treatment plan      | 30 3.9       | 16 3.2   | 14 5.2  | .176   |
| Asking questions    | 32 4.2       | 21 4.2   | 11 4.1  | .930   |
| Number of problems  |              |        |        |        |
| 0                   | 523 67.8     | 344 68.7 | 179 66.1 | .459   |
| 1                   | 162 21.0     | 107 21.4 | 55 20.3 | .729   |
| 2                   | 49 6.4       | 30 6.0   | 19 7.0  | .578   |
| 3+                  | 38 4.9       | 20 4.0   | 18 6.6  | .104   |
| Prefer telehealth   | 346 44.8     | 243 48.5 | 103 38.0 | .005   |
| 5/5 satisfaction    | 535 69.3     | 384 76.7 | 151 55.7 | <.001  |

Figure 2. Distribution of patient satisfaction scores.

Figure 3. Preference for next visit if given the choice between in-person visit and telemedicine visit.
On bivariate analysis, there were several statistically significant differences between the 2 institutions that participated in this study (Table 1). Site B had a significantly greater percentage of audio-only encounters (76.4% vs 9.2%, \( P < .001 \)). There was also a significant difference in visit types between institutions specifically for follow-ups and postoperative visits. Site B also had a greater percentage of patients that would have traveled 10 to 25 miles (34.3% vs 29.7%, \( P < .001 \)), whereas site A had a greater percentage of patients who would have traveled over 100 miles (19.8% vs 10.7%, \( P = .001 \)). Most notably, there was a greater percentage of patients at site A who reported a 5 out of 5 satisfaction score (76.7% vs 55.7%, \( P < .001 \)) and who preferred telemedicine for their next appointment (48.5% vs 38%, \( P = .005 \)).

### Patient and Visit Characteristics by Institution

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### Patient and Visit Characteristics Associated With 5 out of 5 Satisfaction Scores

Bivariate analysis revealed that visit type or mileage did not play a significant role in achieving satisfaction scores. However, those who had audio only for the telemedicine visit were significantly less likely to be very satisfied (Table 2). Patients who did not have any problems were significantly more likely to be very satisfied with their telemedicine visit, whereas patients with one or more problems were significantly more likely to have a lower satisfaction score. Similarly, when looking at the individual types of problems, when any technical or clinical problem was reported, patients were significantly less likely to report a 5 out of 5 satisfaction score (Table 2).

Multivariate analysis demonstrated that patients from site B had significantly increased odds to have a satisfaction score less than 5 out of 5 (odds ratio [OR] = 2.68 [95% CI 1.86-3.88]). In the multivariate analysis by problematic type, problems with exam and imaging had the greatest impact on lowering satisfaction score below 5 out of 5 (OR 7.03 [95% CI 4.17-11.85] and OR 5.48 [95% CI 2.02-14.86], respectively) (Table 3). A subanalysis was then performed to determine if the number of problems encountered during the telemedicine visit, and not just the type of problem, was associated with poorer satisfaction. The multivariate model that included number of cumulative problems (“number-of-problems” model)

### Table 2. Patient and visit characteristics based on achievement of five out of five satisfaction score and telemedicine preference.

| Overall | 5/5 satisfaction | ≤4/5 satisfaction | Prefer in-person visit | Prefer telehealth |
|---------|------------------|-------------------|------------------------|-------------------|
|         | n %              | n %               | n %                    | P                 | n %              | n %               | P                 |
| Visit type |                  |                   |                        |                   |                  |                   |                   |
| New      | 183 23.7         | 127 23.7          | 56 23.6                | .974              | 107 25.1         | 76 22.0           | .306              |
| Follow-up| 267 34.6         | 191 35.7          | 76 32.1                | .328              | 122 28.6         | 145 41.9          | <.001             |
| Postoperative | 322 41.7     | 217 40.6          | 105 44.3               | .331              | 197 46.2         | 125 36.1          | .005              |
| Audio only | 253 32.8       | 146 27.3          | 107 45.2               | <.001             | 155 36.4         | 98 28.3           | .018              |
| Miles    |                  |                   |                        |                   |                   |                   |                   |
| 0-10     | 210 27.2         | 145 27.1          | 65 27.4                | .926              | 140 32.9         | 70 20.2           | <.001             |
| 10-25    | 229 29.7         | 161 30.1          | 68 28.7                | .694              | 123 28.9         | 106 30.6          | .594              |
| 25-50    | 128 16.6         | 89 16.6           | 39 16.5                | .951              | 58 13.6          | 70 20.2           | .014              |
| 50-100   | 75 9.7           | 48 9.0            | 27 11.4                | .295              | 38 8.9           | 37 10.7           | .408              |
| 100+     | 128 16.6         | 91 17.0           | 37 15.6                | .630              | 65 15.3          | 63 18.2           | .273              |
| Age, years |                  |                   |                        |                   |                   |                   |                   |
| <50      | 151 19.6         | 112 20.9          | 39 16.5                | .148              | 64 15.0          | 87 25.1           | <.001             |
| 50-59    | 173 22.4         | 126 23.6          | 47 19.8                | .253              | 83 19.5          | 90 26.0           | .031              |
| 60-69    | 235 30.4         | 150 28.0          | 85 35.9                | .029              | 141 33.1         | 94 27.2           | .075              |
| 70+      | 204 26.4         | 140 26.2          | 64 27.0                | .808              | 135 31.7         | 69 19.9           | <.001             |
| Male sex | 356 46.1         | 237 44.3          | 119 50.2               | .129              | 196 46.0         | 160 46.2          | .948              |
| Problems |                  |                   |                        |                   |                   |                   |                   |
| Audio    | 75 9.7           | 41 7.7            | 34 14.4                | .004              | 37 8.7           | 38 11.0           | .284              |
| Video    | 89 11.5          | 37 6.9            | 52 21.9                | <.001             | 53 12.4          | 36 10.4           | .378              |
| History  | 38 4.9           | 8 1.5             | 30 12.7                | <.001             | 31 7.3           | 7 2.0             | .001              |
| Exam     | 104 13.5         | 28 5.2            | 76 32.1                | <.001             | 89 20.9          | 15 4.3            | <.001             |
| Imaging  | 33 4.3           | 7 1.3             | 26 11.0                | <.001             | 27 6.3           | 6 1.7             | .002              |
| Treatment plan | 30 3.9           | 10 1.9           | 20 8.4                | <.001             | 22 5.2           | 8 2.3             | .041              |
| Asking questions | 32 4.2           | 12 2.2           | 20 8.4                | <.001             | 22 5.2           | 10 2.9            | .115              |
| Number of problems |                  |                   |                        |                   |                   |                   |                   |
| 0        | 523 67.8         | 432 80.8          | 91 38.4                | <.001             | 259 60.8         | 264 76.3          | <.001             |
| 1        | 162 21.0         | 81 15.1           | 81 34.2                | <.001             | 100 23.5         | 62 17.9           | .059              |
| 2        | 49 6.4           | 15 2.8            | 34 14.4                | <.001             | 37 8.7           | 12 3.5            | .003              |
| 3+       | 38 4.9           | 7 1.3             | 31 13.1                | <.001             | 30 7.0           | 8 2.3             | .003              |
| Site B (vs site A) | 271 35.1       | 151 28.2          | 120 50.6               | <.001             | 168 39.4         | 103 29.8          | .005              |
instead of problem type (“type-of-problem” model reported in Table 3) showed that the number of problems increased the odds that a patient’s satisfaction score would be less than 5 out of 5 (1 problem OR = 5.26 [95% CI 3.53-7.84], 2 problems OR = 11.89 [95% CI 6.08-23.26], 3 or more problems OR = 21.9 [95% CI 9.16-52.35]) (Table 4). Similar to the “type-of-problem” model, the “number-of-problems” model demonstrated that patients from site B had significantly increased odds to have a satisfaction score less than 5 out of 5 (OR = 3.02 [95% CI 2.1-4.34]).

**Patient and Visit Characteristics Associated With a Preference for Telemedicine**

Following a similar trend as seen in the bivariate results for satisfaction scores, on bivariate analysis for telemedicine preference, patients who had 2 or more problems with the telemedicine visit were significantly more likely to prefer an in-person visit over telemedicine ($P = .003$) (Table 2). This pattern was also seen with respect to individual problems with the exception of problems with audio, video, and asking questions. Again, following a similar trend, patients who had audio only for their telemedicine visit were significantly more likely to prefer an in-person visit ($P = .01$). The key differences in this analysis are with regard to visit type, miles traveled, and patient age. Patients who live closer to the doctor’s office (ie, within 10 miles round-trip) preferred an in-person visit ($P < .001$), whereas those who were slightly further (ie, within a 25- to 50-mile round-trip) preferred telemedicine ($P = .014$). Patients younger than 59 years were significantly more likely to prefer telemedicine ($P < .05$), whereas patients older than 60 years were significantly more likely to prefer an in-person visit ($P < .001$) (Table 2).

On multivariate analysis, patients who noted a telehealth preference generally had greater distance to travel, were younger, and had a decreased number of problems with the physical exam when compared to patients with an in-person visit preference (Table 5). In a subanalysis based on number of problems instead of type of problems (Table 6), an increased number of problems was associated with decreased odds of telehealth preference (1 problem OR = 0.62 [95% CI 0.43-0.9], 2 problems OR = 0.36 [95% CI 0.18-0.71], 3 problems OR = 0.30 [95% CI 0.13-0.68]). The “number-of-problems” multivariate model for telehealth preference similarly found that greater travel distance, younger patients, and site A (OR = 0.72, CI 0.52-0.99) were associated with telehealth preference.

**Discussion**

This cross-sectional study examining spine telemedicine visits during the COVID-19 pandemic found that patients overall were highly satisfied, with 70% of patients rating their visit as 5 out of 5 and 87.7% of patients rating their visit as 4 out of 5 or greater. Furthermore, 45% of the responses indicated a
preference for telemedicine visit over an in-person visit if given the choice. Prior studies evaluating patient satisfaction with telemedicine nonspine, orthopedic visits have found similarly high patient satisfaction.\textsuperscript{12,14-16,18,19,21,24} However, direct comparison of their findings to our study is difficult due to their small sample sizes and study designs. European studies examining satisfaction and future visit preference after orthopedic telemedicine consultation included patients accompanied by a nurse or junior surgeon in a controlled setting.\textsuperscript{12,14}

Kane et al\textsuperscript{18} completed a prospective, randomized clinical trial to evaluate telemedicine for postoperative follow-up after arthroscopic rotator cuff repair. Of the 28 patients who received telemedicine follow-up, 94.1\% were either satisfied or very satisfied with their visit. While these results are comparable to those presented herein, it is important to note the small sample size, specific visit-type (postoperative only) and eligibility requirements of the Kane et al\textsuperscript{18} study. Patients without high-speed internet or communication capabilities were excluded. Furthermore, active range of motion is restricted after rotator cuff repair, making the physical examination component less significant. Marsh et al\textsuperscript{19} evaluated telemedicine for late follow-up after total joint arthroplasty. A total of 118 patients received web-based follow-up with 75.6\% being extremely or very satisfied with their visit. Of the patients seen via telemedicine, 44\% said they preferred this method over office visits, which was similar to our results (45\%); however, this was only for follow-up visits. Sathiyakumar et al\textsuperscript{16} completed a randomized clinical trial utilizing telemedicine for fracture care follow-up. In the telemedicine cohort, 89\% of patients were satisfied with their care and 75\% agreed to future telemedicine visits, but this was based on only 8 patients.

Multivariate analysis identified numerous factors associated with reduced satisfaction and preference for in-person follow-up appointments. While some factors are not modifiable (age, distance traveled), others, such as audio and video reliability, can be optimized to increase patient satisfaction with telemedicine in the future. As might be expected, the odds of not achieving five out of five satisfaction increased with each successive problem. Similarly, patients were increasingly less likely to prefer future telemedicine visits with each problem. According to our analysis, problems with the visit (physical examination, understanding of imaging, ability to communicate history and symptoms, audio, and video) contributed to worse satisfaction. Problems with the physical exam were also associated with reduced telemedicine preference. These issues are likely related to the rapid initiation of the telemedicine programs, the absence of standardized visit protocols, and difficulty with the spine telemedicine examination.\textsuperscript{12,14,26,27} As discussed, previous telemedicine studies often included technology-related inclusion criteria or office-based assistance. While our patients were encouraged to optimize their connectivity prior to their exams, physician- and patient-based internet issues certainly impacted some of the visits. As we continue to utilize telemedicine, connectivity will hopefully improve and experience with the examination and web-based video platforms increase.

Increased age and travel distance significantly impacted preference for future telemedicine visits in our study. Patients who would normally travel greater than 10 miles round trip were more likely to prefer a future telemedicine visit. Prior studies have found similar results, with patients noting the time and economic benefits associated with telemedicine and reduced travel distance in general.\textsuperscript{14,15,18,19,24,28-30} While not a modifiable factor, this information can be utilized by spine practitioners when offering telemedicine visits to patients. Despite being as satisfied with their telemedicine visits, patients older than 60 years were less likely to prefer future telemedicine visits. Older patients tend to have a harder time embracing change and accepting technology, including telemedicine.\textsuperscript{31,32} Aside from their technology preferences, older patients may be less likely to worry about missing work than younger patients, which may also contribute to their reduced preference.

Multivariate analysis for satisfaction and preference found site to be a significant variable. More specifically, patients from site B were less likely to achieve 5 out of 5 satisfaction and less likely to prefer a future visit. The majority (76.4\%) of site B visits occurred with audio-alone compared with only 9.2\% of site A visits. However, audio-alone was not found to be significant after multivariate analysis. In an effort to limit survey-time and burden, a number of variables that may contribute to telemedicine satisfaction and preference were not captured. Examples include but are not limited to health status, insurance status, ethnicity, transportation means, geographical region (rural vs suburban vs urban), internet connection, device access, employment status, video platform, and clinical problem (cervical, lumbar, etc). While the percentage of respondents was similar between sites, the response rate was only 21.9\%, which may also contribute to these findings. Furthermore, there is significant regional variation of COVID-19 within the United States.\textsuperscript{33} Perhaps patients in certain geographical regions and communities within the United States may be better suited for telemedicine.

Our study has a number of strengths and limitations. The large number of responses, multiple sites and inclusion of all visit types makes our study unique. To our knowledge, this is the first telemedicine study to focus solely on spine patients presenting to spine surgeons. As a result, these findings are generalizable to other spine surgeons and their practices. In addition to the aforementioned limitations (potential confounding variables and response rate), this study is limited by its retrospective nature and lack of a control group. However, a concurrent control group was not possible due to social distancing restrictions. When feasible, higher level studies are needed to compare telemedicine to in-person visits for spine patients. Future studies should also explore the physician learning curve with telemedicine and assess the quality of the spine telemedicine examination.

The COVID-19 pandemic led to the rapid expansion of telemedicine across medicine. While telemedicine allows for social distancing and has the potential to reduce costs and increase access to care, it is important to establish patient
satisfaction with this platform. Our cross-sectional, survey-based study consisting of responses from 772 spine telemedicine visits at two practices in different geographic regions during the COVID-19 pandemic found a high rate of patient satisfaction with telemedicine. Furthermore, 45% of the responses indicated a preference for a telemedicine visit over a traditional in-person visit in the future. Patient- and visit-based factors associated with increased satisfaction and visit preference were identified. In light of these findings, telemedicine for spine care may be a preferable option for a subset of patients into the future.

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