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# The impact of web-based clinical practice guidelines on pediatric fracture clinics

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**Abstract**

**Background**

In an effort to standardize management and reduce overtreatment of uncomplicated pediatric fractures, the Victorian Pediatric Orthopaedic Network and the Royal Children's Hospital, Melbourne, created publically available web-based pediatric fracture pathways. The aim of this study was to determine the impact of web-based fracture pathways on the clinic volume at a tertiary-care pediatric fracture clinic.

**Methods**

A comparative retrospective review was performed at a large, urban, tertiary-care children's hospital. Fracture Clinic data from two 12 week periods before and after implementation of the fracture pathways were compared. For each study period, data collected included: total number of emergency department visits, number of Fracture Clinic visits, number of Fracture Clinic visits for patients that presented with upper extremity fractures for which web-

based fracture pathways were available, number of radiology department visits for x-rays, and number of Fracture Clinic visits for patients requiring orthopaedic intervention in the operating room (closed or open reductions).



**Results**

The number of Fracture Clinic visits for patients with upper extremity fractures decreased 12% post-pathway implementation, from 954 visits to 842 visits. The number of radiology department visits for patients with upper extremity fractures decreased 24% post-pathway implementation, from 714 visits to 544 visits.

**Conclusions**

The implementation of web-based fracture pathways for upper extremity pediatric fractures was associated with a decrease in clinic resource utilization at a tertiary-care children's hospital.

**Introduction**

Musculoskeletal injuries are one of the most common reasons to seek urgent care (1). Pediatric fractures, in particular, place a significant burden on the healthcare system, with 2% of children presenting to the emergency department annually (2) .

In many healthcare systems, after initial assessment and treatment in the emergency department, non-operative patients are referred to an outpatient fracture clinic where they are managed by orthopaedic surgery registrars, fellows or consultants. Fracture clinics are resource intensive, placing significant burden on a healthcare system. In addition to the surgical

personnel, patients seen in fracture clinics often require additional resources from orthopaedic technologists, radiographers, radiologists and physiotherapists.

Routine orthopaedic surgeon assessment and follow-up is unnecessary for many uncomplicated pediatric fractures (3,4,5,6). However, a conservative approach of close clinical and radiographic follow-up is often over-utilized by clinicians with limited experience in pediatric orthopaedics thereby increasing resource consumption unnecessarily (7,8). This practice can increase the costs incurred by the hospital but can also place significant economic burden on families as accompanying parents have to take more time off from work (6,7,8,9).

In part to address the differences in management that potentially lead to overtreatment of pediatric fractures, the Victorian Pediatric Orthopaedic Network and the Royal Children's Hospital, Melbourne, created evidence based web-based pediatric fracture pathways for use in emergency departments and outpatient clinics by general practitioners, emergency room physicians, orthopaedic surgeons and their respective trainees (Figure S1, Figure S2) (10). Web-based pediatric fracture pathways for upper extremity fractures were published on our institution's website in October 2012. These included pathways for fractures of the clavicle, proximal humerus, humeral shaft, supracondylar, lateral condyle, medial epicondyle, Monteggia, olecranon, radial neck, radius and ulna shaft, Galleazzi, distal radius and ulna metaphysis, and distal radius and ulna physis.

The aim of this study was to determine the impact of web-based fracture pathways on resource utilization at a tertiary-care pediatric fracture clinic.

**Methods**

This comparative retrospective review was performed at a large, urban, tertiary-care children's hospital.

In our institution, all fractures are managed in the Fracture Clinic staffed by Senior Specialist Registrars in Orthopaedic Surgery or Fellows in Paediatric Orthopaedic Surgery. Paediatric Orthopaedic Consultant input is available at the request of trainees in the Fracture Clinic. New referrals to the Fracture Clinic, whether from the Emergency Department, an outside hospital, or a community orthopaedic surgeon, are reviewed and triaged by trainees assigned to the Fracture Clinic. In addition, all fractures requiring intervention in the operating room (closed or open reductions) are followed post-intervention in the Fracture Clinic. Computers with access to the web-based fracture pathways are available in each consultation room. Although all clinicians in the Fracture Clinic were informed of the existence and location of the web-based pathways, no additional training on the use of the pathways was provided. No incentives to use the pathways were provided. Clinicians were unaware that this review would be conducted to minimize any positive influence of observation.

Following research ethic board approval, clinic data from two 12 week periods (January 9$^{th}$-March 30$^{th}$ 2012 and January 6$^{th}$ 2014-March 28$^{th}$ 2014) pre and post implementation of the fracture pathways were compared. To minimize confounding variables, both study periods had the same number of Fracture Clinics, occurred during the same season, and had the same number

of weekends and holidays. Moreover, emergency department and orthopaedic trainees who triaged and managed patients were at the same level of training during both study periods.

For each study period, data collected included: total number of emergency department visits, number of Fracture Clinic visits, number of Fracture Clinic visits for patients that presented with upper extremity fractures for which web-based fracture pathways were available, number of radiology department visits for x-rays, and number of Fracture Clinic visits for patients requiring orthopaedic intervention in the operating room (closed or open reductions). Data from patients who were skeletally mature, or who had suffered polytrauma were excluded from analysis.

To better evaluate the effect of the fracture pathways on Fracture Clinic volume, we audited the triaging of upper extremity fractures in the 2014 study period and assessed whether new referrals were triaged according to our fracture pathways (e.g. distal radius buckle fractures appropriate for follow up with community practitioner rather than follow-up in the Fracture Clinic) and whether parents and referring clinicians adhered to these triage decisions.

**Results**

The total number of emergency department visits increased between the study periods, from 15545 visits in 2012 to 19020 in 2014. However, the total number of fracture clinic visits remained similar with 1634 visits in 2012 and 1637 in 2014. The number of Fracture Clinic visits for patients with upper extremity fractures decreased 12% post-pathway implementation, from

954 visits in 2012 to 842 visits in 2014. In contrast, the number of other fractures (for which web-based pathways were not available) presenting to the Fracture Clinic increased over the same period from 650 visits in 2012 to 758 in 2014 (Table 1). The decrease in clinic utilization was also noted in patients with upper extremity fractures who had required intervention by an orthopaedic trainee or surgeon in the operating room with 147 visits in 2012 compared to 87 visits in 2014. The number of radiology department visits for patients with upper extremity fractures decreased 24% post-pathway implementation, from 714 visits in 2012 to 544 visits in 2014 (Table 1).

There were 508 new referrals from all sources (e.g. our institution's Emergency Department, external emergency departments, community orthopaedic surgeons, etc) to the Fracture Clinic during the 2014 study period. 283 (56%) of the new referrals were eligible to be triaged using the web-based paediatric fracture pathways. Based on our pathways, 66 (23%) should have been triaged to the primary healthcare provider (e.g. distal radius buckle fractures or Gartland type 1 supracondylar humerus fractures). However, only 37 (13%) of the new referrals were actually triaged to the primary healthcare provider, with the remaining 29 (10%) inappropriately triaged to be seen in the Fracture Clinic. 7 out of the 37 patients who were triaged to be managed by their primary care physicians, presented to our fracture clinic regardless.

**Discussion**

The implementation of web-based fracture pathways for upper extremity pediatric fractures was associated with a decrease in clinic resource utilization at a tertiary-care children's hospital. This association was seen with both non-operatively and operatively managed fractures. Web-based pathways encourage consistency within an institution and with external sources of referral. This consistency may potentially reduce resource utilization further by decreasing the need for unscheduled interventions (e.g. cast changes). By providing an evidence-based framework, the pathways provide clinicians with acceptable referral, reduction, follow-up, and discharge criteria (7, 8). In an analysis of a web-based pathway for paediatric proximal humerus fractures in Toronto, Canada demonstrated a potential reduction in clinic visits by 83.5% and x-rays by 70.8% (8). In addition to the direct financial benefit to the hospital, the pathways may decrease the financial burden on families too (7, 8, 9). In their survey of pediatric fracture clinics, Morris et al. found that for every 4 fracture clinic visits, the accompanying parent required 1 day of carer's leave from work highlighting the financial burden of clinic visits on families (9).

The audit of new referrals in our study suggested that much of the decrease in patient visits may be due to appropriate triaging of patients with uncomplicated fractures (e.g. distal radial buckle fractures and Type 1 supracondylar fractures). Evidence supports the safety of discharging uncomplicated paediatric fracture patients from orthopaedic care once the correct diagnosis is made with instructions provided to the parents as to when to remove immobilization and when to allow a return to high-risk activities (3,4,5,6). However, healthcare providers have been slow to follow these recommendations (11). In our study, 29 out of 66 new referrals that

should have been triaged to the primary healthcare provider as per the pathways, were inappropriately triaged to be seen in the Fracture Clinic. This relative lack of pathway adherence could be improved with better education of triaging clinicians regarding the potential benefits of the pathways.

Although web-based fracture pathways may improve primary healthcare providers' comfort level with diagnosing and managing uncomplicated pediatric fractures, 7 patients post-pathway implementation presented to our Fracture Clinic despite being triaged to their primary healthcare provider. We are unable to determine whether this was driven by the parent or referring clinician. In many healthcare systems, primary healthcare providers may not receive adequate paediatric musculoskeletal education during their training and therefore have relatively little confidence in managing paediatric fractures (7,12). A patient's primary healthcare provider may feel uncomfortable managing uncomplicated paediatric fractures, despite access to web-based fracture pathways (7). To ensure patient safety, a fracture clinic visit may be justified at the expense of cost minimization (7,8). Future strategies worthy of exploration include virtual assessments by competent physicians, which has been successful in the adult setting (13).

This study has several limitations worthy of mention. Given the study design we are unable to draw causal relationships between the implementation of our fracture pathways and observed differences in Fracture Clinic visits or radiology department visits. In addition, we could not exclude the possibility that any other processes implemented in the emergency department or fracture clinic between 2012 and 2014 affected our observed outcomes. To our

knowledge, no novel processes or pathways were implemented at our institution during this time frame but we cannot exclude this possibility entirely. Our study design did not provide usage or compliance data with the web-based pathways. As orthopaedic trainees were not required to consult the pathways when triaging new referrals, trainees may have triaged patients as they were taught to do at other hospitals. Importantly, although we have shown an improvement in fracture management efficiency, we did not examine the clinical outcomes of any patients and there is a concern that clinical results have been negatively impacted. This concern is, however, mitigated by the fact that each fracture pathway was created using the highest quality evidence available (10). Our study findings may not be generalizable to other institutions or healthcare systems. At our institution, pediatric fractures are primarily managed by orthopaedic trainees. As such, healthcare settings in which consultant surgeons are directly involved in every fracture may not see the same benefits.

In conclusion, this comparative retrospective review found that the implementation of web-based fracture pathways for upper extremity pediatric fractures was associated with a decrease in clinic resource utilization at a tertiary-care children's hospital. Our data supports web-based fracture pathways as a reliable resource that facilitates greater efficiency in care that may yield cost benefits to families, the hospital and the healthcare system. To gain the greatest benefit from the pathways a continuous education and credentialing program should be implemented.

**References**

1. Gorman DR, Ramsay LJ, Wilson GS, Freeland P. Using routine accident and emergency department data to describe local injury epidemiology. Public Health. 2000Jan.19;113(6):285-9.

2. Gunz AC, Canizares M, Mackay C, Badley EM. Magnitude of impact and healthcare use for musculoskeletal disorders in the paediatric: a population-based study. BMC Musculoskelet Disord. BioMed Central Ltd; 2012Jun.12;13(1):98.

3. Calder JDF, Solan M, Gidwani S, Allen S, Ricketts DM. Management of paediatric clavicle fractures--is follow-up necessary? An audit of 346 cases. Annals of the Royal College of Surgeons of England. The Royal College of Surgeons of England; 2002Oct.26;84(5):331-3.

4. Cuomo AV, Howard A, Hsueh S, Boutis K. Gartland type I supracondylar humerus fractures in children: is splint immobilization enough? Pediatric emergency care. 2012Nov.2;28(11):1150-3.

5. Boutis K, Willan A, Babyn P, Goeree R, Howard A. Cast versus splint in children with minimally angulated fractures of the distal radius: a randomized controlled trial. CMAJ. Canadian Medical Association; 2010Sep.7;182(14):1507-12-1512.

6. Gladstein AZ, Schade AT, Howard AW, Camp MW. Reducing Resource Utilization During Non-Operative Treatment of Pediatric Proximal Humerus Fractures. Orthop Traumatol Surg Res. 2017 Feb;103(1):115-118.

7. Adamich J, Howard A, Camp M. Do all clavicle fractures in children need to be managed by orthopaedic surgeons? Pediatr Emerg Care. Accepted for publication.

8. Crawford E, Pincus D, Coyte P, Camp M. Cost Savings of Implementing the SickKids Paediatric Orthopaedic Pathway (SKPOP) for Proximal Humerus Fractures in Ontario, Canada. Paediatrics & Child Health. Accepted for publication.

9. Morris MWJ, Bell MJ. The socio-economical impact of paediatric fracture clinic appointments. Injury. 2006Feb.14;37(5):395-7.

10. Royal Children's Hospital, Melbourne, Australia, Clinical Practice Guideline on Fractures, [Internet; cited February 19th, 2015], Available from: http://www.rch.org.au/clinicalguide/index.cfm

11. Boutis K, Howard A, Constantine E, Cuomo A, Narayanan U. Evidence into practice: emergency physician management of common pediatric fractures. Pediatric emergency care. 2014Jul.1;30(7):462-8.

12. Jandial S, Myers A, Wise E, Foster HE. Doctors likely to encounter children with musculoskeletal complaints have low confidence in their clinical skills. J. Pediatr. Elsevier; 2008Sep.27;154(2):267-71-271.

13. Jayaram PR, Bhattacharyya R, Jenkins PJ, Anthony I, Rymaszewski LA. A new "virtual" patient pathway for the management of radial head and neck fractures. J Shoulder Elbow Surg. Elsevier; 2014Feb.15;23(3):297-301-301.

List of Supporting Information:

Figure S1 (The Royal Children's Hospital, Melbourne, Paediatric Fracture Guidelines Landing Page)

Figure S2 (The Royal Children's Hospital, Melbourne, Paediatric Fracture Guidelines Supracondylar Guideline example)

**Table 1. Comparative Emergency Department, Fracture Clinic and Radiology Department visit data**

| Visit type | 2012 Review Period Number of Visits | 2014 Review Period Number of Visits |
|---|---|---|
| Emergency Department | 15545 | 19020 |
| Fracture Clinic | 1634 | 1637 |
| Upper Extremity Fracture† | 954 | 842 |
| Other trauma‡ | 650 | 758 |
| Elective§ | 30 | 37 |
| Radiology Department* | 714 | 544 |

† Upper Extremity Fracture patients included those patients with fractures for which a web-based fracture pathway had been published.

‡ Other trauma patients included patients with other acute injuries or infections of the musculoskeletal system.

§ Elective patients include those patients for whom scheduling difficulties resulted in an inability to be seen by their consultant surgeon, instead being seen in the Fracture Clinic.

* Radiology Department visits include only those patients with fractures for which a web-based fracture pathway had been published.