How We Continued to Care for Our Patients: The Rapid Implementation of Telemedicine to Provide Pediatric Musculoskeletal Care in Response to COVID-19 at a Large Academic Children's Hospital

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Abstract: The aim of this paper is to outline the telemedicine strategies and infrastructure implemented by the Division of Orthopaedics due to the COVID-19 pandemic at the Children's Hospital of Philadelphia (CHOP). We rapidly implemented new tools to make the transition to telemedicine possible. This involved leveraging existing infrastructure to develop clinical decision support, a centralized training platform, and access to real time data for quality improvement. Our division now conducts over 50% of visits via telemedicine. In the first 3 weeks, established patients accounted for the largest proportion of these visits, and knee injuries were the most common diagnoses encountered. Preliminary results indicated high satisfaction with the telemedicine experience. The COVID-19 pandemic has required healthcare providers to rapidly implement telemedicine on a larger scale than ever before. We expect that the expansion of telemedicine will increase access to healthcare beyond the pandemic.

Key Points:

- Telemedicine is an effective addition to in-person care and will expand access to care beyond the duration of the COVID-19 pandemic.

- Electronic Medical Record portals provide functional media platforms for virtual telemedicine visits.

- Engagement between the clinical team and data analytics is necessary to analyze data in real-time and make informed decisions.

- Telemedicine has been a driving force behind maintaining access to patient care and in a time when it would not be otherwise possible.

Introduction

Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), the viral causative agent of the infectious disease coronavirus 2019 (COVID-19), was detected on December 30, 2019.[1,2,3] By March 11, 2020 the number of confirmed COVID-19 cases worldwide had spiked to over 118,000 throughout 114 countries and the World Health Organization declared the outbreak a pandemic, marking the first coronavirus-caused pandemic in history.[3-5] Since then, the United States has been disproportionately impacted by the spread of the novel virus, and as of April 18, 2020, the United States accounted for nearly one-third of the 2.2 million cases worldwide.[5] The pervasive nature of the virus has caused unprecedented disruption to our healthcare system,
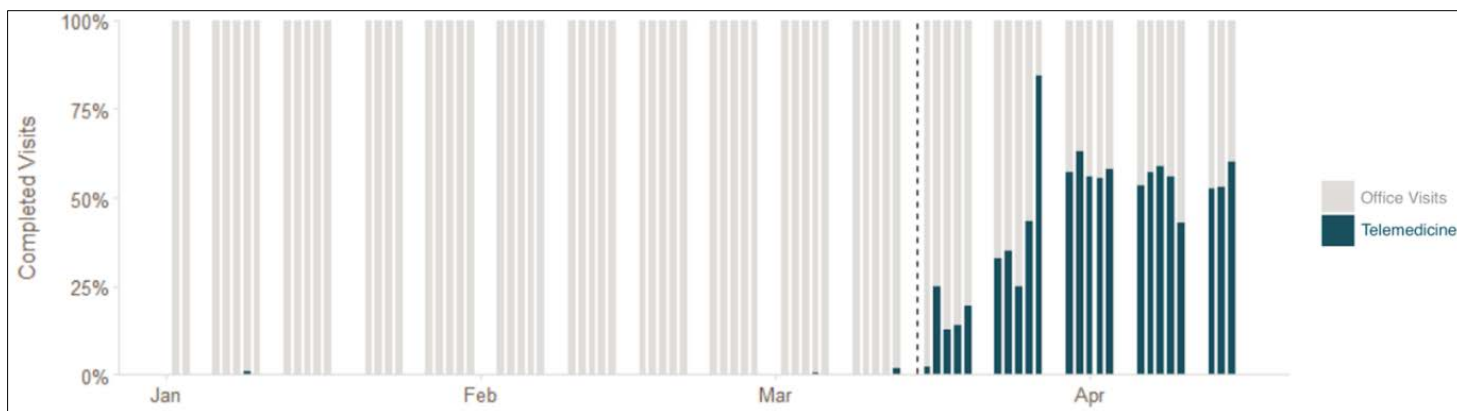
Figure 1. *Percentage of completed orthopaedic visits that are telemedicine*

generating an influx of infected patients and critical supply shortages.[6-8]

Following Center for Medicare & Medicaid Services (CMS) guidelines and American College of Surgeons (ACS) recommendations to minimize virus transmission and preserve acutely scarce resources, the Children's Hospital of Philadelphia (CHOP) announced the cessation of all nonessential procedures, admissions, and outpatient visits starting the week of March 15, 2020.[9,10] These precautions posed challenges to the delivery of healthcare at CHOP and countless other hospitals worldwide.

Musculoskeletal (MSK) conditions account for a large percentage of healthcare visits in the United States.[11] The U.S. Bone and Joint Initiative reports that 48 persons per 100 population are affected in some way by an MSK disorder.[11] While the MSK disorder burden increases with age, studies show that the MSK disorders still account for a significant portion of healthcare visits in the pediatric population.[12-14] Notably, it has been reported that one-third of pediatric medical conditions are MSK related.[13] Therefore, the implementation of telemedicine is critical in order to ensure that pediatric patients continue to have access to orthopaedic care while minimizing patient and provider physical exposure and mitigating the increasing number of deferred patient visits. In 2017, Abel et al. examined the effectiveness of virtual video visits for pediatric knee arthroscopic surgery follow-ups at CHOP by revealing no significant

difference in clinical findings between telemedicine and in-office visits, as well as demonstrating high patient satisfaction.[15] In addition to this study, both patients and providers demonstrate high satisfaction ratings of telemedicine in the literature[16-18] This work was acknowledged and slowly adopted within our division, but did not gain traction until our response to COVID-19 resulted in the cancellation of all non-emergent office visits and surgeries. With the strain that COVID-19 has put on our healthcare system, it is essential to implement telemedicine strategies on a large scale to best serve the population. The purpose of this report is to provide an educational resource describing how the use of telemedicine has allowed continued access to non-emergent, yet necessary MSK care at a large academic pediatric hospital and care network. Here we outline the strategies and operational infrastructure implemented within the Division of Orthopaedic Surgery at CHOP that allowed for a successful transition to telemedicine in the outpatient setting.

Methods

Within the CHOP pediatric care network comprising more than 50 locations, the Division of Orthopaedics provides MSK services at five specialty care and three ambulatory surgical care centers in Pennsylvania and New Jersey, in addition to a 546-bed hospital on its primary campus. In response to the mandated cancellations and postponements of our non-urgent surgeries and office encounters, the Division of Orthopaedics rapidly increased telemedicine utilization

over a period of 72 hours. This rapid expansion was made possible through extensive coordination between CHOP Digital Health, Information Services (IS) support, data analytics, and patient care teams.

Leveraging Existing Infrastructure

Prior to COVID-19, the CHOP patient portal "MyCHOP", a branded version of Epic's MyChart platform, provided patient families with quick access to their children's health information, including appointment details, medications, and lab results. MyCHOP also provided a place for patients and families to leave messages and questions for the patient care team. Video-based telemedicine visits were available through the patient portal, but these visits were limited to follow-up encounters within the 90-day global period of care. In response to COVID-19 and temporary regulatory waivers from the federal government, this platform was expanded to facilitate virtual video visits through the MyCHOP mobile app for iPhones (Android phones do not work), tablets, and laptop/desktop computers with cameras.[9] Our infrastructure allowed for the rapid expansion of the program to include patient encounters beyond those within a 90-day global period, where no additional reimbursement for care was expected. To assist patients and families navigating video visits, a user guide with step-by-step instruction was developed and made publicly available on CHOP's website and the MyCHOP app.

Table I. Breakdown of Telemedicine Visits by Primary Diagnosis, Percentage Postoperative, and Percentage New Patients

Primary Diagnosis	n	% Post-op	% New Patients
Knee	**118**		
Meniscus Tear	28		
OCD	17		
ACL	16	28.5%	11.9%
Pain	13	(34)	(14)
Instability	9		
Dislocation	6		
Other	29		
Fracture	**112**		
Humerus	25		
Foot	17		
Tibia	14		
Forearm/Radius/Ulna	12	41.1%	6.3%
Clavicle	10	(46)	(7)
Fibula	10		
Femur	8		
Lower leg unspecified	5		
Other	11		
Concussion	**110**	0% (0)	9.1% (10)
Scoliosis	**28**		
Adolescent idiopathic	23	17.9%	14.3%
Juvenile idiopathic	2	(5)	(4)
Other/unspecified	3		
Hip	**26**		
Congenital deformity	10		
Joint derangement	4	30.8%	15.4%
Pain	3	(8)	(4)
Osteochondropathy	2		
SCFE	2		
Other	5		
All visits	**553**	23.5% (130)	12.7% (70)

Clinical Decision Support

To facilitate video visits for orthopedic providers, a clinical informaticist developed clinical decision support (CDS) tools to provide additional guidance on billing for video visits and utilizing tools embedded within

Epic. Tips on billing by length of time were placed within an order set that included the billing levels for new, established, and postoperative patients along with the telemedicine visit modifiers. The informaticist worked with IS to streamline orders for visits to prevent the loss of patients as visits were switched from in-person to video or telephone visits. The order includes specific, discrete items for video and telephone visits along with specific items regarding future encounters, in-person or via telemedicine. Discrete descriptors for the visit include casting and X-ray orders, visit type and location, and the provider for the visit. Once signed, the order is routed to a work queue that is managed by administrative staff. The order remains in the work queue until the visit is scheduled. The order can also be sent as a scheduling ticket to the patient or family to schedule their visit using the patient portal.

Patient Screening

To utilize telemedicine for new patient visits, a new workflow and screening system was developed within the division to determine which new patients could benefit from a telemedicine visit. Calls coming into the office were taken by appointment schedulers who were given instruction for telemedicine visits, including enrolling patients and families in MyCHOP and determining if their cell phones were compatible with the app. Additional help for scheduling patients and triaging was sent to a small staff of registered nurses (RN) and athletic trainers (ATC). They screened the patients and determined the timing and appropriate provider for the visit based on criteria set by the division's surgeons and sports medicine pediatricians.

Training

New workflows and tools were developed to train all providers: physicians, physician assistants, RNs, ATCs, and scribes. To operationalize the process, a telehealth knowledge base was developed by the Emerging Technology & Transformation and Digital Health teams. This centralized communication platform gives
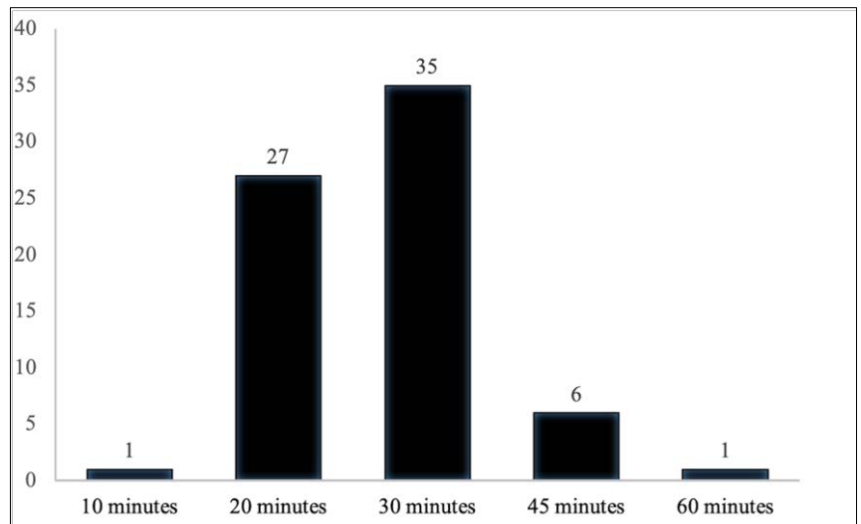
Figure 2a. *Length of outpatient visits for evaluation and management of new patients*

providers access to frequently asked questions (FAQs) and training videos and tip sheets with information on how to use Epic's mobile apps Haiku/Canto for video visits, visits with multiple providers, and interpreter services. The platform also includes guidance for billing and scheduling, HIPAA compliant legal guidance for video visits outside of Epic, and additional resources for telephone visits and troubleshooting. The division's clinical informaticist worked with IS to develop a dashboard within Epic that includes all of the training and video links from the internal website and data on video visits. Providers are able to see the number of telemedicine video and telephone visits that have been completed by the division since March 15, 2020 and the current number of scheduled telemedicine visits. Data is captured from Epic in real-time with a system of rule-based summary reports. Providers can also monitor the number of patients who have been offered and have activated the patient portal daily since March 15, 2020.

The dashboard has also allowed our healthcare team to identify areas needing improvement. It has allowed the identification of visits that were cancelled, completed, or no-shows within the first 24 hours of transitioning to telemedicine. We are also able to track visit type and patient diagnosis through electronic medical record (EMR) note templates and billing codes.

Program Outcomes

From March 15 through April 10, out of 1,692 visits completed in the Division of Orthopaedics, 543 were video visits, and 10 were telephone visits. This was the highest number of telemedicine visits completed among surgical specialties at CHOP during this time period. Figure 1 displays the overall number of visits and the rapid transition to telemedicine following the sharp decline of in-person care due to COVID-19. Additionally, the number of orthopaedic patients with MyCHOP accounts activated prior to appointments is on track to increase from around 60% to 80% by April 20.

Of the 553 completed telemedicine visits, 325 were billed as established patients, 130 were postoperative or post-fracture, 70 were new patients, three were consults, and five were telephone visits. Of the remaining, 16 were assigned "no-charge" by CPT coding guidelines and four were undetermined because the chart had not been closed by the provider at the time of this writing. A breakdown of telemedicine visits by diagnosis is shown in Table I. The most common categories of injury are included in the table: knee-related diagnoses, fracture, concussion, scoliosis, and hip-related diagnoses. Knee injuries made up the largest proportion of telemedicine visits (21.1%), while fractures had the greatest percentage of postoperative visits (41.1%) and scoliosis had the highest percentage of new patients (14.3%). Using CPT telemedicine codes, video and telephone visit lengths were recorded for both new and established patients (Figure 2a and Figure 2b). The most frequent length of visit for new patients was 30 minutes, and the most frequent length of visit for established patients was 15 minutes.

Provider experience was measured by the Digital Health team using a hospital-wide REDCap survey distributed to providers for the purpose of quality improvement. Out of 890 surveys that were distributed, 218 (24.5%) responses were received.[19,20] Net promoter score was calculated from the surveys to determine future recommended use of telemedicine, where 0=not very likely, 5=somewhat likely, and 10=very likely. The average net promoter score was 8.4, and additionally, 99 (45.4%) respondents reported "everything worked well (no issues) during the visit." The following technical issues occurred but did not cause encounters to be aborted: "video not or stopped working" (23.4%), "audio not or stopped working" (19.3%), "audio quality not good enough" (18.3%), and "video quality not good enough" (15.1%). While data continues to be recorded and analyzed, some technical issues have been identified and resolved.

CHOP Digital Health is also creating a REDCap survey to measure patient experience and satisfaction. Data has not been collected yet, but we are encouraged by the following CHOP patient testimonials, which demonstrated high satisfaction:

"We did the appointment online! I LOVED IT! IT was so convenient and easy."

"Our first virtual appointment due to their COVID-19 outbreak IT was a very [pleasant] experience. The doctor was right on time and the video session worked well. I am happy we were able to be seen without having to go into the office."

"The telehealth visit was easy and we were able to consult with the doctor and get the prescription refills my son needed. Overall, a great experience."

Discussion

Through the rapid implementation of telemedicine, the Division of Orthopaedics has maintained our commitment to providing outstanding patient care while reducing in-person care to minimize resource utilization and adhere to physical distancing per CMS guidelines.[9] Prior to COVID-19, the division was conducting one to two telemedicine visits per week. Currently, telemedicine encounters have grown to over 50% of completed visits every day. This rapid increase has also been possible due to updates in telemedicine policy and expansion of eligible services and providers.

Despite overall success in rapid mobilization to address the COVID-19 crisis, we have still experienced challenges in the transition to telemedicine. One

expected weakness of telemedicine use for patients is the occurrence of intermittent software and hardware malfunction. We attribute these difficulties to the learning curve of a new process and its implementation and expect to discover and fine-tune other technical glitches as they arise. Another weakness is the disparity in care based on socioeconomic status that may pose a barrier to many patients and families who may not have internet access or the necessary devices to access the patient portal. To mitigate access to technology as a barrier, CHOP also provides telephone visits in addition to virtual video visits.

Although there are still challenges to be addressed, telemedicine has been a driving force behind maintaining access to patient care in a time when it would not be otherwise possible. By identifying patients who meet the criteria for telemedicine, patients avoid waiting rooms, another potential source of community infection spread and disease transmission, where physical distancing is challenging.[21] Likewise, the risk to healthcare providers is reduced as many have the ability to provide care remotely from home. On an institutional level, the addition of telemedicine is helping to mitigate the backlog of patients waiting to receive care and reduce the financial burden on both the hospital and physician practices by maintaining a revenue stream. Additionally, telemedicine broadens healthcare access by minimizing unnecessary travel and expanding healthcare to those who are unable to travel due to distant geographic locations. We expect that future studies will report the impact of how telemedicine has influenced access to care and patient outcomes.

Conclusion

The COVID-19 pandemic prompted CHOP and the Division of Orthopaedic Surgery to develop new CDS tools and increase engagement between the clinical team, data analytics, and IS. This has allowed us to provide training and analyze data in real-time in order to make more informed decisions for the benefit of our patients and resource distribution. Previous studies have
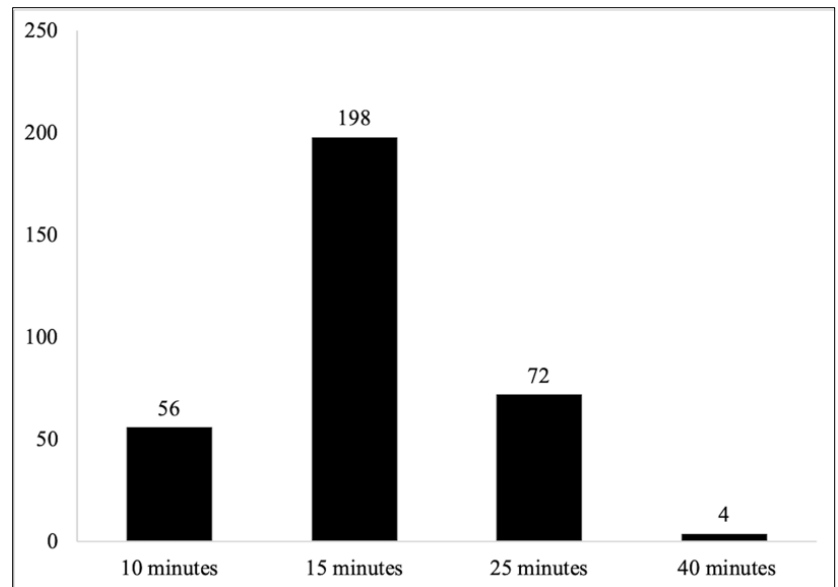
Figure 2b. *Length of outpatient visits for evaluation and management of established patients*

shown telemedicine to be an effective addition to traditional in-person care. In this article, we outline how a division-wide telemedicine system was developed and implemented. Telemedicine currently accounts for over half of all completed orthopaedic visits at CHOP. Our multidisciplinary team continues to refine this system to deliver the best possible patient and provider experience. We expect that telemedicine will allow us to expand our care and educational opportunities beyond the duration of the COVID-19 pandemic.

Additional Links

"Spring" Into Telemedicine: SARS-CoV-2 (a.k.a. COVID-19), AAOS Webinar: https://www.aaos.org/videos/video-detail-page/21691__Videos

Understanding the Financial Impact of COVID-19 and Preparing for the Future, AAOS Webinar: https://www.aaos.org/videos/video-detail-page/21692__Videos

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