

Telemedicine Use during the COVID-19 Pandemic: Results of an International Survey

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Abstract

Objective The aim of the study is to survey hand surgeons' perspectives on telemedicine during the coronavirus disease 2019 (COVID-19) pandemic and intended applications after the pandemic.

Methods Online surveys were sent to 285 Canadian and American surgeons in late April and early May 2020.

Results Response rate was 63% (180)—84% (152) American and 16% (28) Canadian. Forty-three percent (76) of respondents were in private practice, 36% (64) academics, 13% (24) privademics, and 6% (12) hospital employed. The most common telemedicine platform was Zoom. During the pandemic, 42% of patient visits were conducted via telemedicine; however, 37% required a subsequent in-person office visit. The most common complaint by surgeons was the inability to provide routine in-office procedures. The most beneficial feature was ease of use, and the most frustrating feature was connectivity difficulty. Time spent was similar to in-person visits, and surgeons were likely to recommend their platforms. Surgeons were neutral about using telehealth in the future and were most likely to use it for follow-up visits. New patient visits for traumatic injuries or fractures were of limited value. Canadians used telemedicine for a greater proportion than Americans (50 vs. 40%, $p < 0.05$) and spent more time than in-person visits (7/10 vs. 5/10, $p < 0.05$). Americans were more likely to use telemedicine for postoperative follow-up visits (6/10 vs. 4/10, $p < 0.05$) and in mornings before clinic opens (4/10 vs. 2/10, $p < 0.05$). Private practices were more likely to use telemedicine for future allied health provider visits than all other practice types ($p < 0.05$).

Conclusion Telemedicine comprised nearly half of patient encounters during the COVID-19 pandemic, but limitations remain.

Keywords

- ▶ COVID-19
- ▶ telemedicine
- ▶ telehealth
- ▶ hand surgery
- ▶ virtual visits

The World Health Organization (WHO) defines telemedicine as “various types of information and communication technologies used to provide clinical support, overcome geographical barriers, and with the goal of improving health

outcomes.”¹ In the past, hand and upper extremity surgeons used telemedicine primarily for remote inpatient and emergency room consultations, outpatient clinic consultations, and postoperative telemedicine visits, but it remained

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uncommon for patient assessment.² New mobile applications and videoconferencing services have improved access and broadened the conceptions of telemedicine.² The coronavirus disease 2019 (COVID-19) pandemic has disrupted the traditional delivery of health care, thereby making telemedicine an attractive option for both patients and surgeons. The payment structure for telemedicine has historically been challenging, also making it difficult to adopt into routine practice.

Recent clinic closures across the country have paved the way for increased telemedicine usage. Furthermore, in response to the Coronavirus Preparedness and Response Supplemental Appropriations Act, the Centers for Medicare & Medicaid Services (CMS) expanded coverage for telehealth services. For example, in most cases telehealth visits are now considered the same as in-person visits and reimbursed at the same rate. In addition, several commercial health plans such as Aetna, Cigna, and BlueShield BlueCross have made public commitments to broaden payments for telehealth services. These factors contributed to the growing public and governmental acceptance of telehealth services this year.

The rationale for this study was to capture North American hand surgeons' perceptions on, and use of, telemedicine services during the COVID-19 pandemic. This survey specifically examines telemedicine in the form of remote clinical visits with patients. We hypothesized that telemedicine was most useful for routine follow-up care and most challenging for new patient visits. We further hypothesized that telemedicine would be viewed as less efficient than in-person evaluations and that the physical exam would be the most difficult component of a virtual visit. As far as future applications are concerned, we hypothesized that most hand surgeons would find utility in telemedicine for future practice, but only for specific types of clinic visits, and potentially favoring the visit be conducted with an allied health care provider.

Materials and Methods

This international cross-sectional study utilized an online survey to capture time-sensitive information on telemedicine from North American hand surgeons during the COVID-19 pandemic. The survey was constructed online using SurveyMonkey and consisted of 36 questions covering the following three domains of inquiry: telehealth in general, platform specifics, and plans to incorporate telehealth in the future. Question designs were a mixture of free response questions and multi-item Likert scale statements ranging from 0 to 10. A complete survey can be found in the **Appendix A**.

Eligible recipients were North American hand surgeon members of the Chicago Society for Surgery of the Hand, Rush University Hand Fellowship Alumni, Handemonium Hand Club, New Millennium Hand Club, Manus Hand Club, Duke Hand Society, and Wrist Evaluation Canada (WECAN). These groups were chosen as they were groups familiar to the researchers, hoping for a high response rate and knowing they encompassed various age groups and a mix of private and academic physicians.

The survey was first delivered to hand surgeons via email within the last week of April 2020. Within 72 hours, a single reminder was sent to all recipients via email. Both email correspondences instructed recipients to complete the survey assuming any billing practice changes from federal governments remained in place after the pandemic resolved. Since major structural changes to the administration of health care began with populous states, such as New York and California, instituting emergency lockdowns during the week of March 1, and most other states following suit thereafter, the authors believe there was ample time for survey respondents to have acclimated their practice settings to address needs and logistics during the pandemic.

Extraction of all survey responses resulted in the primary dataset. Data analysis for Likert scale questions involved calculation of means. Free response questions from the survey were compiled and analyzed manually by the authors to highlight common themes.

Additional subgroup analyses of American and Canadian respondents were performed to report any statistically significant differences in means, as evaluated by Welch's *t*-test. Data stratification by respondents' practice type (e.g., private, privademic, academic, hospital employed) was also performed.

Results

In total, 285 surgeons received the survey and 180 responses were recorded, for a response rate of 63%. Of the respondents, 152 (84%) were American and 28 (16%) Canadian, thus a response rate of 67% American and 47% Canadian. The breakdown of practice settings was private practice (76, 43.18%), academics (64, 36.36%), privademics (24, 13.64%), and hospital employed (12, 6.82%).

The most common telemedicine platform was Zoom, followed by Doxy.me (**Table 1**). The most common clinical scenario where telemedicine was of limited utility was the need for in-office procedures (e.g., injections, suture removal) (**Table 2**). The most beneficial feature reported was ease of use (**Table 3**). The most unfriendly feature was difficult connectivity (**Table 4**).

The average percentage of patients at a practice seen via telemedicine was 42%. Time devoted to telemedicine visits was similar or slightly higher than in-person visits (mean = 6/10). Satisfaction with telehealth visits was positive (mean = 7/10). Frustration with connectivity or technical problems was neutral (mean = 5/10). The average estimated percentage of patients who needed an office visit shortly after a telemedicine visit due to limitations was 37%.

Surgeons were likely to recommend their platforms to a colleague (mean = 7/10). Telehealth platforms were considered easy to use (mean = 8/10), and feedback from patients to surgeons about the ease of telemedicine use was also positive (mean = 7/10). However, 49% of respondents were unable to show patients imaging results through their telehealth platform. Platform integration with electronic medical record (EMR) was also less seamless (mean = 4/10). Addition of a third party to a virtual visit was not an option for 56% of respondents.

Table 1 Distribution of telemedicine platforms used by respondents

Platform	Percent of all platforms reported
Zoom	23.64
Doxy.me	21.21
Epic	6.66
FaceTime	6.66
Telephone only	6.06
Telephone with another platform	4.84
eClinical Works	3.36
Doximity	3.03
OrthoLive	3.03
Ontario Telehealth Network	1.82
Webex	1.82
Chiron	1.21
eVisit	1.21
Hospital-owned/Proprietary	1.21
Medeo	1.21
Microsoft Teams	1.21
OttoHealth	1.21
Updox	1.21
Accuro	0.61
AmWell	0.61
AXS Health	0.61
Bluestream	0.61
Canto	0.61
Clocktree	0.61
Google hangouts	0.61
InTouch	0.61
Medisprout	0.61
Medstar	0.61
Input health	0.61
Pexip	0.61
SBR	0.61
Skype	0.61
USC telecare	0.61

A few aspects of the patient visit received neutral mean scores of 5/10 suggesting they were no harder or easier when compared with a traditional in-person evaluation: ease of taking a history, providing patient education, answering questions, and documentation. Physical examination was more difficult than an in-person visit (mean = 7/10), as was setting a treatment plan (mean = 6/10).

Regarding future telehealth use, surgeons were neutral about implementing telehealth for their own patient encounters (mean = 5/10), as well as for their allied health

Table 2 Scenarios where telemedicine was of limited utility

Scenario	Number of surgeons reporting
Need for an in-office procedure (e.g., injection, suture removal)	45
Need for physical examination	37
Need for imaging	26
New patient	22
Patient with pain	13
Patient with fracture	9
New complaints in a familiar patient	7
Patient unable to participate (e.g., limited access to technology, problems with using application)	4
Patient with trauma	4
Poor connectivity	4
Patient with acute injury	2
Patient with complex injury	2
Language differences between provider and patient	2
Postoperative patients	2
Pediatric patients	1

Table 3 Best features of specific telehealth platforms

Feature	Number of surgeons reporting
Ease of use (e.g., accessible on mobile devices, “simple” and “familiar”).	46
Social distancing and no need for travel	23
Integration with EMR	19
Safety and privacy (e.g., HIPAA compliance, secured connection, anonymous caller ID, “reliable”).	18
File and screen sharing	12
No need to download application	8
“Waiting room” feature	7
Quality of video	4
Free	4
Scheduling ease	3

Abbreviation: EMR, electronic medical records.

providers (mean = 5/10). For new patient evaluations, surgeons were less likely to use telehealth for both elective (mean = 3/10) or trauma cases (mean = 2/10). However, surgeons were more likely to use telehealth in the

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Table 4 Unfriendly features of specific telehealth platforms

Feature	Number of surgeons reporting
Connectivity (e.g., internet, dropped calls)	39
Quality (e.g., video resolution, crashes/glitches/bugs, customization)	23
None	19
Lack of EMR integration	15
Patient-specific factors (e.g., accessing platform, remembering appointments, directing camera appropriately at injury site, enabling microphone and camera).	14
Scheduling issues (e.g., time differences, no waiting room feature)	13
Safety and privacy (e.g., HIPAA compliance, provider anonymity)	8
Need to download application	4
Scheduling ease	3
Missing feature (e.g., group conferencing, screen sharing)	2
Price	1
Time limit	1

Abbreviations: EMR, electronic medical records; HIPAA, Health Insurance Portability and Accountability Act.

future for follow-up visits, specifically postoperative visits (mean = 6/10), injection follow-ups (mean = 6/10), and to communicate imaging or study results (mean = 6/10). They were less likely to use telemedicine for fracture care follow-ups (mean = 4/10).

Despite their willingness to adopt telemedicine moving forward, there was no logistical virtual patient visit scenario surgeons strongly supported. The most favorable time for scheduling future telehealth appointments was after clinic ends, however, only with an overall neutral rating (mean = 5/10). The least favorable time was on a surgical day (mean = 3/10). Other less likely times included early morning before clinic starts (mean = 4/10) or interspersed during a normal clinic day (mean = 4/10). The likelihood of setting separate time aside for an allied provider to see patients via telehealth was neutral (mean = 5/10).

Subgroup analyses revealed statistically significant differences between American and Canadian respondents. Canadians reported using telemedicine to see a larger percentage of patients during the pandemic than Americans (50 vs. 40%, $p < 0.05$). Canadians also reported spending more time on telemedicine visits compared with similar in-person visits (mean = 7/10 vs. 5/10, $p < 0.05$). Americans reported they were more likely to use telemedicine for postoperative visits (6/10 vs. 4/10, $p < 0.05$) and in the early morning before clinic starts (4/10 vs. 2/10, $p < 0.05$). Notably, both countries had similar perceived patient satisfaction, integration with EMR, likelihood of recommending their platform to a colleague, and ease of use.

Additional data stratification by practice type (e.g., private, privademic, academic, hospital employed) revealed statistically significant differences in plans to use telemedicine for allied health providers. While the mean score was the same (5/10) for each subgroup, statistically significant differences were found with independent *t*-tests when private practice data were compared with a combination of all other groups—privademic, academic, and hospital employed. Similar significant results were found concerning allied health providers when private practice data was compared with combined academic and privademic data. No other statistically significant differences were found in the results from other survey questions.

Discussion

The rationale for this cross-sectional study was to capture North American hand surgeons' attitudes on and use of telemedicine during the COVID-19 pandemic. While definitions continue to evolve, telemedicine and telehealth are synonymous and interchangeable according to the WHO.¹ Telemedicine use by physicians has increased over the past few years, although this has not been documented specifically in hand surgery literature.³ Given the convenience of telemedicine appointments for patients and the positive feedback received with its rapid and widespread implementation we surmise that telehealth will remain a valid option. Prior studies from Europe and elsewhere have explored the structure of teleconsultations following the COVID-19 pandemic, but none have addressed the North American perception.⁴ To provide value to both the patient and the physician, we must be critical of how to successfully implement telemedicine. Additionally, we must adopt secure telehealth platforms that are safe and compliant for use.

This investigation was designed to capture data during the height of the pandemic response, but also with sufficient time for surgeons to optimize and familiarize with telemedicine. We intentionally queried a wide mix of ages and practice types amongst the hand societies and groups polled. While we did not query the age of the responder so not to give the impression we would divide or analyze the results by age, our own familiarity with the societies allowed us to choose diverse groups. This diversity is reflected in 43% in pure private practice and 50% with some academic appointment. However, there was a relatively low number of hospital-employed physicians (7%) thus this group is likely underrepresented.

Despite our data showing satisfaction from patients and surgeons, only 42% of all patient visits during the pandemic were conducted by telemedicine and 37% of those encounters required an office visit shortly afterward—implying telemedicine is unable to replicate all elements found in traditional clinic visits. We view this as a major concern, as it will be troublesome if telemedicine—a system theorized to provide time savings and potentially cost containment—may lead to increased time expenditure and cost in additional visits. Thus, a dive into the limitations of telemedicine may have value, and results may be different between medical specialties.

While we hypothesized that the physical examination would be the main limitation of telemedicine to surgeons, our survey found that surgeons were more dissatisfied with the inability to perform routine in-office procedures, such as corticosteroid injections and suture removals. A need for a physical exam, however, was the second most reported scenario where telemedicine was of limited utility. Previous orthopaedic studies concluded that telemedicine physical examinations are excellent. For example, in a randomized controlled trial of video-assisted orthopaedic telemedicine encounters, surgeons rated their ability to examine the patient as “good” or “very good” for 98% of visits.⁵ We maintain that the hand surgeon’s physical examination is nuanced and can be difficult to perform over telemedicine, as evidenced by our survey results. The specific tests and precise maneuvers of a hand examination may be difficult to describe to patients virtually—further investigation is warranted.

Systematic planning of telemedicine visits can limit the frequency of suboptimal visits in circumstances where procedures are needed. For example, postoperative visits with external suture closures or emergency department follow-up’s for lacerations may be best directly filtered out by schedulers for in-person visits. The same could be done for new patients with symptoms consistent with digital stenosing tenosynovitis or DeQuervain’s tenosynovitis—two conditions often treated with corticosteroid injections at the initial visit. Along a similar line, surgeons felt they were less likely to apply telemedicine for fracture care follow-up and new patients with trauma. This may be due to the absence of radiographic evaluation during telemedicine. While this is a difficult problem to avoid for follow-up patients, many new patients with fractures have already obtained radiographs at an emergency department or urgent care center. However, since these injuries are often time sensitive, if these patients can provide their images via disk or email on a case-by-case basis, then their care can often be effectively initiated over telemedicine.

We found that hand surgeons were more likely than not to recommend their platform to another hand surgeon, and both physicians and seemingly patients as reported by physicians found the platforms easy to use. This is the case even though only 50% of platforms could show images to patients, along with other limitations (► **Table 4**). This may suggest that from the hand surgeon’s perspective the essentials of patient education and communication were able to be accomplished well without those capabilities. Further investigations of patients’ perspectives could demonstrate if they feel similarly.

We must also consider security and patient privacy as we begin to apply telemedicine on a large scale. Only 56% of platforms used during the pandemic were compliant with patient privacy laws (e.g., HIPAA). Zoom was the most common platform utilized by hand surgeons during the pandemic (23%). Free and regular Zoom services are not compliant with patient privacy and protection laws for health care. A health care entity must enter into a business associate agreement with Zoom for the platform to meet

legal compliancy in some countries, and in Europe, all forms of Zoom are not permissible. Emphasis will need to be placed on adopting platforms that are as secure as possible for medical encounters, and in accordance with each country’s patient privacy laws.

Surgeons responded that they would be most likely to use telemedicine in the future for follow-up visits, which is consistent with our hypothesis, as follow-up visits tend to be focused and often do not require in-office procedures. Telemedicine has anecdotally reduced the number of postoperative visits and simple urgent consultations, as well as proven in studies to reduce lags in follow-up, minimize travel time, and decrease the carbon footprint.⁶ For example, after implementing a rural telemedicine program for hand surgery in Arkansas, Tripod et al found a significant decrease in the number of transfers and transportation costs.⁷

Surprisingly, although hand surgeons saw value in continuing telemedicine in the future, no specific form of practice was viewed favorably at greater than 5 out of 10. Placing these visits at the end of a clinic day appeared the most favorable, and on a surgical day the least favorable, but without strong opinions. This suggests that trial and error will likely be necessary to find the best format for any given practice or hospital system. We were also surprised that our hypothesis that surgeons would favor these visits be conducted with allied health providers was not correct, as this format was only rated at a neutral 5/10. It may be that as physicians become more comfortable with what circumstances to perform telemedicine in, and its limitations, they may become more comfortable delegating it to allied providers such as physician assistants or nurse practitioners. Interestingly, data stratification by practice type revealed that private practice surgeons were more likely to use telemedicine for future allied professional visits. Private practices may already have more streamlined clinical services in place, including delegation to allied providers in other aspects. However, larger practices, such as academic centers, hospitals, and certain privademic set-ups, may incur a higher upfront cost or system-wide effort to implement telemedicine services, including delegation to allied professionals. Nonetheless, delegating these visits to allied professionals could improve efficiency within any practice type.

American and Canadian data were similar. This suggests that the conclusions of this investigation likely pertain in similar ways to both groups. Since Canadians reported spending more time on telemedicine visits compared with similar in-person visits (mean = 7/10) than Americans (mean = 5/10), further comparative research should delve into documentation and visit requirement differences for hand surgeons in each country—as this could account for the difference in time spent, especially since Canadian respondents had more experience seeing larger portions of patients over telemedicine and the reported difficulty with telemedicine platforms was similar between countries. Americans also showed significant differences from their counterparts in the likelihood of using telemedicine for postoperative visits and use in the early morning hours before clinic starts, which further reflects possible nuances in practice

management strategies and approaches to patient follow-up. Further exploration of American value-based care and the Canadian Medicare system and their effects on telemedicine is needed.

Our data showed that connectivity and call quality are the most unfriendly features of telemedicine platforms (– **Table 4**). Although increased telemedicine use has coincided with access to more platforms and new technology, device capability and stable internet connectivity on the provider- and patient-end are still necessary. In fact, technological limitations in telemedicine may be an ethical quandary that should be of concern to the hand surgeon, as it may lead to unequal quality and access to care should telemedicine become a more integral means of clinical practice.⁸

There are several limitations to this study. The response rate was 63%. While a follow-up email was sent to surgeons to increase participation, we nevertheless believe that this is a good general representation of practicing hand surgeons across both academic and private practice. Another limitation involves inherent flaws in surveys. Since we included a mixture of free response and multi-item Likert scale questions, this approach allowed for personal input but less standardization and therefore less generalizability of our results. Another limitation may be a response bias, since only surgeon-members of specific hand surgery groups received the survey. A more all-encompassing survey could limit this potential bias, but also tends to take time to roll out. We believed timing was critical. It should also be noted that this survey was completed by participants with the theoretical understanding that the reimbursement patterns for telemedicine would not change. While pay structure could be reversed at any time, it is likely that concerns for continuation or resurgence of COVID-19 will last for some time, and when combined with high patient satisfaction and potentially improved efficiency, may lead to improved reimbursement for telemedicine in the long term.⁹

While this survey shows promising results on surgeon satisfaction with telemedicine, future studies should also assess patient satisfaction, as well as effects on patient-reported outcomes. One orthopaedic randomized controlled trial demonstrated that 63% of patients in the in-person clinic group and 86% of patients in the telemedicine group preferred telemedicine for future encounters.¹⁰ More research of this type and specific to hand surgery is needed. Since telemedicine use is likely to continue to increase, upholding patient safety and confidentiality is paramount. Breaches in confidentiality can be audiovisual.¹¹ The unauthorized viewing of patient information of any kind—intentional or unintentional—is unethical and not in compliance with medicolegal policies.¹² Telemedicine presents additional ethical and patient safety concerns that must be navigated. Due to recent changes in legislation and the breadth of telemedicine platforms now available, future studies should also revisit the financial and economic impacts of telemedicine.¹³

Ethical Approval

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008. This study was reviewed by the Rush University Medical Center Institutional Review Board (IRB) and was approved for a waiver of informed consent.

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None.

Conflict of Interest

None declared.

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Appendix A Compilation of all survey questions

Telehealth in general	
What best describes your practice?	A. Private practice B. Academics C. Privademics D. Hospital employed
During the coronavirus pandemic, once you had a telemedicine platform up and running, what percentage of patients would you and your physician extenders evaluate via telemedicine?	0–100%
How much time do you think you devoted to a telemedicine appointment compared with a similar in person appointment? (1–Much less time ... 10–Much more time)	0–10
How satisfied have patients seemed to be with the telehealth visits (1–Not happy, 10–Extremely happy)	0–10
To what degree were you frustrated by connectivity or technical problems (1–Not at all frustrated ... 10–Extremely frustrated)	0–10
What percentage of patients still needed an office visit to be scheduled shortly after the telemedicine visit (i.e., limited utility, not much was gained by the telemedicine visit)?	0–100%
What was the most common scenario where the telemedicine was of limited utility?	Free response
Telehealth platform specifics	
What telemedicine platform do you use? (telephone only, FaceTime, Zoom, Webex, etc.)	Free response
How likely are you to recommend this platform to a fellow hand surgeon? (1–Not at all; 10–Absolutely)	0–10
How easy is your telehealth platform to use? (1–Extremely difficult ... 10–Extremely easy)	0–10
From the feedback you have gotten from your patients, how easy is the telehealth platform for them to use? (1–Extremely difficult ... 10–Extremely easy)	0–10
What is the most beneficial feature of the specific telehealth platform you are using?	Free response
What is the most unfriendly feature of the specific telehealth platform you are using?	Free response
Can you show your patient imaging through your telehealth platform?	Yes No
How well does it integrate into your EMR? (1–Not at all, 10–Seamless)	0–10
Can you collaborate with your telehealth visit, or in other words can you add in another MD, case manager, a third party to the virtual visit?	Yes No
Compared with an in-office visit	
How difficult is it to accomplish the following with telemedicine compared with regular outpatient visits? (1–Much easier ... 5–Just as easy ... 10–Exceedingly harder)	
Taking a history	0–10
Conducting a physical exam	0–10
Providing patient education	0–10
Answering questions	0–10
Setting a treatment plan	0–10
Documentation	0–10
Incorporating telehealth in the future	
Once there are no contract restrictions, your practice volume is back to normal, and assuming reimbursement remains the same:	
To what degree are you planning on implementing telehealth for your own patient encounters? (1–Not at all ... 10–Major implementation)	0–10
To what degree are you planning on implementing telehealth for your allied health provider’s (PA, NP) patient encounters (1–Not at all ... 10–Major implementation)	0–10
How likely are you to apply telehealth in the following settings? (1–Not at all; 10–Very frequently)	
New patient evaluations, elective	0–10
New patient evaluations, trauma	0–10
Postoperative visits	0–10

(Continued)

Appendix A (Continued)

Telehealth in general	
Fracture care follow-up	0–10
Injection follow-up	0–10
Communication of imaging/study results	0–10
How likely are you to schedule telemedicine appointments in the following ways during your work week? (1—Not at all ... 10—Very likely)	
Early morning before clinic starts	0–10
Interspersed during a normal clinic day	0–10
Late day after clinic ends	0–10
On a surgical day	0–10
Separate time set aside for just an allied provider (PA/NP) to see the patient	0–10

Abbreviation: EMR, electronic medical record.