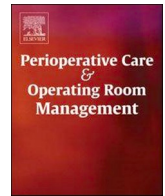




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Telemedicine for the pediatric preoperative assessment during the COVID-19 pandemic: Evaluating patient and provider satisfaction

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ARTICLE INFO

Keywords:

Telemedicine
Anesthesia
Pediatric surgery
Patient satisfaction
COVID-19

ABSTRACT

The COVID-19 pandemic has presented unprecedented challenges in delivering healthcare to surgical patients. To avoid delays in patient care while still minimizing COVID-19 infection risk to patients and providers, anesthesiology preoperative clinics were presented with the opportunity to implement telemedicine to assess patients' risks prior to surgery. This study explores patient and provider satisfaction with video-based telemedicine preoperative clinic visits during the COVID-19 pandemic via a patient and provider satisfaction survey. A vast majority (>93%) of patients expressed overall satisfaction with telemedicine visits. Similarly, >85% of providers agreed with the benefits of and expressed overall satisfaction with the preoperative telemedicine visits. Overall, patient and provider study participants had positive feedback in response to anesthesia preoperative telemedicine visits. Future studies could assess the preference of telemedicine to in-person visits once the fears of COVID-19 spread have been mitigated, as well as an assessment of outcomes comparing telemedicine and in-person visits.

1. Introduction

The COVID-19 pandemic presented unprecedented challenges in delivering healthcare to patients around the world resulting in delays in non-urgent surgeries and elective healthcare visits, which had immeasurable medical and economic impacts for patients and healthcare systems. Most significant, delays in diagnostic evaluation and treatment can result in more advanced disease and worse outcomes for patients.¹ The World Health Organization recognized and warned against the effects of overwhelmed healthcare systems and the importance of maintaining equitable access to essential health services.² Telemedicine was rapidly adopted as a way to deliver healthcare during the pandemic while reducing exposure to potentially ill patients, preserving personal protective equipment, and minimizing the number of patients in waiting rooms at healthcare facilities.³ The Centers for Disease Control and Prevention (CDC) and various professional medical societies, including the American Society of Anesthesiologists (ASA), provided guidance to

healthcare professionals about implementing telemedicine in their own practices.^{4,5} The ASA supported the continued investment in telemedicine and recommended the use of telemedicine for components of the preoperative patient evaluation.⁶ The U.S. Centers for Medicare & Medicaid Services (CMS) also dramatically expanded access to telemedicine services, setting Medicare reimbursement for telemedicine at equivalent rates as in-person visits.^{5,7}

The role of the anesthesiology preoperative clinic is to identify and ensure patient's underlying medical conditions are optimized, perform care coordination, patient education and counseling to maximize patient safety and optimal outcomes.^{8,9} Anesthesiology preoperative clinics were presented with the opportunity to implement telemedicine to assess patients' risks prior to surgery. Unique to the pediatric setting, healthcare workers are challenged with not only evaluating their patients, but also reassuring, connecting with, and guiding these children's families and guardians. As telemedicine evolves and becomes a potentially permanent option in patient care, it is important to include it in

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<https://doi.org/10.1016/j.pcorm.2022.100252>

Received 2 December 2021; Received in revised form 18 February 2022; Accepted 30 March 2022

Available online 1 April 2022

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measures to preserve and improve patient satisfaction across all healthcare delivery modalities. Patient and provider satisfaction should play a significant role in the endurance of telemedicine after the COVID-19 pandemic is no longer driving the practice. Studies of patient satisfaction with telemedicine services during the pandemic have found to have high rates of satisfaction in adult patients,^{3,10,11} as we predict will be the same in this study. To our knowledge, this is the first descriptive observational study of patient and provider satisfaction with telemedicine use in pediatric preoperative clinics since the start of the COVID-19 pandemic. This study explores patient and provider satisfaction with video-based telemedicine visits during the COVID-19 pandemic, utilizing a telemedicine satisfaction survey of both pediatric patients and their parents or guardians who presented to an Anesthesiology Preoperative Evaluation Clinic, and of physician and advanced practice providers who conducted the visits.

2. Methods

2.1. Intervention: telemedicine protocol

Children's National Hospital is a nationally ranked, freestanding, 323-bed, pediatric acute care children's hospital located in Washington D.C. The Anesthesiology Preoperative Care Clinic (POCC) sees an average of 900 patients a year in preparation for surgery or procedures under anesthesia either in person or via telemedicine. The Preoperative Care Clinic at Children's National Hospital sees patients with complex medical conditions or multiple comorbidities, those who have had problems with anesthesia in the past, have severe anxiety or behavioral concerns, and any patient or guardian who desires education and counseling prior to surgery. Upon receiving a consultation from the surgeon, the patient is reviewed by a POCC provider and determined if the patient is low risk and can be evaluated with chart review or warrants a visit with POCC. Patients ineligible for telemedicine are those with unstable comorbidities, such as uncontrolled asthma or decompensated cardiac condition, those with syndromes or conditions associated with potential difficult intubation, morbid obesity, and patients with recent respiratory illness requiring auscultation for anesthesia clearance. Patients who required routine preoperative laboratory studies were given the option of attending an in-person POCC visit which would allow for all necessary studies to be obtained or having the visit via telemedicine and presenting to our laboratory facilities for blood work at a different time. Similarly, patients without access to or knowledge of technology required to participate in telemedicine were offered an in-person visit.

The clinic's video-based telemedicine visits were conducted via Zoom for Healthcare (Zoom Video Communications, Inc., San Jose, California), a Health Insurance Portability and Accountability Act-compliant platform with data in motion encrypted at the application layer using Advanced Encryption Standard. Physicians and advanced practice providers in the anesthesiology department received training to conduct virtual telemedicine visits. Patients and their parents/guardians were assessed for capability for a video-based telemedicine visit and then given instructions to prepare for their visit. The telemedicine visit included verbal or electronic consent; confirmation of upcoming procedure and goal of the visit; review of medical history, anesthesia history, and medications; and a brief physical exam. Preoperative instructions and anesthesia and postoperative plan were discussed. The anesthesiologist conducted the telemedicine visit in a private office. At the conclusion of the telemedicine preoperative clinic visit, patients or their parents/guardians were given the opportunity to complete an anonymous survey about their experience. A separate survey was created to assess overall provider satisfaction with telemedicine encounters at the end of the study timeframe.

2.2. Study design

A chart review was conducted of telemedicine outpatient encounters by in the Anesthesiology Preoperative Care Clinic at Children's National Hospital from September 1 to December 15, 2020. Only patients who were seen via video-based encounter were included, while patients who received telephone consults or in-person visits were excluded.

Following the telemedicine visit, the patient or their parent or guardian was contacted by a research assistant to voluntarily complete the anonymous patient satisfaction survey. Verbal consent to participate was obtained.

A structured survey was created to assess patient and caregiver satisfaction with video-based telemedicine visits. The device used and education level of the respondents was obtained by querying respondents during the survey. The survey used modifications of the telemedicine usability questionnaire (TUQ) and included questions regarding interaction quality, ease of use, privacy concerns, comparison to in-person visits, and overall satisfaction. The TUQ is a validated survey tool used to measure the quality of computer-based user interface and telemedicine interaction and services.¹² The survey allowed responses using the Likert scale to range from 1-strongly disagree to 5-strongly agree. The survey permitted comparison of responses across different devices, measured the quality of the telemedicine interaction, and assessed patient satisfaction with the encounter compared to conventional in-person visits.

A similar Likert scale survey was created to assess provider satisfaction with telemedicine consultation. This project was reviewed by Children's National Institutional Review Board (IRB) and was determined to be a Quality Improvement Initiative. As such it was exempted from further IRB review and not under the direct oversight of the IRB.

2.3. Data collection

If the patient was over the age of 18 and able to make medical decisions, they participated in the survey themselves. However, since the majority of the patients were underage, the parent or guardian present at the visit was contacted by phone following the telemedicine visit. Non-English-speaking respondents were contacted with an interpreter. Phone calls were made using the hospital line or via the hospital operator, to allow the hospital name to display on the recipient's caller ID. The first attempt at contact was made on the same day as the telemedicine visit. For non-answered calls, two additional attempts were made the following day at different times. After three attempts, the patient was deemed unable to be contacted. Demographic data and survey responses were collected anonymously. Study data were collected and managed using REDCap electronic data capture tools hosted at Children's National Hospital.

All providers who conducted video-based telemedicine visits were given an email link to anonymously complete a satisfaction survey regarding their overall views of telemedicine for the pre-anesthesia evaluation.

2.4. Data analysis

Patient demographics were presented descriptively using mean with standard deviation (SD) for continuous data, and frequency with percentage for categorical data. The Likert scale responses from the patient and provider satisfaction surveys were presented as frequencies with percentages of the corresponding responses. Mean and median scores and the standard deviations and range for each item were calculated by assigning points to each response as follows: 1= strongly disagree, 2= disagree, 3= neither agree nor disagree, 4= agree and 5= strongly agree. Statistical analyses were performed using R statistical software, version 4.0.0 (R Core Team, 2020).

3. Results

Between September 1 and December 15, 2020, a total of 325 patients received clinic-based preoperative consultations, of which 204 encounters were conducted using a video-based telemedicine platform. Survey responses were obtained from 101 of the 204 encounters, for a response rate of 49.5%. Patient demographic characteristics are presented in Table 1. The average age of participating patients was 9 years old. The majority of study participants preferred English as their primary language (88%). Most participants conducted the telemedicine visit using a smartphone (52%), followed by a laptop (37%).

The majority of the patient study participants (>93%) either agreed or strongly agreed with statements regarding the benefits of the preoperative visit, that their concerns were addressed, that video clarity was acceptable, that they were able to talk easily and understand recommendations, that patient privacy was maintained, that they saved time traveling, their overall satisfaction with the visit, and their willingness to participate in telemedicine again. Fewer participants (84% agreed or strongly agreed) felt the technology was easy to use. The lowest mean score was with opinions of telemedicine visits being as effective as an in-person visit (4.3); still, a clear majority had positive responses with 85% who agreed or strongly agreed that the telemedicine visit was as effective as an in-person visit. The results of the study participant satisfaction survey can be seen in Table 2.

Eighteen out of 21 providers consisting of 15 anesthesiologists and 3

Table 1
Patient demographics (N = 101).

Patient demographics	N = 101
Age (years), mean (SD)	9.1 (6.4)
Sex, n (%)	
Male	55 (54.5)
Female	46 (45.5)
Race, n (%)	
White	30 (33.3)
Black	43 (47.8)
Asian	3 (3.3)
American Indian or Alaska Native	1 (1.1)
Other	13 (14.4)
Ethnicity, n (%)	
Hispanic or Latino	19 (19.6)
Not Hispanic or Latino	78 (80.4)
Insurance status, n (%)	
Uninsured	1 (1.0)
Private insurance	57 (57.0)
Medicaid	40 (40.0)
Medicare	2 (2.0)
Preferred language, n (%)	
English	88 (88.0)
Spanish	11 (11.0)
Pashto	1 (1.0)
Procedure, n (%)	
Orthopedic	37 (37.0)
General Surgery	9 (9.0)
Otolaryngology	27 (27.0)
Plastic Surgery	3 (3.0)
Ophthalmology	1 (1.0)
Dental	4 (4.0)
Radiology	1 (1.0)
Urology	9 (9.0)
Other, Multiple Surgeons	9 (9.0)
Device used, n (%)	
Smartphone	52 (51.5)
Tablet	8 (7.9)
Laptop	37 (36.6)
Desktop	4 (4.0)
Educational attainment of respondent, n (%)	
Did not complete high school	5 (5.3)
Completed high school	18 (18.9)
Some college	24 (25.3)
Bachelor's degree	33 (34.7)
Post-graduate degree	15 (15.8)

nurse practitioners completed a satisfaction survey regarding their overall experience with the telemedicine anesthesia preoperative visits, resulting in a response rate of 85%. Similar to patients and caregivers, providers who conducted video-based telemedicine preoperative clinic visits were overwhelmingly satisfied. The majority of providers (86%) either agreed or strongly agreed with statements regarding the benefits of and overall satisfaction with the preoperative visits, the ability to communicate with and hear patients and their parents/guardians during visits, the ability to obtain necessary information, and the ease of technology use. Fewer providers were confident that patients' privacy was protected (83%) and again the lowest scores were associated with opinions of telemedicine visits being as good as in-person visits (mean score of 3.7, with 61.1% of providers agreeing or strongly agreeing). Despite this, 88.2% of providers agreed or strongly agreed that they were ultimately "very satisfied" with the telemedicine preoperative anesthesia visit. The results of the provider satisfaction survey can be seen in Table 3.

4. Discussion

Preoperative clinics provide a structured environment for anesthesiologists to perform assessments prior to surgery. The goals of the preoperative evaluations are to optimize medical conditions for patients, create rapport with the patient and family and coordinate care with specialists and surgeons prior to surgery. The expectations and goals of the surgery are reviewed, potential risk factors and complications are discussed, factors that might influence surgery and postoperative recovery after surgery. Preoperative clinics should be accessible to the patient and team. Many practice groups, including anesthesiology preoperative clinics, have increasingly relied on telemedicine visits during the COVID-19 pandemic to help with the accessibility to care for patients.

Telemedicine has allowed healthcare practices to mitigate the spread of COVID-19 and other illnesses while also preserving personal protective equipment.¹³ Apart from limiting possible exposure, telemedicine provides several potential benefits including increased access to healthcare particularly for underserved and rural areas, reduced travel time to and from the physician's office, reduced wait times during appointments, and reduced costs associated with attending an in-person appointment.^{7,14} Telemedicine visits have reduced patient's total time of a clinical encounter with a 72% reduction in duration without any significant change in quality of care.¹⁵ This can lead to reduced costs for patients as well as increased efficiency for healthcare providers. While there has been a steep learning curve for both patients and healthcare practitioners to implementing telemedicine, the levels of patient and provider satisfaction with these platforms suggests telemedicine could be a permanent tool for healthcare delivery.^{3,13} We found telemedicine to be a valuable tool to conduct an anesthetic preoperative evaluation, with high patient and provider satisfaction.

Anesthesiologists in preoperative clinic are able to obtain a comprehensive history, review patient specific risk factors, discuss risk factors of anesthesia and surgery, develop a preoperative plan, recommend labs/tests that need to be completed prior to surgery, prepare the patient and family for the day of surgery and answer anesthesia related questions over video-based visits. While only a limited physical examination can be carried out during a telemedicine visit, Prasad et al. (2020) showed airway examination, which is critical for an anesthesiology evaluation, can be performed thoroughly via a virtual visit with appropriate equipment and patient guidance.¹⁰ If it is medically appropriate to delay a formal physical exam until the morning of surgery, a pre-anesthesia clearance visit conducted via telemedicine is an alternative that should be considered in the pediatric population. The lack of full physical examination raises concerns regarding the appropriateness of telemedicine consultation for medically complex patients. There is a paucity of studies identifying what medical conditions exclude patients from telemedicine consultation.¹⁶ We permitted telemedicine

Table 2
Telemedicine patient satisfaction Likert scale score data (N = 101).

Likert Scale Score	n (%)					Mean score (SD)	Median score (Range)
	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)		
My concerns were addressed during this visit	0 (0%)	0 (0%)	1 (1.0)	34 (33.7)	66 (65.3)	4.6 (0.5)	5.0 [3.0, 5.0]
Preoperative anesthesia instructions were given during this visit	1 (1.0)	3 (3.0)	3 (3.0)	35 (35.0)	58 (58.0)	4.5 (0.8)	5.0 [1.0, 5.0]
I feel this preoperative consultation was beneficial to my child's care	0 (0%)	0 (0%)	0 (0%)	37 (37.0)	63 (63.0)	4.6 (0.5)	5.0 [4.0, 5.0]
The technology to set up the telemedicine visit was easy to use	1 (1.0)	5 (5.0)	10 (9.9)	36 (35.6)	49 (48.5)	4.3 (0.9)	4.0 [1.0, 5.0]
I was able to talk comfortably with the providers on the video screen	0 (0%)	2 (2.0)	2 (2.0)	32 (31.7)	65 (64.4)	4.6 (0.6)	5.0 [2.0, 5.0]
I was able to understand the provider's recommendations for my child	0 (0%)	1 (1.0)	1 (1.0)	30 (29.7)	69 (68.3)	4.7 (0.6)	5.0 [2.0, 5.0]
I was able to see the providers easily during the telemedicine visit	0 (0%)	1 (1.0)	2 (2.0)	31 (30.7)	67 (66.3)	4.6 (0.6)	5.0 [2.0, 5.0]
I feel confident my child's privacy was respected during the telemedicine visit	0 (0%)	0 (0%)	2 (2.0)	34 (33.7)	65 (64.4)	4.6 (0.5)	5.0 [3.0, 5.0]
Overall, I am very satisfied with this preoperative anesthesia visit	0 (0%)	0 (0%)	0 (0%)	38 (37.6)	63 (62.4)	4.6 (0.5)	5.0 [4.0, 5.0]
Telemedicine saved me time traveling to a hospital or clinic	1 (1.0)	1 (1.0)	2 (2.0)	27 (26.7)	70 (69.3)	4.6 (0.7)	5.0 [1.0, 5.0]
The visit provided over the telemedicine system is as effective as in-person visits	2 (2.0)	7 (6.9)	7 (6.9)	30 (29.7)	55 (54.5)	4.3 (1.0)	5.0 [1.0, 5.0]
I would use telemedicine services again	2 (2.0)	1 (1.0)	2 (2.0)	33 (33.0)	62 (62.0)	4.5 (0.8)	5.0 [1.0, 5.0]
Overall, I am satisfied with this telemedicine system	0 (0%)	1 (1.0)	1 (1.0)	39 (38.6)	60 (59.4)	4.6 (0.6)	5.0 [2.0, 5.0]

Table 3
Likert scale score data for providers (N = 18).

Likert Scale Score	n (%)					Mean score (SD)	Median score (Range)
	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)		
I could easily talk to the patient/parent on the video screen	0 (0)	0 (0)	0 (0)	10 (55.6)	8 (44.4)	4.4 (0.5)	4.0 [4.0, 5.0]
I was able to hear the patient/parent clearly	0 (0)	0 (0)	0 (0)	12 (66.7)	6 (33.3)	4.3 (0.5)	4.0 [4.0, 5.0]
I was able to see the patient/parent during the telemedicine visit	0 (0)	0 (0)	1 (5.6)	11 (61.1)	6 (33.3)	4.3 (0.6)	4.0 [3.0, 5.0]
I feel confident the patient's privacy was respected during the telemedicine visit care	0 (0)	0 (0)	3 (16.7)	7 (38.9)	8 (44.4)	4.3 (0.8)	4.0 [3.0, 5.0]
I was able to obtain all the necessary information during this telemedicine visit	0 (0)	0 (0)	2 (11.1)	11 (61.1)	5 (27.8)	4.2 (0.6)	4.0 [3.0, 5.0]
The preoperative anesthesia visit provided over the telemedicine system is as effective as an in-person visit	0 (0)	3 (16.7)	4 (22.2)	7 (38.9)	4 (22.2)	3.7 (1.0)	4.0 [2.0, 5.0]
The technology to set up the telemedicine visit was easy to use	0 (0)	0 (0)	2 (11.1)	11 (61.1)	5 (27.8)	4.2 (0.6)	4.0 [3.0, 5.0]
I am very satisfied with the telemedicine preoperative anesthesia visit	0 (0)	0 (0)	2 (11.8)	10 (58.8)	5 (29.4)	4.2 (0.6)	4.0 [3.0, 5.0]

evaluation for medically complex patients who were medically stable and up to date with specialist visits. Kamdar et al. found that patients with American Society of Anesthesiologists physical status I-IV can successfully use telemedicine consultation without a difference in procedure cancellation rates.¹⁷ Similarly, we had zero same-day surgical cancellations due to an incomplete preoperative evaluation, suggesting the integration of telemedicine did not negatively impact the quality of our preoperative assessment.

Telemedicine visits during the COVID-19 pandemic have shown to have high patient satisfaction in the adult population.^{10,11} Patient satisfaction is an important measure of high quality, value-based care and has shown to reduce 30-day readmission rates and postoperative complications.¹⁸ In this study, patients and parents/guardians reported high satisfaction with the telemedicine visits, with a mean score of 4.5-4.6. Along with high satisfaction with the preoperative anesthesia

telemedicine visits, patients or parents/guardians indicated that they would use the telemedicine services again (mean score 4.9).

Patients also appeared to be satisfied with the interface of Zoom itself, despite reported difficulties setting it up. Prior to each video-based telemedicine visit, each parent or guardian was contacted, their capability for a video-based telemedicine visit was assessed, and log-in instructions were provided. The parent or guardian was emailed the Zoom link, along with the names of the clinician and time of the appointment. Although the patient, parent or guardian indicated high satisfaction with the how the technology enabled them to talk, see, and understand providers during the video-based visit, they shared that the technology was difficult to set up, citing timing of receiving and finding the email link, confirming an internet connection, and comfort with the technology as barriers to setting up the technology. With this knowledge, we have implemented changes in our telemedicine scheduling process,

including making the email confirmation easier to search for, sending email reminders two days prior to appointment, and calling each scheduled patient the day prior to their appointment to ensure they have the Zoom link, adequate internet connection, and are able to log in. With these changes in place, there have been fewer delays in patients logging into the virtual visit, our no show and cancellation rate has decreased, and parents/guardians have expressed increased satisfaction with the log-in process.

A majority of respondents also agreed that telemedicine visits saved them time in traveling to the clinic. Our telemedicine visits are scheduled at one-hour intervals and we have found that regardless of delays due to technical issues, the telemedicine visit rarely requires an hour to complete. In contrast, our in-person visits are scheduled in 30–60 min intervals depending on patient complexity, and while the visit itself may take 30–60 min, there is increased time and money spent when accounting for travel time and costs, especially in a metropolitan area with significant travel times due to traffic, as is the case in Washington, D.C.¹⁷

A previous study indicates that the patient-provider relationship during a telemedicine visit is comparable to in-person visits where patients were equally satisfied with the physician's ability to build rapport, have a shared mental model with the patients, and advocate for patient-centered communication.¹⁹ Consistent with this previous study, patients we surveyed expressed high satisfaction with their interaction with the health care provider during the telemedicine visit. However, a unique aspect of pre-anesthesia evaluation visits is that most patients do not have an established relationship with the provider; therefore, the satisfaction expressed by these study participants pertains to the telemedicine visit itself, without any previous bias based on provider-patient relationship influencing satisfaction scores. Interestingly, the feasibility of telemedicine increases access to care and diminishes many obstacles for patients who may require multiple preanesthetic evaluations over time, thereby improving those patient-provider relationships and patient outcomes.

The importance of face-to-face interaction has been stressed by health care providers expressing concern about the barriers to telemedicine.²⁰ Although patients, parents/guardians shared that the anesthesia evaluation was beneficial to the patient's care, the lowest mean scores were seen when the telemedicine visit was compared to an in-person visit. Some caretakers felt that the telemedicine visits were not as effective as in-person visits. Anecdotal reports show caretakers express concern with the lack of physical examination. Similarly, adult patients have indicated that telemedicine visits are not the same as in-person visits due to the lack of physical examination and lack of "human touch".²¹ We must effectively communicate and demonstrate the value of telemedicine to enhance confidence in the encounter. Reassurance that many elements of the physical examination pertinent to anesthesia clearance can be completed effectively via telemedicine with patient and parental collaboration is necessary. The clinician should use a high-resolution camera with ample lighting and maintain eye contact. Every individual present should be acknowledged and introduced. An overview and expectations of the visit should be declared, as well as possible tasks that may require patient or parental assistance. After a comprehensive and detailed clinical assessment and treatment plan, allowing time for questions and providing the clinician's contact information ensures patients they are receiving the same quality care as an in-person encounter.

A verbal or electronic consent was provided to patients and guardians prior to or during the telemedicine visit based on the legal counsel at Children's National Hospital. The consent included informing participants of the possibility that a breach of security protocols with the technology would allow the chance for medical information to be shared; cautioned participants that telemedicine is not an exact science; and stated that no guarantees could be made regarding outcomes and results of the examinations and treatments. Despite these cautions, most patients and guardians indicated they felt confident that the patient's privacy was respected, and the quality of care was not compromised

with telemedicine. Many patients, parents/guardians, especially with regard to children with medical complexity, shared that they were familiar with telemedicine visits with other specialists which made the patient, parent or guardian more comfortable with each visit. When the survey started on September 1, 2020, of the 1336 Children's National Hospital ambulatory visits, 497 (37%) were telemedicine visits. Similarly, on December 15, 2020, 35% of all Children's National Hospital ambulatory visits were telemedicine encounters, showing that more than 1/3 of patients utilized the telemedicine services consistently during the study period.

Unique to many patient satisfaction studies involving telemedicine services, physicians and nurse practitioners were also surveyed since provider satisfaction is a critical factor in determining if telemedicine will continue to be utilized.²² Previous studies have looked at various determinants of provider satisfaction including effective organization, reliable technology, sufficient financing, institutional support of its use, and acceptance from providers and patients.²³ In our study, providers rated telemedicine preoperative visits favorably in terms of physician-patient communication and the technological interface. Anecdotal reports showed providers believed telemedicine is extremely efficient as it eliminates the time needed for travel, registration, and checking into an in-person visit, it was easier to communicate with patients without the PPE required for in-person visits, patients were more easily accessible and allowed participation from additional guardians/caretakers that may not have been able to attend an in-person visit, and overall felt safer with telemedicine services as it decreased the risk of exposure to COVID-19. Providers also noticed patients and their family were more at ease as they were able to conduct the visit in the comfort of their home, and the visit was perceived to be a more pleasant and joyful experience. Similar to patient opinions about telemedicine, providers also had the lowest mean score with telemedicine visits being as effective as in-person visits, possibly indicating that providers and patients still find that the most thorough or complete evaluation is in person. Anecdotally, providers expressed the lack of the ability to auscultate as the major concern.

4.1. Limitations

The COVID-19 pandemic expedited the use of telemedicine services, and although the study started a few months after the implementation of telemedicine in our clinic, the sample size was low (101 survey responses from 204 encounters). The results of the survey may have been influenced by the respondents' alleviated fears of reducing their exposure to COVID-19 with telemedicine visits instead of in person clinic visits. The survey did not include questions regarding patient or provider concerns about the pandemic and their individual health, or their thoughts of the telemedicine visits in relation to COVID-19. Recall bias may have had an impact on the survey results depending on if the parent/guardian was reachable immediately after the telemedicine encounter versus the next day. There is also a selection bias: patients included in this study had access to technology, knowledge about the technology, and the literacy level needed to understand the email link that was sent to them. A comparative study between telemedicine encounters and in-person visits could be more effective in determining patient and provider satisfaction with telemedicine services.

5. Conclusion

The COVID-19 pandemic pushed providers to re-examine access to care and incorporate telemedicine into their practice. Patient satisfaction metrics are an important component of health care quality and play a significant role in long-term acceptance and success of a telemedicine program. Telemedicine is a valuable tool to conduct an anesthetic preoperative evaluation, with high patient and provider satisfaction. To our knowledge, this is the first study addressing patient and provider satisfaction with telemedicine in an anesthesiology pediatric preoperative

clinic during the COVID-19 pandemic and serves as an excellent pilot study precluding randomization of telemedicine versus in-person visits for an assessment of outcomes.

Funding/Support

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

CRediT authorship contribution statement

Giuliana Geng-Ramos: Conceptualization, Visualization, Data curation, Supervision, Writing – review & editing. **Richa Taneja:** Writing – original draft, Writing – review & editing. **Chaitanya Challa:** Visualization, Data curation, Writing – review & editing. **Caroll Vazquez- Colon:** Visualization, Data curation, Writing – review & editing. **Jessica Cronin:** Visualization, Data curation, Writing – review & editing. **Ana Campos:** Data curation, Writing – review & editing. **Rachel Selekman:** Writing – review & editing. **Md Sohel Rana:** Formal analysis, Writing – review & editing. **Anjna Melwani:** Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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