

Telemedicine utilisation in a paediatric sports medicine practice: decreased cost and wait times with increased satisfaction

Alfred Atanda Jr., Miguel Pelton,² Peter D Fabricant,³ Ashley Tucker,¹ Suken A Shah,¹ Nicholas Slamon⁴

¹Department of Orthopedic Surgery, Nemours/Alfred I duPont Hospital for Children, Wilmington, Delaware, USA

²Department of Orthopedic Surgery, MedStar Georgetown University Hospital, Washington, District of Columbia, USA

³Department of Orthopedic Surgery, Hospital for Special Surgery, New York City, New York, USA

⁴Department of Pediatric Critical Care Medicine, Nemours/Alfred I duPont Hospital for Children, Wilmington, Delaware, USA

Correspondence to

Dr Alfred Atanda Jr.,
Department of Orthopedic Surgery, Nemours/Alfred I. duPont Hospital for Children, Wilmington, DE 19803, USA; Alfred.Atanda@nemours.org

Accepted 19 January 2018

ABSTRACT

Objectives Telemedicine is the use of telecommunication to provide healthcare remotely. We sought to quantify time/cost savings and satisfaction between a cohort of telemedicine and inperson visits in a tertiary paediatric orthopaedic clinic.

Methods Time for clinical visits and wait times were compared between telemedicine and inperson visits. Costs to patients and department were also calculated for both visit types. Parents completed a five-item satisfaction survey regarding their telemedicine experience.

Results Visit times (15 vs 68 min, $P<0.001$) and wait times (2 vs 33 min, $P<0.001$) were shorter for telemedicine visits. Families saved 85 miles of driving and \$50 in costs per telemedicine visit. Labour cost saved for a telemedicine visit was \$24/patient. More than 90% of patients were satisfied with the telemedicine service.

Conclusion Telemedicine can be used in a sports medicine setting to provide care that reduces costs while maintaining high levels of patient satisfaction.

Level of evidence Level III.

INTRODUCTION

The culture of healthcare has slowly shifted over the past decade from a fee-for-service model to bundled payments and value-based reimbursement. This new climate has motivated providers and health systems to maximise quality by finding ways to reduce cost and improve resource utilisation without compromising patient care and satisfaction. Recent advances in technology have improved healthcare delivery by making it more efficient, accessible and affordable for patients and families. One such innovation is telemedicine, which uses telecommunication and information technology to securely and remotely provide clinical healthcare. Various methods are available to facilitate this information exchange, including smart phones, two-way video, email and text messaging. Possible patient and family benefits include decreased wait time, decreased travel costs, and increased satisfaction with and more control over the patient/provider interaction. Possible provider/hospital benefits include decreased labour costs and resource utilisation.

Telemedicine historically has been used to provide healthcare for patients who live in rural or remote areas and have limited access to care or specialists.^{1,2} However, recent literature has shown that telemedicine can also be used to evaluate patients with complex problems, including gastrointestinal

What are the new findings

- ▶ Telemedicine visits were shorter overall than inperson visits.
- ▶ Patients saved an average of 85 miles in round-trip travel and \$50 in travel costs.
- ▶ The department/hospital saved \$24 per patient by keeping patients out of the hospital.
- ▶ There was a high level of patient satisfaction with the telemedicine visits.

and urological conditions, stroke, or congestive heart failure.³⁻⁶

In orthopaedic surgery, telemedicine is not as widespread as in other specialties. Sathiyakumar *et al* reported their experience with telemedicine in patients with orthopaedic trauma. Their randomised, prospective trial showed there was no difference in satisfaction, complication rate or need for further transport between postoperative patients evaluated inperson and those evaluated via telemedicine.⁷ Telemedicine has also been used to evaluate active duty military patients in remote settings.⁸⁻¹¹ Specifically, Blank *et al*⁹ reported their 9-year results of evaluating injured military personnel with telemedicine and showed that consultation via a web-based platform was capable of diagnosing and triaging many acute musculoskeletal complaints for these patients.

The purpose of this study was to quantify cost and time savings and evaluate satisfaction with telemedicine utilisation in a tertiary paediatric orthopaedic clinic. We hypothesise that telemedicine visits will be shorter and cheaper for patients as well as the hospital.

METHODS

We conducted a retrospective cohort analysis of all patients who participated in at least one telemedicine visit between September 2015 and August 2016 at a single academic, paediatric tertiary care referral facility. All patients were younger than 18 years and were receiving clinical care in our paediatric sports medicine clinic during the study period. Telemedicine visits were performed using either of two Health-Insurance-Portability-and-Accountability-Act-of-1996 (HIPAA) compliant applications. Demographic data and clinical diagnoses were recorded from the electronic medical record. Total time for the clinical visit, percentage of the total visit time spent with the provider and wait times



To cite: Atanda A Jr., Pelton M, Fabricant PD, *et al*. *JISAKOS* Epub ahead of print: [please include Day Month Year]. doi:10.1136/jisakos-2017-000176

Types of Telemedicine Visits

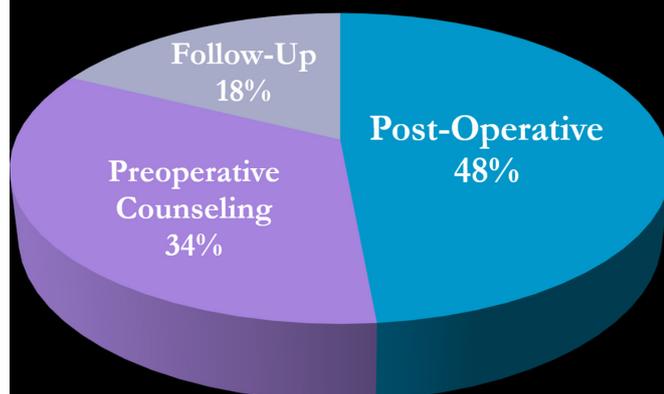


Figure 1 Types of telemedicine visits. Telemedicine visits were either postoperative, follow-up or preoperative counselling. There were no new visits conducted via telemedicine.

for telemedicine visits were compared with a randomly selected cohort of traditional inperson visits from the same institution during the same time period.ⁱ Distance travelled, cost to patient (transportation) and cost to department (direct labour cost) were also calculated for both visit types.ⁱⁱ Direct labour costs were estimated based on institutional hourly wage rates for clinic personnel (check-in person, medical assistant, X-ray technician and physician). At the time of the telemedicine visit, parents were also asked to complete a five-item satisfaction survey regarding their experience. Telemedicine visits were conducted during business hours as part of routine clinic workflow or off-hours at the discretion of the provider. After ensuring data normality, comparative statistics for continuous variables between groups were performed using independent samples Student's t-tests. All analyses were two-tailed, and $P=0.05$ was set as the threshold for statistical significance.

RESULTS

We evaluated 90 patients during 120 telemedicine visits during the study period. All patients were younger than 18 years and had a parent/guardian primarily interact with the provider during the telemedicine visit. Thirty-three (37%) patients were male, and the mean age was 14 (range, 2–18) years. Type of visits included postoperative and follow-up visits and preoperative counselling (figure 1). All patients who opted for a telemedicine visit were able to be reached, and there were no 'no-shows'. In addition, there were no complications missed or telemedicine visits that needed to be subsequently converted to an inperson visit.

Telemedicine visits were shorter and had shorter wait times, greater percentages of time spent with the provider, lower labour

ⁱVisit time was defined as the total time from check-in to the moment of checkout. Data pertaining to clinic and wait times for traditional, inperson visits were obtained from a departmental continuous improvement initiative during that time period.

ⁱⁱTransportation cost was calculated from the American Automobile Association data assuming that the cost of owning and operating a motor vehicle is \$0.58/mile driven.¹⁵ This calculation assumes that the family drove to the appointment in a motor vehicle that they own, and maintain and drive at an average rate of 15 000 miles/year.

Table 1 Comparison between inperson and telemedicine visits

Category	Inperson	Telemedicine
Total visit time (min)	68	17
Mean wait time (min)	33	2
Total visit time spent with provider (%)	15	88
Labour cost (department)	\$114	\$90
Miles travelled	85	0
Travel cost (patient)	\$50	\$0

All values were significant at $P<0.001$.

costs, and lower travel costs than inperson visits ($P<0.001$; table 1).

Eighty-three per cent of the families completed the satisfaction survey. Ninety-one per cent of patients found the interface application easy to download, 85% were satisfied with the audio and video quality of the application, 98% found the telemedicine visits convenient, 98% would be interested in future telemedicine visits, and 99% would recommend telemedicine to other patients.

DISCUSSION

In many medical subspecialties, telemedicine is beginning to change traditional healthcare delivery. Using mobile devices to convey secure medical information via text messaging, teleconferencing and email increases access to providers. Consumers are drawn to telemedicine because it eliminates travel expenses and waiting as components of accessing healthcare. In addition, telemedicine allows the consumer to have control over when and how they receive medical care. Direct labour costs for staff are significantly reduced because telemedicine visits primarily occur between a provider and a patient. Also, telemedicine as a triage mechanism can help ensure that patients see the appropriate provider and that they are only seen when absolutely necessary. Furthermore, geography and access are no longer barriers to practice growth, particularly when the provider is subspecialised.

Opponents of telemedicine claim that it can distort the doctor-patient relationship, overlook anatomical findings detectable on physical examination and cause confusion when seeking reimbursement from insurance carriers. In addition, there may be costs associated with telemedicine visits that could be substantial depending on the platform used and the hospital/department resources available. Nevertheless, telemedicine is becoming more widely used in our technology-saturated society.

Traditionally, telemedicine has been popular in specialties such as critical care medicine, emergency medicine, internal medicine, family medicine, paediatrics, neurology, ophthalmology and dermatology. More recently, it has been used in orthopaedic practices to evaluate postoperative joint arthroplasty patients.^{12 13} Sharareh and Schwarzkopf compared 44 traditional follow-up patients with 34 telemedicine patients who used Skype (Skype Technologies, Luxembourg City, Luxembourg), a proprietary voice-over internet protocol service. The telemedicine group was more satisfied with their postoperative care, and there were no significant differences in functional outcomes between the two groups.¹³ Marsh *et al* randomised 410 postoperative arthroplasty patients to a web-based versus clinic-based follow-up appointment. Forty-six per cent of patients preferred the web-based follow-up, 38% preferred clinic-based follow-up and 16% had no preference. They also found that the cost of web-based visits was nearly \$70 lower than the clinic-based visits.¹²

Paediatric sports medicine is well suited for these patients because parents can get immediate access to a sports medicine provider without having to miss work or remove their child from school. In many instances, the parents are merely seeking information, guidance and advice about their child's injury that can be often conveyed via the telemedicine platform without the need for special equipment. Moreover, the athletes themselves are often well-versed in current technology and can assist their parents with the technical aspects of the telemedicine visit (ie, application download and camera/microphone adjustment).

Telemedicine may have several benefits for the patient, provider and department/health system. Decreased costs for both the patient and the department were noted in this study. Cost savings (transportation) to the patient averaged \$50 per family per visit. This number solely represents the cost of driving a motor vehicle to the visit and does not include other common costs such as food, parking, tolls and lost wages. The department saved approximately \$24 per patient in direct labour costs. This was likely an underestimation as it did not include indirect costs associated with paper form printing and electricity/water used in the exam room. It also failed to calculate opportunity costs associated with seeing higher acuity patients in the same office space. The results of this study also demonstrated lower wait and overall visit times and an increase in percentage of time spent with the surgeon during telemedicine visits. Total visit time via telemedicine was only 17 min compared with 68 min—almost half of which was spent waiting—for traditional inperson visits. It should be noted that there could also be delays with telemedicine visits as well; however, delays would be most likely due to technical issues. Our department is fortunate enough to have technical support individuals who guide the family through the downloading and connection process prior to the start of the telemedicine visit. In addition, the negative impact of delays during a telemedicine visit is likely to be less since the family is often at home rather than a clinic waiting room.

Our current opinion is that telemedicine is not meant to replace traditional, inperson visits; rather, it is meant to serve as a mechanism to deliver healthcare to select patients remotely and only in the appropriate clinical scenario. The young athletes evaluated via telemedicine in this study were all selected by the physician. The visit types for these patients were follow-up, postoperative, imaging review and surgical informed consent discussion. There were no *new* patient consultations seen via telemedicine in this cohort. All telemedicine patients were seen in person and had a formal physical examination performed by a physician some time prior to their telemedicine visit. Any families who were not comfortable with or did not have access to appropriate technology were seen in person. Similarly, patients with complex problems or conditions were seen in person. Inappropriate clinical scenarios have missed major diagnoses and prescribed treatment inconsistent with established clinical guidelines.¹⁴ This emphasises that the treating provider must be very selective of the patients they evaluate via telemedicine as its current use in orthopaedics is novel. Our clinical goal was not to operationalise the use of telemedicine throughout our practice but rather to use it as an appropriate modality to streamline care for a highly select group of patients.

This study had several limitations. First, there was no randomisation of patients based on type of visit. The telemedicine patients participated on a voluntary basis after being deemed appropriate by the treating physician. It is possible that there was a selection bias in our cohort towards patients who were more tech-savvy and interested in trialling the technology, which may have overestimated their satisfaction. There were also no

satisfaction surveys administered at the inperson visits for baseline comparison. However, the purpose of the study was to evaluate time and cost savings, with complementary satisfaction data, rather than demonstrate superior patient satisfaction scores. Although unavoidable selection bias may have affected satisfaction scores, cost and visit time, analyses were unlikely to be affected.

Cost savings for patients and the department were estimated from the American Automobile Association data and department wages, respectively. They were an estimate for patient transportation costs and departmental labour costs for patient-related personnel. These figures did not account for other indirect or opportunity costs, such as patient travel times, parking fees, lost wages and missed time at school. All patients were assumed to have driven to the hospital with a motor vehicle that they owned and operated. It is likely that some of the patients in our cohort routinely use public transportation or carpool to their visits, which would mean transportation cost savings were overestimated for the telemedicine group.

The physicians administered the satisfaction surveys at the conclusion of each telemedicine visit; this may have compelled patients to respond more favourably. Ideally, the surveys would have been completed anonymous to minimise any potential provider coercion. Also, there was no comparison of patients who had their follow-up completely done via telemedicine. The telemedicine patients all had *at least* one telemedicine visit; however, many also had inperson visits during their follow-up course. An ideal study would have compared patients who had only telemedicine visits postoperatively with those who had only inperson visits. This heterogeneity, however, may have biased our results towards the null, and the differences we have shown are in fact an underestimate of the true differences between telemedicine and inperson visits. This technology is still in its infancy as it pertains to clinical medicine, and there are many questions still under investigation.

Currently in our practice, it is difficult to conduct all of a patient's postoperative and follow-up visits via telemedicine. Uninterested patients often cited lack of comfort with technology and desire for face-to-face interaction as common reasons they preferred inperson visits. However, our data suggest that those patients who had at least one telemedicine visit were extremely satisfied with their experience. Lastly, these results may not be generalisable to centres in all states. The state of (blinded) is unique as it has recently passed legislation that requires insurance carriers to make provisions to cover telemedicine visits similar to inperson visits. In other states, telemedicine visits may not be covered or reimbursed similar to inperson visits, making it potentially more costly for patients and less financially appealing for providers.ⁱⁱⁱ In addition, there is a start-up cost (~100k) associated with implementing this technology that was negotiated by the senior leadership of our institution. Depending on available financial resources, other institutions may or may not be able to afford such start-up costs, making our cost savings even less generalisable.

CONCLUSION

Telemedicine can be used in a sports medicine outpatient clinical setting to provide efficient care to patients that reduces costs for both the patient and hospital system and maintains high levels

ⁱⁱⁱInformation regarding individual state policies, laws and reimbursement protocols can be found at www.americantelemed.org and www.telehealthresourcecenter.org.

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of patient satisfaction. As reimbursement models increasingly emphasise value and satisfaction, providers could potentially use telemedicine to comply with payer requirements. Further studies are warranted to examine how telemedicine could be further integrated into sports medicine clinical practice.

Contributors AA was responsible for the overall manuscript preparation and study design. MP and PDF prepared the introduction. AT was responsible for the Methods section. SAS, PDF and NS were responsible for the Discussion section. NS was responsible for statistical analysis.

Funding This research received no specific grant from any funding agency in the public, commercial and not-for-profit sectors.

Competing interests None declared.

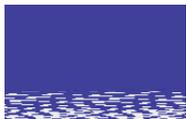
Ethics approval Approval was granted by the Nemours/Alfred I duPont Hospital for Children Institutional Review Board.

Provenance and peer review Not commissioned; externally peer reviewed.

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J ISAKOS published online February 1, 2018

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