Diagn Interv Radiol 2022; DOI: 10.5152/dir.2022.21837

INTERVENTIONAL RADIOLOGY

ORIGINAL ARTICLE

Establishing a telemedicine program for interventional radiology: a study of patient opinion and experience

Sadeer J. Alzubaidi
Aditya Khurana
Andrew Sill
J. Martha-Gracia Knuttinen
Scott Kriegshauser
Sailendra Naidu
Indravadan Patel
Rahmi Oklu

PURPOSE

The coronavirus disease 2019 (COVID-19) pandemic forced healthcare officials to implement new policies, such as the use of virtual consultations over office-based medical appointments, to reduce the transmission of the virus. The purpose of this study was to quantitatively compare patients' experiences with virtual outpatient telemedicine encounters at a single academic institution in interventional radiology (IR) and in-person visits during the course of the COVID-19 pandemic.

METHODS

The TeleENT Satisfaction Questionnaire and the Medical Communication Competence Scale (MCCS) were used to survey patients' satisfaction with both in-person and virtual office visits.

RESULTS

Ninety respondents (38 in-person and 52 virtual) acknowledged numerous benefits of virtual visits versus in-person office visits including reductions in time, cost, and potential viral transmission risk during the COVID-19 pandemic. No statistically significant difference was noted, based on a Likert scale from 1 to 7, between in-person and virtual visits (all $P > .05$) for scheduling-related factors. No statistically significant difference was noted in any of the MCCS subscales between the 2 cohorts with regard to medical information communication (all $P > .05$). A majority of patients with virtual encounters (82.7%) stated that it was easy to obtain an electronic device for use during the telemedicine visit, and 73.1% of patients felt that setting up the telemedicine encounter was easy.

CONCLUSIONS

This study demonstrates that telemedicine is an acceptable alternative to in-office appointments and could increase access to IR care outside of the traditional physician–patient interaction. With telemedicine visits, patients can communicate their concerns and obtain information from the doctor with noninferior communication compared to in-person visits.

From the Division of Vascular and Interventional Radiology (S.J.A. ✉ Alzubaidi.Sadeer@mayo.edu, J.M.-G.K., S.K., S.N., I.P., R.O.); Department of Radiology (A.S.), Mayo Clinic Arizona, Arizona, USA; Department of Radiology (A.K.), Mayo Clinic Minnesota, Minnesota, USA.

Received 7 October 2021; revision requested 5 November 2021; last revision received 20 December 2021; accepted 29 December 2021.

Publication date: 1 December 2022.

DOI: 10.5152/dir.2022.21837

Telemedicine is an efficient and cost-effective service "that seeks to improve a patient's health by permitting a two-way, real-time interactive communication between the patient and the physician at a distant site," according to the Centers for Medicare and Medicaid Services (CMS).[1] With improvements in real-time audiovisual communications technology and secure high-speed internet access over the past several decades, the practice of telemedicine has evolved to augment and even replace traditional face-to-face medical visits. This has translated into improved accessibility to high-quality medical care for a wide variety of patient populations.

In recent years, telemedicine has been shown to improve care logistics and increase the geographic reach of healthcare providers, which is more important than ever in the current environment of specialty care centralized in higher volume urban medical centers.[2,3] The benefits of telemedicine include improved clinical efficiency, increased access for patients in underserved areas to specialty care, reduction in transportation time and costs, as well as increased patient satisfaction.[4-11] Telemedicine has proven useful for a variety of patient appointments (e.g., initial consultations, preoperative evaluation, postoperative checks, and long-term follow-ups) in a broad range of healthcare settings (e.g., primary care,

You may cite this article as: Alzubaidi SJ, Khurana A, Sill A, et al. Establishing a telemedicine program for interventional radiology: a study of patient opinion and experience. *Diagn Interv Radiol.* 2022;28(6):603-608.

specialty care, stroke care, and physician-to-physician consultation between academic institutions or networks of rural community clinics).[7-15] However, despite this progress, telemedicine had previously not been broadly adopted due to regulatory hurdles and inflexible payment structures until coronavirus disease 2019 (COVID-19).[16]

The pandemic forced healthcare systems to implement new practice workflows to mitigate the spread of severe acute respiratory syndrome coronavirus-2. Various governing bodies and associations instituted guidelines resulting in the cancelation of elective, non-emergent appointments and procedures. However, a large cohort of patients remained who suffered from time-sensitive ailments that required urgent consultation, evaluation, and medical procedures, making cancellation impossible.

In order to continue to deliver care to these patients and reduce both patients' and healthcare workers' exposure to the virus, clinical assessments shifted to a virtual platform. Furthermore, CMS authorized a rule stating that virtual telemedicine visits would be temporarily reimbursed at the same rate as face-to-face visits to incentivize the use of telemedicine and thus reduce viral transmission rates.[17] These changes were welcomed by healthcare personnel and patients alike. Additionally, the use of telemedicine allowed for continued routine care of the elderly or high-risk patients who would otherwise have been hesitant to seek face-to-face care in the midst of the pandemic.

Telemedicine is a relatively new endeavor for many providers in a variety of specialties. Although various guidelines and recommendations have been published, there are few studies of telemedicine utilization in the practice of interventional radiology (IR).[18-33] The aim of this study was to evaluate patients' experiences with the newly implemented COVID-19 era telemedicine in IR at a single tertiary care academic center.

Main points

- In a pilot telemedicine program for interventional radiology clinic visits at a tertiary care hospital, the experience of telemedicine encounters was not inferior to in-person visits.
- There was no significant difference in patient experience and satisfaction between in-person and virtual encounters.
- There was no significant difference in the transmission and understanding of information between in-person and virtual encounters.

Methods

This retrospective cross-sectional study was conducted at an academic, tertiary care hospital IR practice with an associated IR-independent residency staffed by 6 board-certified faculties. The study was compliant with the Health Insurance Portability and Accountability Act and approved by the Institutional Review Board (IRB), under the protocol IRB #20-004646.

In compliance with the pandemic guidelines, the IR faculty at this institution transitioned to virtual visits for the majority of preprocedural consultations and postprocedural follow-ups. This was mainly accomplished by using telephone and electronic medical record (EMR)-based video software. Similar to how in-person visits would have an established appointment time within the EMR, virtual visits would also be assigned a time within the provider's schedule. If video was used, a link would be sent by the scheduling department beforehand so that the patient would be ready when the provider finally entered the HIPPA-secure video chat room. However, there was a small cohort of patients who would still require in-person visits to be physically assessed or to have minor procedures performed, such as drain removals, etc.

Study design

Patients aged 18 years and older who were seen by an IR provider either in-person or via telemedicine from January 1, 2020, to August 31, 2020, were eligible to participate in the study. Eligible patients' preferred email addresses were gleaned from the EMR. A survey was constructed and administered using a secure, web-based survey platform (Qualtrics, Provo) to assess patients' satisfaction with their most recent IR appointment. The survey was anonymous and voluntary and did not request indefinable information about the respondents. The email instructions and survey questions were reviewed by the IRB. It was deemed to be of no appreciable risk to patients, so a waiver of consent was approved. This allowed for the distribution of the survey during the early phase of the COVID-19 pandemic.

The previously validated TeleENT Satisfaction Questionnaire and Medical Communication Competence Scale (MCCS) were used, which evaluate the transmission and understanding of information within medical encounters.[34,35] The survey consisted of 66 questions designed to evaluate patients' experiences and satisfaction with their IR appointment. Questions that asked patients to rate how much they agreed or disagreed with a statement were evaluated on a Likert scale of 1 to 7. Survey questions were essentially the same for participants who had in-person and telemedicine visits. However, for the questions that asked about telemedicine-related factors, the participants who had in-person visits were asked their hypothetical thoughts regarding these factors.

The survey questions specifically addressed the following: (1) appointment-related factors—ease of appointment scheduling, accessibility of care, time and money costs, type of device used (telemedicine only), and ease of obtaining a device to use (telemedicine only); (2) communication-related factors—ability to hear and see the physician well and 2-way patient and physician understanding/comprehension; (3) safety-related factors—personal comfort with in-person visits during the pandemic, reduced potential exposure to the virus with telemedicine visits, and adequate physical examination for telemedicine visits; (4) patient-related factors—willingness to use telemedicine as an alternative to in-person visits and personal preference for telemedicine or in-person visits; and (5) general experiences—patients' expectations being met, overall satisfaction with the quality of service provided, and willingness to receive care via the same visit type again. The survey also asked participants their highest level of educational attainment and whether or not they self-identified as being high risk for COVID-19, according to the Center for Disease Control (CDC) guidelines (i.e., age 65 years or older, resident of a nursing home or long-term care facility, and/or have an underlying medical condition that increases the risk of severe COVID-19 illness).[36]

Data analysis

Data analysis was performed using an online survey platform (Qualtrics, Provo) and Microsoft Excel. Survey responses for in-person and telemedicine visits were compared. MCCS responses were aggregated in 4 groups previously published by Cegala et al.[35] Their study proposed the following: information giving, information seeking, information verifying, and socioemotional communication. Normally distributed data are described using the mean and standard deviation. Categorical data are described by frequencies and proportions and statistically analyzed using chi-square tests. Continuous variables were statistically analyzed using a Student *t* test. Statistical significance was determined with a probability value less than .05.

Results

Out of 621 surveys sent to IR patients, 90 patients completed the survey, with a response rate of 14.5%. Of these responses, 38 were completed by patients with in-person encounters and 52 were virtual encounters (Table 1). There was no significant difference in the patient's level of education between those who underwent in-person and virtual encounters when looking across a distribution ranging from "Less than high school" to "Doctorate" ($P = .18$). However, when the responses were grouped into "Less than a 4-year degree" and "4-year degree or greater," the virtual cohort had a significantly higher level of education ($P < .01$). The majority of both cohorts felt themselves to be part of an at-risk population for infection with COVID-19 according to the CDC guidelines, and there was no significant difference between cohorts ($P \geq .99$). There was no significant difference in the distribution of ages ($P = .052$) and sexes ($P = 1.0$) of the patients between the 2 cohorts. The average age of the in-person cohort was 66.68 ± 12.03 years, while the average age of the virtual cohort was 60.40 ± 16.77 years. The median date of each appointment type was significantly different ($P < .001$), with in-person encounters occurring earlier in the year as opposed to virtual encounters (April 14, 2020, vs June 2, 2020).

Table 1. Patient demographics for in-person and virtual visits

	In-person (N = 38)	Virtual (N = 52)	Significance
Education			
Less than high school	1 (2.6%)	0 (0.0%)	.18
High school graduate	4 (10.5%)	5 (9.6%)	
Some college	11 (28.9%)	8 (15.4%)	
2-year degree	7 (18.4%)	4 (7.7%)	
4-year degree	6 (15.8%)	12 (23.1%)	
Professional degree	8 (21.1%)	19 (36.5%)	
Doctorate	1 (2.6%)	4 (7.7%)	
Education (grouped)			
Less than 4-year degree	23 (60.5%)	17 (32.7%)	<.01
4-year degree or above	15 (39.5%)	35 (67.3%)	
CDC-designated at-risk population for COVID-19 infection			
Yes	29 (76.3%)	39 (75.0%)	>.99
No	8 (21.1%)	11 (21.2%)	
Unsure	1 (2.6%)	2 (3.8%)	
Age			
<25	0 (0.0%)	3 (5.8%)	.052
25-50	4 (10.5%)	10 (19.2%)	
50-75	23 (60.5%)	29 (55.8%)	
>75	9 (23.7%)	8 (15.4%)	
Average	66.68 ± 12.03	60.40 ± 16.77	
Sex			
Male	19 (50%)	26 (50%)	1.0
Female	19 (50%)	26 (50%)	
Median appointment date	April 14, 2020	June 2, 2020	<.001

CDC, Center for Disease Control; COVID-19, coronavirus disease 2019.

About 82.7% (43/52) of patients with virtual encounters stated that it was easy to obtain an electronic device for use during the telemedicine visit, and 73.1% (38/52) of patients felt that setting up the telemedicine encounter was easy. About 71.2% (37/52) of virtual encounters believed that they saved money while acquiring care through this format. About 63.5% (33/52) of patients who underwent virtual encounters believed that the appointments were quicker due to the use of telemedicine. Most virtual encounters were conducted on a personal laptop or desktop (67.3%; 35/52), followed by smartphones (15.4%; 8/52), tablets (13.5%; 7/52), and landline/non-smartphones (3.8%; 2/52).

Both in-person and virtual participants rated their appointment experience highly (Table 2). Both cohorts were satisfied with appointment quality (in-person: 6.3 ± 1.24/7; virtual: 6.4 ± 0.77/7) and felt their expectations were met for a physician visit (in-person: 6.4 ± 1.15/7; virtual: 6.2 ± 1.04/7). For all questions regarding appointment experience, there was no significant difference in the level of agreement, as indicated by the Likert scale, between in-person and virtual visits (all $P > .05$).

Patients were also asked questions that pertained to the subscales of MCCS. On the Likert scale of 1 to 7, patients with in-person visits rated their interaction with the interventionist as a mean of 6.3 on information giving, 6.5 on information seeking, 6.5 on information verifying, 6.4 on socioemotional communication, 6.5 on patient's self-competence, and 6.3 on patient's other competence. In comparison, patients with virtual visits rated their interaction with a mean of 6.0 on information giving, 6.3 on information seeking, 6.3 on information verifying, 6.4 on socioemotional communication, 6.3 on patient's self-competence, and 6.1 on patient's other competence. There was no significant difference found between in-person and virtual visits for any of the MCCS subscales (all $P > .05$) (Table 3).

Discussion

The COVID-19 global pandemic dramatically changed the practice of medicine. The task of reducing the transmission of the virus, caring for those infected, treating other acutely ill patients, and continuing health maintenance for chronic conditions with finite resources required a major shift in healthcare delivery. This led national and

Table 2. Appointment experience of in-person and virtual visits			
	Likert scale score (SD)		
Survey question	In-person	Virtual	Significance
I could see the doctor clearly during the visit.	6.4 (1.24)	6.5 (0.92)	.77
I could hear the doctor clearly when he/she spoke to me.	6.6 (0.86)	6.5 (0.83)	.66
The doctor seemed to understand my problem.	6.7 (0.61)	6.5 (0.83)	.28
I understood what the doctor told me about my problem.	6.8 (0.59)	6.4 (1.24)	.07
Overall, I am satisfied with the quality of service being provided.	6.3 (1.29)	6.4 (0.77)	.58
The encounter met my expectations for a visit with my physician.	6.4 (1.15)	6.2 (1.04)	.43

SD, standard deviation.

global health organizations to call hospitals to "review all scheduled elective procedures with a plan to minimize, postpone, or cancel electively scheduled operations."[37]

Another recommendation was to increase the utilization of virtual appointments.[32] For many practices around the country, the institution of telemedicine was novel or underutilized. There was immediate concern that virtual visits would not suffice particularly when a patient requires a thorough physical examination. This is often seen in IR, where a specific line, drain, or other inserted "tool" can require examination by the physician. However, for most preprocedure visits within IR, telemedicine visits may be sufficient especially if patients feel they understand the physician's explanations and objectives just as well. IR procedural plans frequently rely more heavily on the imaging rather than the physical exam, and the patients ideally have been already examined by the referring provider.

New consultations and long-term surveillance provide opportunities for implementing telemedicine permanently in IR beyond the COVID-19 pandemic. They highlight the potential utility of telemedicine to provide expert specialty evaluation to patients in remote or underserved areas who otherwise lack access to specialty care. For example, patients could undergo a comprehensive evaluation remotely for a procedure and have the physical exam be performed before the in-person procedure. Telemedicine can allow IR practices to reach a wider geographic region of patients and lessens transportation burden of the patients. Initial decisions on the utility of performing a procedure can be decided before traveling so that the patient only needs to travel once for the actual intervention, resulting in both time and monetary savings.

Telemedicine visits are easily accessible through smartphones or tablets, given that 28.8% of this study's respondents conducted their visit via smartphone or tablet. Most respondents found it quite easy to join a scheduled appointment from their devices. However, this study did not assess how the socioeconomic background of patients affected their ability to easily attain appropriate devices for telemedicine appointments. Devices were not provided to respondents, and so socioeconomic background, and ability to have compatible devices, can affect the accessibility of telemedicine.

Telemedicine in IR is not without obstacles. There may be difficulty for patients to engage with the technology, especially those with hearing or vision problems which may impede interaction with the physician virtually. The majority of respondents did not seem to have technological limitations with telemedicine visits and were actually satisfied with their care (Table 2). The telehealth cohort's scores on MCCS were not significantly different when compared to the in-office control cohort, meaning that there was no reduction in the patient's ability to receive and seek more information as well as no reduction in the doctor's ability to coherently provide information and communicate (Table 3). Patients were able to describe their symptoms and receive accurate medical information from the physician no matter the type of visit format. These results indicate that the quality of consultation by interventional radiologists will not diminish when done virtually and that this format is scalable for a larger patient cohort.

Telemedicine also offers a potential opportunity to expand the outreach and network of IR specialists attempting to grow their patient base. Currently, the Society of Interventional Radiology is emphasizing the transition of IR to a primary clinical service. Telemedicine could make the field more visible to patients by allowing for quicker consultations, especially for outpatient procedures. The strategy of virtual visits to facilitate the ease of patients receiving a specialist opinion can be marketed to medical colleagues that could act as valuable referral sources.

While new policies and technology are often met with skepticism, the general opinion of telemedicine seems to improve after experiencing a telemedicine visit. All opinions regarding telemedicine were significantly higher and more positive in the telemedicine group. This suggests that a greater adoption of telemedicine within an IR practice will result in higher patient satisfaction and willingness to continue using telemedicine services. For patients who have not experienced telemedicine encounters, there may be an initial assumption that the quality of the conversation and appointment would be compromised, but changes in overall quality did not seem to be the case in this cohort. Furthermore, only 23.3% of total respondents in the

Table 3. Scores on MCCS subscales for in-person and virtual visits			
	Likert scale score (SD)		
Survey question	In-person	Virtual	Significance
Information giving	6.3 (0.62)	6.0 (0.80)	.07
Information seeking	6.5 (0.54)	6.3 (0.76)	.15
Information verifying	6.5 (0.65)	6.3 (0.78)	.45
Socioemotional communication	6.4 (0.83)	6.4 (0.82)	.67
Patient's self-competence	6.5 (0.46)	6.3 (0.58)	.07
Patient's other competence	6.3 (0.85)	6.1 (0.92)	.36

MCCS, Medical Communication Competence Scale; SD, standard deviation.

survey said they would be comfortable going to a doctor's office for a visit. This percentage may be biased by the fact that the current patient population resides in a large metropolitan area and may change depending on the geographic region of the population.

All types of IR clinic visits were included in this study (i.e., initial consultation, additional preoperative evaluation, postoperative visits, and long-term follow-up). Prior publications focused mainly on one visit type, typically postoperative care.[4,6,38-42,44] The study population is neither biased toward nor against virtual interactions, because the transition to telemedicine visits during the pandemic was involuntary at this institution.

Several study limitations are noted, some of which are inherent to the ongoing pandemic. This study is limited by the low response rate resulting in a nonresponse bias. Out of 621 surveys sent to IR patients, 90 patients completed the survey, with a response rate of 14.5%. Additionally, as the study cohort was solely patients in the Division of Interventional Radiology, these results may not be applicable to all specialties. The use of telemedicine may be more suited to certain types of visits, and this may be an area of further investigation by other specialties. Although it is generally accepted that the virtual visits would save a patient's time and money, the specific cost reductions were not quantified in this study.

Digital e-health literacy would be an important variable to compare between those that did and did not use more technologically intensive systems to interact with their providers. This was only indirectly done through the level of education of the respondents. It is interesting to note that when looking at the responses as a distribution among 6 response types there was no significant difference in education, yet when grouped into binary responses (below and at-or-above a 4-year degree), a significant difference was uncovered. Further study is required to know if this is an actual significant finding. Perhaps those with higher education would be more comfortable using telemedicine as an initial experience. However, because this significant difference was not present in the way the questions were presented to the patient, there was some control for education between the 2 cohorts. Future iterations of this survey should include more direct assessments of digital e-health literacy to determine if this plays a role in willingness to engage in telemedicine services.

Additionally, there may be some temporal bias in patient responses, as those with non-virtual visits were more likely to occur earlier in the year, before the COVID-19 restrictions were placed. Of the surveys completed, the median appointment date for in-person appointments was April 14, 2020, while for virtual appointments it was June 2, 2020. Patients with appointments earlier in the year are more subject to recall bias. Additional studies can be performed in the future that look at patients undergoing virtual and non-virtual appointments at similar times in an effort to reduce the recall and temporal bias. We pulled all visits from the 2020 year up to the date of this study in order to reduce any sort of temporal confounding of the results. However, given that virtual visits increased after restrictions were put in place to reduce the spread of the virus, it is expected that there would be a difference in the median appointment date for the 2 types of encounters. In the interest of public health safety, the institution significantly limited the amount of in-person visits as the year progressed, so there would not have been a safe way to ensure that the 2 cohorts had nonsignificant median dates given the unprecedented circumstances. It would have been difficult to get an adequate sample size of patients undergoing in-person visits at the same time as telemedicine visits. However, we acknowledge that the inherent bias within survey studies is highly dependent on the response rate and even the length of time between medical encounter and survey response.

Finally, these results can only be limited to patient populations that are highly educated or have a high degree of medical literacy. Perhaps due to the online nature of the survey, more highly educated patients were likely to respond. A majority of respondents in both cohorts attempted at least some form of education after a high school degree. This may inherently bias results and not make them representative of the opinions of patient populations where, for example, the majority has fewer than 8 years of education.

Conclusion

The global COVID-19 pandemic led to rapid implementation of virtual alternatives to the traditional in-office visit, forcing patients and clinical staff alike to adapt to these changes. There was no difference in the experience, satisfaction, and transmission of information between in-person and virtual IR appointments. Those who underwent telemedicine encounters were more likely to agree that telemedicine could have positive impacts on their care delivery. The virtual visit met patients' expectations, was user friendly, time and cost effective, and prevented unnecessary exposure during the COVID-19 pandemic. This demonstrates that the quality of the patient–physician relationship can be maintained through this new, growing medium and that there is a future role for telemedicine in IR.

Conflict of interest disclosure

The authors declared no conflicts of interest.

References

1. Telemedicine. Available at: https://www.medicaid.gov/medicaid/benefits/telemedicine/index.html. Accessed April 1, 2020.
2. Federation of State Medical Boards. Available at: https://www.fsmb.org/siteassets/advocacy/policies/fsmb_telemedicine_policy.pdf. Accessed June 8, 2020.
3. Pew Research Center. Mobile fact sheet. Available at: https://www.pewresearch.org/internet/fact-sheet/mobile/. Accessed June 8, 2020.
4. Viers BR, Lightner DJ, Rivera ME, et al. Efficiency, satisfaction, and costs for remote video visits following radical prostatectomy: a randomized controlled trial. *Eur Urol*. 2015;68(4):729-735. [CrossRef]
5. Holt B, Faraklas I, Theurer L, Cochran A, Saffle JR. Telemedicine use among burn centers in the United States: a survey. *J Burn Care Res*. 2012;33(1):157-162. [CrossRef]
6. Gunter RL, Chouinard S, Fernandes-Taylor S, et al. Current use of telemedicine for post-discharge surgical care: a systematic review. *J Am Coll Surg*. 2016;222(5):915-927. [CrossRef]
7. Safir IJ, Gabale S, David SA, et al. Implementation of a tele-urology program for outpatient hematuria referrals: initial results and patient satisfaction. *Urology*. 2016;97:33-39. [CrossRef]
8. Cain SM, Moore R, Sturm L, et al. Clinical assessment and management of general surgery patients via synchronous telehealth. *J Telemed Telecare*. 2017;23(2):371-375. [CrossRef]
9. Jue JS, Spector SA, Spector SA. Telemedicine broadening access to care for complex cases. *J Surg Res*. 2017;220:164-170. [CrossRef]
10. Valsangkar NP, Eppstein AC, Lawson RA, Taylor AN. Effect of lean processes on surgical wait times and efficiency in a tertiary care Veterans Affairs Medical Center. *JAMA Surg*. 2017;152(1):42-47. [CrossRef]
11. Dean P, O'Donnell M, Zhou L, Skarsgard ED. Improving value and access to specialty medical care for families: a pediatric surgery

telehealth program. *Can J Surg*. 2019;62(6):436-441. [CrossRef]
12. Asiri A, AlBishi S, AlMadani W, ElMetwally A, Househ M. The use of telemedicine in surgical care: a systematic review. *Acta Inform Med*. 2018;26(3):201-206. [CrossRef]
13. Mullen-Fortino M, Rising KL, Duckworth J, Gwynn V, Sites FD, Hollander JE. Presurgical assessment using telemedicine technology: impact on efficiency, effectiveness, and patient experience of care. *Telemed J E Health*. 2019;25(2):137-142. [CrossRef]
14. Paquette S, Lin JC. Outpatient telemedicine program in vascular surgery reduces patient travel time, cost, and environmental pollutant emissions. *Ann Vasc Surg*. 2019;59:167-172. [CrossRef]
15. Schroeder C. Pilot study of telemedicine for the initial evaluation of general surgery patients in the clinic and hospitalized settings. *Surg Open Sci*. 2019;1(2):97-99. [CrossRef]
16. Flannery D, Jarrin R. Building a regulatory and payment framework flexible enough to withstand technological progress. *Health Aff (Millwood)*. 2018;37(12):2052-2059. [CrossRef]
17. Medicare telemedicine Healthcare provider fact sheet. Available at: https://www.cms.gov/newsroom/fact-sheets/medicare-telemedicine-health-care-provider-fact-sheet.
18. Catanese S, Pentheroudakis G, Douillard JY, Lordick F. ESMO Management and treatment adapted recommendations in the COVID-19 era: pancreatic cancer. *ESMO Open*. 2020;5(suppl 3). [CrossRef]
19. Contreras CM, Metzger GA, Beane JD, Dedhia PH, Ejaz A, Pawlik TM. Telemedicine: patient-provider clinical engagement during the COVID-19 pandemic and beyond. *J Gastrointest Surg*. 2020;24(7):1692-1697. [CrossRef]
20. Grenda TR, Whang S, Evans NR. Transitioning a surgery practice to telehealth during COVID-19. *Ann Surg*. 2020;272(2):e168-e169. [CrossRef]
21. Hakim AA, Kellish AS, Atabek U, Spitz FR, Hong YK. Implications for the use of telehealth in surgical patients during the COVID-19 pandemic. *Am J Surg*. 2020;220(1):48-49. [CrossRef]
22. Hemingway JF, Singh N, Starnes BW. Emerging practice patterns in vascular surgery during the COVID-19 pandemic. *J Vasc Surg*. 2020;72(2):396-402. [CrossRef]
23. Kling SM, Philp MM. The effects of the COVID-19 pandemic on oncological surgery. *J Surg Case Rep*. 2020;2020(5):rjaa157. [CrossRef]
24. Latifi R, Doarn CR. Perspective on COVID-19: finally, telemedicine at center stage. *Telemed J E Health*. 2020;26(9):1106-1109. [CrossRef]
25. Layfield E, Triantafillou V, Prasad A, et al. Telemedicine for head and neck ambulatory visits during COVID-19: evaluating usability and patient satisfaction. *Head Neck*. 2020;42(7):1681-1689. [CrossRef]
26. Mascagni D, Eberspacher C, Mascagni P, et al. From high volume to "zero" proctology: Italian experience in the COVID era. *Int J Colorectal Dis*. 2020;35(9):1777-1780. [CrossRef]
27. Pignatti M, Pinto V, Miralles MEL, Giorgini FA, Cannamela G, Cipriani R. How the COVID-19 pandemic changed the Plastic Surgery activity in a regional referral center in Northern Italy. *J Plast Reconstr Aesthet Surg*. 2020;73(7):1348-1356. [CrossRef]
28. Plocienniczak MJ, Noordzij JP, Grillone G, Platt M, Brook C. Guidelines for resident participation in otolaryngology telehealth clinics during the COVID-19 pandemic. *Otolaryngol Head Neck Surg*. 2020;163(3):498-500. [CrossRef]
29. Shipchandler TZ, Nesemeier BR, Parker NP, et al. Telehealth opportunities for the otolaryngologist: a silver lining during the COVID-19 pandemic. *Otolaryngol Head Neck Surg*. 2020(Jul);163(1):112-113.
30. Shirke MM, Shaikh SA, Harky A. Tele-oncology in the COVID-19 era: the way forward? *Trends Cancer*. 2020;6(7):547-549. [CrossRef]
31. Tanaka MJ, Oh LS, Martin SD, Berkson EM. Telemedicine in the era of COVID-19: the virtual orthopaedic examination. *J Bone Joint Surg Am*. 2020;102(12):e57. [CrossRef]
32. Vecchione L, Stintzing S, Pentheroudakis G, Douillard JY, Lordick F. ESMO management and treatment adapted recommendations in the COVID-19 era: colorectal cancer. *ESMO Open*. 2020;5(Suppl 3). [CrossRef]
33. Walędziak M, Różańska-Walędziak A, Pędziwiatr M, et al. Bariatric surgery during Covid-19 pandemic from patients' point of view-the results of a national survey. *J Clin Med*. 2020;9(6). [CrossRef]
34. Seim NB, Philips RHW, Matrka LA, et al. Developing a synchronous otolaryngology telemedicine clinic: prospective study to assess fidelity and diagnostic concordance. *Laryngoscope*. 2018;128(5):1068-1074. [CrossRef]
35. Cegala DJ, Coleman MT, Turner JW. The development and partial assessment of the medical communication competence scale. *Health Commun*. 1998;10(3):261-288. [CrossRef]
36. COVID-19: people with certain medical conditions. Available at: https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html. Accessed April 1, 2020.
37. American College of Surgeons. COVID-19: recommendations for management of elective surgical procedures 2020. Available at: https://www.facs.org/covid-19/clinical-guidance/elective-surgery. Accessed June 15, 2020.
38. Hwa K, Wren SM. Telehealth follow-up in lieu of postoperative clinic visit for ambulatory surgery: results of a pilot program. *JAMA Surg*. 2013;148(9):823-827. [CrossRef]
39. Kummerow Broman K, Roumie CL, Stewart MK, et al. Implementation of a telephone postoperative clinic in an integrated health system. *J Am Coll Surg*. 2016;223(4):644-651. [CrossRef]
40. Nikolian VC, Williams AM, Jacobs BN, et al. Pilot study to evaluate the safety, feasibility, and financial implications of a postoperative telemedicine program. *Ann Surg*. 2018;268(4):700-707. [CrossRef]
41. Soegaard Ballester JM, Scott MF, Owei L, Neylan C, Hanson CW, Morris JB. Patient preference for time-saving telehealth postoperative visits after routine surgery in an urban setting. *Surgery*. 2018;163(4):672-679. [CrossRef]
42. Williams AM, Bhatti UF, Alam HB, Nikolian VC. The role of telemedicine in postoperative care. *mHealth*. 2018;4:11. [CrossRef]
43. Ungar OJ, Handzel O, Cavel O, Oron Y. A smartphone-based weber test may discriminate between a conductive and a sensorineural hearing loss. *Audiol Neurotol*. 2019;24(4):191-196. [CrossRef]
44. Shapiro SB, Lipschitz N, Kemper N, et al. Early experience with telemedicine in patients undergoing otologic/neurotologic procedures. *Otol Neurotol*. 2020;41(9):e1154-e1157. [CrossRef]