Electronic Consultation Systems: Impact on Pediatric Orthopaedic Care

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Background: The demand for pediatric orthopaedic surgery consultation has grown rapidly, leading to longer wait times for elective consultation in some regions. Some specialties are addressing this increased demand through electronic consultation services. We wanted to examine the impact of pediatric orthopaedic e-consultations in Canada's Eastern Ontario region.

Methods: We developed a cross-sectional study of all the cases directed to a pediatric orthopaedic surgery specialist using the Champlain Building Access to Specialists through eConsultation (BASE) eConsult service over a 2-year period and examined their impact on in-person referrals, time of e-consultation and primary care satisfaction as well as types of clinical questions that were asked.

Results: Electronic consultations avoided in-person appointments in 68% of the submitted cases. The median response by specialists received by the primary care providers (PCPs) was <20 hours. A total of 69% of consultations involve >1 type of clinical questions, most commonly about basic trauma/fracture care and management recommendations. Ninety-seven percent of the PCPs found the overall value for the care of the patients to be good or excellent.

Conclusions: This cross-sectional study demonstrates the effective and timely use of eConsult in pediatric orthopaedic surgery. It also shows a significant reduction in the number of in-person consultations required and demonstrates a high satisfaction rate by PCPs using the service.

Clinical Relevance: In addition to the efficacy and time-sensitive care provided to the patients, the study shows that, professionally, 89% of PCPs found this service to be excellent or good. The broader implications of electronic consultation on overall quality of care, population health, and patient satisfaction requires further investigation.

Key Words: electronic consultation, pediatric orthopaedics, health care, quality improvement

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Access to specialist care in a timely fashion is a challenging health care issue. Wait times often do not correspond to the severity of patients' conditions, which could lead to prolonged emotional distress and physical discomfort. If triage based on urgency is present, less urgent cases have a prolonged wait for assessment.[1] Pediatric orthopaedic surgery has seen rapid growth globally in the demand for care, leading to long wait times for elective consultation.[2] For instance, in Ontario, Canada, waits for pediatric orthopaedic consultation are an average 59 days overall and 108 days in Eastern Ontario.[3] Wait-time reduction strategies require attention to a multitude of issues, including prioritization, triaging, and physical capacity. One proposal to address the care backlog is the use of electronic consultation services.[4,5]

The Champlain health region's Building Access to Specialists through eConsultation (BASE) service, referred to as "eConsult," is a web-based asynchronous electronic communication service (www.champlainbaseeconsult.com) developed to allow primary care providers (PCPs), including physicians and nurse practitioners, to submit patient-specific clinical questions to a specialist using a standardized electronic form. Experience with eConsult has been reported in hematology and endocrinology settings, and found to be associated with 66% and 44% reductions in the need for face-to-face consultations, respectively.[6,7] These findings demonstrate the potential for wait-time reduction for elective consultations, with possible economic benefits.

A 2015 multicenter meta-analysis of electronic consultation also supports an overall reduction in wait times and enhanced access to specialist care.[5] However, no studies have focused on the results of eConsults in pediatric orthopaedic surgery. Our aim is to analyze the impact of electronic consultation services in pediatric orthopaedics.

METHODS

We conducted a cross-sectional study of all the cases directed to pediatric orthopaedic surgery specialists using

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the Champlain BASE eConsult service from January 27, 2015, to December 28, 2016, in the Champlain region of Eastern Ontario, covering 17,600 mi^2 (45,584 km^2) and a population of 1.2 million.[8] Data was acquired in collaboration with the Champlain Local Health Integration Network. Further details in regards to the design and development of the service are described in a 2013 paper by Keely et al.[8]

For this study, we reviewed the results of the pediatric orthopaedic surgery eConsults that were completed by 3 surgeons (S.C., K.K., and K.S.). The eConsults are initiated by the PCP who logs into a password protected secured electronic web-based system and submits a question, or questions concerning a patient's care as they would during a traditional consultation. The PCPs can also attach pertinent information such a laboratory or radiology reports and even clinical photos and then submit the eConsult to the most appropriate service. Specialists are then notified electronically about the eConsult and are asked to login to the system and respond at their convenience within 7 days with advice, recommendations including a need for in-person referrals, or requests for additional information (further history, physical findings, laboratory, and radiographic reports). On the basis of the accessible information, if a face-to-face consultation is warranted, a referral is recommended and information on how a referral can be made is provided in the replies back to the PCPs. Once the clinical question is addressed satisfactorily, the PCP closes the encounter, and completes a mandatory postconsultation survey. The patient remains under the care of the PCP unless an in-person referral is implemented, and the PCP is responsible for the decision of whether and how to implement the advice the specialist provides. Specialists are remunerated at a rate of $200 an hour prorated to the amount of time they report spending on the eConsult responses. PCPs are not remunerated directly by the service, but in Ontario may submit a fee code for $16.[9]

Measures that were collected included the survey data on the PCPs' eConsult experiences and the specialists' responses and self-reported time to complete the consultations. Data collected did not have associated identifiers, relying exclusively on secondary use of anonymous information.

We developed classification systems for the question type asked (diagnosis, investigation, management) (Table 1) as well as the question content (Table 2), to help categorize consultations appropriately. All the study researchers were involved in the first phase of the classification system. An initial subset of the first 50 consecutive consultations was used to develop the classification categories and any conflicts were resolved via team discussion until consensus was reached. The final classification system was applied to all consultations.

TABLE 1. Question Type Classification System (n = 212)*

Diagnosis (# of enquiries; %)	Clinical information interpretation (22; 10)
	Imaging test interpretation (74; 35)
	Laboratory result interpretation (ie, inflammatory markers) (0; 0)
	Pathology result interpretation (ie, biopsy) (0; 0)
	Other (0; 0)
Investigation (# of enquiries; %)	Recommendation for further investigation (60; 28)
	Other (0; 0)
Management (# of enquiries; %)	General recommendation (144; 68)
	Need for referral (99; 47)
	Other (0; 0)

*Total number of consultations was 212, but some of consultations asked >1 clinically relevant question, a total of 399 questions were asked.

RESULTS

Service Usage

During the study period, 212 eConsults were sent through the service, with all 212 consultations completed by the pediatric orthopaedics service. One hundred nine PCPs (94 physicians, 15 nurse practitioners) submitted eConsult requests. The average number of cases requested per PCP was 2, ranging from 1 to 9 cases. The majority (83.9%) of PCPs who utilized the service practiced in an urban setting. The average patient age was 8 years old (range from 4 mo to 18 y of age).

Specialist Response Time

The median response time—from initiation of eConsult by the PCP to the initial response by the specialist—was 19.9 hours (range: <1 h to 24 d). Self-reported time dedicated to each consultation was <10 minutes in 62% of the cases; 10 to 15 minutes in 21%; over 15 to 20 minutes in 11%, and over 20 minutes in 6%. The specialists did not have dedicated time allocated for answering eConsults and completed them at their convenience.

Survey and Satisfaction

Use of eConsult avoided formal face-to-face referrals in 68% of patients. As a result of eConsult, 53% of PCPs changed their original referral plan. Forty-seven

TABLE 2. Question Content Classification System

Question Content	No. Enquiries (%) (Total = 217)*
Fracture/trauma	69 (32)
Foot and ankle abnormality	36 (17)
Spinal abnormality	27 (12)
Musculoskeletal and soft tissue mass	20 (10)
Limb alignment concerns	14 (6.5)
Developmental dysplasia of hip	12 (5.5)
Leg length discrepancy	9 (4)
Nonorthopedic issues	9 (4)
Knee abnormality	7 (3)
Nondevelopmental dysplasia of hip abnormality	5 (2)
Upper extremity abnormality	5 (2)
Gait abnormality	4 (2)

*Total number of consultations was 212, but some of consultations asked >1 clinically relevant question.

TABLE 3. Close Out Survey Responses

Questions	Response	Percentage
Q1. Which of the following best describes the outcome of this eConsult for your patient?	A1: I was able to confirm a course of action that I originally had in mind	A1: 53
	A2: I got good advice for a new/additional course of action	A2: 46
	A3: I did not find the response very useful	A3: 1
	A4: Other	A4: 0
Q2. As a result of the eConsult …	A1: Referral was originally contemplated but now avoided	A1: 47
	A2: Referral was originally contemplated and is still needed—eConsult likely leads to a more effective visit	A2: 26
	A3: Referral was not originally contemplated and is still not needed—eConsult provided useful feedback/information	A3: 21
	A4: Referral was not originally contemplated, but eConsult process resulted in a referral being initiated	A4: 6
	A5: There was no particular benefit to using eConsult	A5: 0
	A6: Other	A6: 0
Q3. Please rate the overall value of the eConsult service in this case for your patient	A1: 1—Minimal	A1: 0
	A2: 2	A2: 1
	A3: 3	A3: 2
	A4: 4	A4: 13
	A5: 5—Excellent	A5: 84
Q4. Please rate the overall value of the eConsult service in this case for you as a PCP	A1: 1—Minimal	A1: 1
	A2: 2	A2: 2
	A3: 3	A3: 8
	A4: 4	A4: 14
	A5: 5—Excellent	A5: 75

percent had originally contemplated referring, but did not as a result of the information provided. An additional 6% of cases that were felt not to be potential referrals were triaged to formal face-to-face clinic referrals after the electronic consultation (Table 3, Q2).

The overall experience with the service was very positive. Review of the feedback from the survey completed by PCPs after each eConsult was completed, demonstrated that PCPs found good to excellent value for their patients in 97% of eConsults (Table 3, Q3) and 89% of PCPs indicated that the value for them professionally was excellent or good (Table 3, Q4).

Review of comments by PCPs on their experiences were all positive and revealed that they most appreciated guidance and reassurance on unfamiliar orthopaedic issues, prompt and efficient responses from the consultants, avoidance of in-person referrals for their patients, and recommendations on referrals to more appropriate services (Table 4). In fact, no negative comments were reported, but the PCPs did suggest the development of a collaborative shared virtual workspace where laboratory and radiographic results can be shared without manual uploading to enhance the eConsult system efficiency.

TABLE 4. Examples of Comments Provided by Primary Care Practitioners

This allowed me to have more confidence in my course of action while avoiding an unnecessary referral and stress for parents/patient
Thank you for the great feedback and confirming my course of action. This reassures the parents and myself
Thank you for taking the time to provide such a thorough response. I will definitely follow through with a referral
A helpful response within minutes with detailed information on management
Really helpful. Will potentially avoid need for consult
Very speedy response thanks! This response will provide reassurance to myself and parents
Thank you for your help, and in helping direct this consult to the right people
What an efficient system

Topic Analysis

In most of the cases (69%), PCPs asked multiple questions surrounding diagnosis, investigations and management, rather than a single question (Table 1). They most commonly inquired about general management recommendations for a given clinical presentation (68%). The next most commonly asked question was need for referral (47%); imaging test interpretation (35%); questions regarding the need for further investigation (28%), and advice on clinical information interpretation (10%).

The most common clinical topics referred to the pediatric orthopaedic eConsult service included fracture/trauma care (32%), foot and ankle abnormality (17%), spinal abnormality (12.5%), musculoskeletal and soft tissue mass (9%), limb alignment concerns (6.5%), and developmental dysplasia of the hip (DDH) (6%) (Table 2). In 5 of the enquiries, >1 clinical topic was addressed.

DISCUSSION

Electronic consultation service is an innovative initiative designed to help address long wait times to see specialists, and to provide specialist clinical support to primary care physicians. In the United States, integrated health care systems in the San Francisco General Hospital and Trauma Center[10,11] and the Mayo Clinic[12] have been implementing electronic consultations to multiple specialty services since 2005. The service has offered rapid access to specialist care, which was positively received by PCPs, confirming its feasibility, applicability, and flexibility in timely provision of specialty guidance.[5] The generalizability of such service was also shown in Canadian health care setting, as eConsult has been developed and implemented successfully in multiple medical subspecialties.[4,6–8] A recent study by Liddy et al[13] looked into the average response time from the enquiry request to responses from specialities involved in multiple

pediatric subspecialities, which was evaluated to be mostly <0.9 days. Our study has demonstrated a comparable result of 19.9 hours as the median time taken to obtain a response. This demonstrates timely access to speciality advise, especially when compared with the average time for in-person consultations in Eastern Ontario, recorded to be 103 days.[3] Although not formally assessed, and relying on the PCP's description exclusively, there was no apparent concern that any inappropriate or inadequate assessments were carried out, nor quality of care being compromised. In our study, 68% of referrals did not require an in-person consultation, where 21% of eConsults were simply looking for additional information, and 47% of the cases prevented a referral that the PCP originally thought needed an in-person consultation. These findings are comparable to prior studies that have investigated referral pattern post eConsult implementation.[14–18] The eConsult service not only avoids unnecessary referrals, but also allows specialities to trigger in-person referrals that may not have been initiated, as in our study, where 6% of eConsults prompted a face-to-face referral when one was not initially thought necessary by the PCP. A 2017 study by Liddy et al,[13] highlighted a comparable finding as well, demonstrating the utility of eConsult in capturing clinically relevant referrals that may otherwise not have been assessed adequately and can expedite appropriate referrals without delays. Our study also identified 9 incidences of nonorthopaedic consultations, and directed PCPs to more appropriate specialty services. Consequently, minimizing delays in service delivery could improve emotional burden associated with delayed specialty medical care that could affect patients and their families in profound ways.[19–21]

E-consultation has proven to improve operational efficiency in health care, which could translate to potential reduction in financial cost. Previous studies have estimated the cost savings through eConsult services at roughly $135 (Canadian dollars) based on avoiding in-person consultations, which is nearly doubled for patients from remote areas.[4,13]

In addition to prompt access and avoidance of unnecessary in-person visit, the educational value provided to PCPs is another factor for high user satisfaction.[22] Although our study did not specifically inquire the users about educational value, their feedbacks commented on reassurance on their clinical acumen, and their confidence in communicating with patient and family members after a direct communication with specialists. Our data categorization identified commonly asked clinical questions including basic musculoskeletal trauma care, and foot and ankle abnormalities as well as variants of normal anatomy (lower limb alignment, flexible pes planus, toe walking, etc.), many of which do not require pediatric orthopaedic surgical interventions. This finding is supported by a 2012 study by Hsu et al[23] that investigated how many of the new referrals to pediatric orthopaedic surgeons are conditions that could be readily managed by a primary care physicians; it was found that 47% of referrals were not necessary. These recurring themes could help develop directed learning objectives in continuing medical education or to inform educational offerings at educational conferences and meetings. It is our hope that with time, the advice and information received through eConsult will improve capacity and confidence among PCPs so that they are more comfortable in dealing with common conditions that do not require surgical intervention which could decrease inappropriate referrals and provide cost savings to the system.[24,25]

Our study demonstrates that eConsult allows timely access to specialty advice without prolonged wait time for in-person referrals. It does not focus however on its impact on the specialists, which was an additional clinical activity, which could have an impact on their time management and wellness.[26,27] It is essential that participation in the service is valued and compensated, and each jurisdiction needs to identify which financial model is best for their region (session fee, salary, fee-for service, etc.) and ensure that eConsults are a recognized clinical activity as is done in other systems such as the San Francisco eReferral system. A recent publication on the specialists perception of eConsults concluded that eConsult is feasible, results in improved communication between providers, and can be integrated into their clinical workflow without difficulty.[28]

A limitation of our study is that feedback we have received are from the PCPs, but not directly from the patients involved in the inquiries. Furthermore, at the current state, we do not have data on long term effect and results of advice received via the eConsult service, nor whether or not the recommendations were followed appropriately. Direct feedback from patients will help us learn how the service impacts them, the quality and promptness of referral process and how information has been communicated throughout the process. Having these feedbacks would enhance the quality of the service and design it to be more patient focused.

CONCLUSIONS

To the best of our knowledge, no other studies have examined the utilization and efficacy of an electronic consultation service in pediatric orthopaedic surgery. This cross-sectional study demonstrates the important impact of the eConsult service in this field. It shows a significant reduction in the number of in-person consultations required. The eConsult system proved to be efficient, with a fast response time and demonstrated a high satisfaction rate by PCPs. It also proves to be a valuable tool in assisting PCPs in unfamiliar areas of pediatric orthopaedic care that does not always necessitate an in-person consultation, where communication about diagnosis, investigations and management can help efficiently manage patients from a distance while having an educational impact. The broader implication of electronic consultation on overall quality of care, population health, and patient satisfaction requires further investigation.

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