

Primary care pathway- a novel way to reduce the burden on orthopaedic fracture clinics within the pediatric subgroup

A Queensland multi-centered review

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Abstract

Emergency departments receive an increasing amount of musculoskeletal injuries, with the majority referred to a fracture clinic (FCs). A literature review revealed certain orthopaedic injuries can be safely managed away from the FC pathway by general practitioners (GPs) or allied health professionals (AHPs). The present study aims to review all paediatric presentations to FCs at 2 Queensland hospitals, identifying low risk injuries that could potentially be managed by GPs or AHPs. This study is a continuation from Cleary et al in which a primary care pathway (PCP) was proposed for the management of low risk adult orthopaedic injuries. A PCP has the potential to have significant savings to the health system.

A retrospective study was conducted looking at paediatric patients (<16 years) referrals to 2 FCs over 8 weeks. Injuries were categorised into those requiring FC care supervised by an orthopaedic surgeon, and those that can be safely managed by GPs or AHPs via a PCP.

Four hundred ninety (57.7%) of the 849 patients referred to FC were assessed as suitable for PCP care. The most common upper limb injury deemed suitable was radius and ulna buckle fractures (18.4%), while the most common lower limb injury is ankle sprains (8%). Total failure to attend rate in the PCP group was 6.7%.

Adopting the PCP has the potential to significantly reduce FC referrals. With proven success of similar pathways abroad, the PCP may generate significant time and financial savings for both the health care system and patient.

Abbreviations: AHP = allied health professionals, ED = emergency department, FTA = fail to attend, FC = fracture clinic, GP = general practitioners, GRI = Glasgow royal infirmary, PCP = primary care pathway.

Keywords: allied health, emergency, fracture clinic, models of care, orthopaedics, paediatrics, primary health care

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1. Introduction

The Global Burden of Disease and Risk Factor study quantifies the health effects of more than 100 diseases and injuries across 8 regions of the world. Between the years 1990 and 2010, there was an 84% increase in musculoskeletal injuries and disorders. If this trend continues, musculoskeletal injuries will account for 20% of all ill health in the world by 2020.^[1] In Australia, between the years 2013 and 2019, the amount of presentations to public hospital emergency departments (ED) has increased by an average of 2.7% each year.^[2] In 2017 to 2019 there were over 270,000 orthopaedic presentations seen in ED's across Australia. The majority of these are subsequently referred to an orthopaedic fracture clinic for ongoing management. This places an increasingly large resource and cost burden on outpatient hospital infrastructure leading to excessive wait times, patient dissatisfaction and potentially unnecessary costs to the health care system.

The Glasgow Royal Infirmary (GRI), Scotland, have successfully implemented a self-care protocol in the management of low risk orthopaedic trauma, with fractures being managed either directly via ED and discharged with information pamphlets or via a virtual orthopaedic consultant led fracture clinic.^[3] The findings following the implementation of this self care protocol revealed an increase in patient satisfaction, and significant direct and indirect cost savings for the patient and hospital.

Jenkins et al carried on from the GRI framework looking at financial returns of a virtual fracture clinic model over a 5 year period in a regional hospital and found that there was significant reduction in local costs compared to the national average.^[4] Additionally it was also found that the total number of fracture clinic outpatient department attendances fell by 15%, which would allow an increase in appointments for elective, oncology and spinal orthopaedic consultations.

A retrospective study was conducted by McKirdy et al assessing the clinical and cost effectiveness of a virtual fracture clinic over a 3 year period in a London District General Hospital.^[5] The study showed statistically significant reductions in number of new patients seen face to face, improved wait times for specialist orthopaedic review, and fewer unnecessary consults and non attenders.^[5] A reduction in patient numbers in outpatient departments would have cost savings to the hospital and individual.

As seen, there is good evidence that the implementation of a virtual fracture clinic can result in cost savings for the hospital as well as achieving good patient outcomes for certain types of orthopaedic trauma. Inspired by this virtual fracture clinic model by the GRI, Cleary et al proposed a primary care pathway (PCP) in Australia to manage certain adult orthopaedic injuries that do not require specialist intervention.^[6] The model involved a virtual fracture clinic referral system, where referrals were reviewed and those that did not require specialist orthopedic input were referred to a PCP. The pathway utilised Allied health professionals (AHPs) and general practitioners (GPs) to conduct ongoing reviews and subsequent management. The referrals deemed suitable for the PCP were based on previously published criteria by the GRI.^[3] Over the study period, 1367 adult patients were referred to fracture clinic of whom 546 (40%) were deemed suitable for PCP care. The findings show the potential the PCP would have in reducing the burden placed on orthopaedic fracture clinics for adult presentations, which may result in financial and time savings for the hospital as well as the patient. Patient satisfaction may also be increased by not needing to attend unnecessary appointments.

This study is a continuation of the proposed PCP by Cleary et al, this time auditing paediatric referral patterns to fracture clinics of 2 Queensland hospitals. The aim is to evaluate whether a PCP may also be effective in reducing the burden of paediatric referrals on a hospital's fracture clinic.

2. Methods

The retrospective study reviewed all paediatric (<16) fracture clinic referrals (849) at Logan (500 beds) and Redlands (250 beds) hospitals (Queensland Health Metro South Health Service) in metropolitan Brisbane, over 8 weeks (February–April 2016). Referrals from ED and within the community were received along with a referral letter, patient history and radiological appearance of the injury with a diagnosis. A senior experienced orthopaedic consultant at the study hospitals oversaw the referral process and referrals were then categorised by an orthopaedic un-accredited registrar to ascertain those injuries that could safely be treated through a PCP by GPs and AHP, and those needing specialist orthopaedic input at a fracture clinic (Fig. 1). The injuries deemed suitable correlated with evidence based protocol-driven guidelines adopted from previously published criteria by the GRI (2-4) (Table 1). Other data collected was the patients fracture clinic attendance record. Diagnosis is confirmed from either the official

x-ray or outpatient clinical notes from the actual consultation (849). All data was inputted into a Microsoft Excel Spreadsheet format and a series of algorithms was then performed to extract and stratify the data into hospital site, did the patient attend or not, upper limb or lower limb and the type of low risk injury. The present study was exempt from ethics approval after local hospital ethics review (HREC/16/QPAH/543: a multicentred retrospective audit of fracture clinic presentations at Logan Hospital – exempt July 22, 2016 – Metro South National Health and Medical Research Council [NHMRC]).

3. Results

Of all 849 paediatric fracture clinic referrals, 490 (57.7%) were assessed as suitable for PCP care. The most common upper limb injury deemed suitable are radius and ulna buckle fractures 18.4% (157) with 34.8% (70) at Redland hospital and 44.2% (87) at Logan hospital. Ankle injuries 8% (39) are the most common lower limb injury across both sites, 39.6%(21) at Redland Hospital and 46.2%(18) at Logan Hospital. There is inter-hospital variability in the number of injury types seen in fracture clinics across the two sites as seen in Tables 2 and 3; with most variance in presentations seen in radius and ulna buckle fractures (44.2% at Redlands v 34.8% at Logan) and metatarsal fractures (30.8% v 15.1%).

The total failure to attend (FTA) rate for all presentations to the fracture clinic over the study period was 10% (85). Fifty-seven (67%) of the FTA's occurred in the PCP suitable group with the FTA rate in this group being 6.7%. Patients with upper limb injuries are more likely to FTA (8.2% v 15.9% at Redlands and Logan respectively) then lower limb 2.6% v 17%).

4. Discussion

The study revealed a large proportion (57.7%) of fracture clinic referrals involved injuries that could be managed by GP's and AHPs via a PCP. A PCP would provide a protocol driven process in which certain orthopaedic injuries can be managed and if there are concerns, referral to an orthopaedic fracture clinic easily arranged.

A paediatric referral to a fracture clinic is heavily dependent on a parents assessment of their child.^[7] A child may not always report an accident or pain in a limb with the only indication of an injury being a refusal to use the limb or holding the limb in a way not accustomed to the parent. Across the 2 sites there is variability in the number and types of presentations (Table 2 and 3). This could be put down to a variety of factors including population densities between the 2 sites, socioeconomic status, difficulty in attending reviews and education about paediatric injuries and presentations, that is, what may be perceived as a wrist sprain by a carer may in fact be a buckle fracture. It may also be inconvenient for a carer to attend a fracture clinic appointment in a hospital due to wait times and parking limitations. A PCP would allow reviews to be conducted in a community setting which may alleviate some of these issues while still maintaining review of orthopedic injuries.

Over the study period, 18.4% of referrals were buckle fractures of the wrist. A buckle fracture is a fracture in which the cortex bulges due to an applied compressive force usually at the transition zone between the metaphyseal and diaphyseal junction.^[8] Many orthopaedic text books and articles refer to these fractures as inherently stable that do not require prolonged

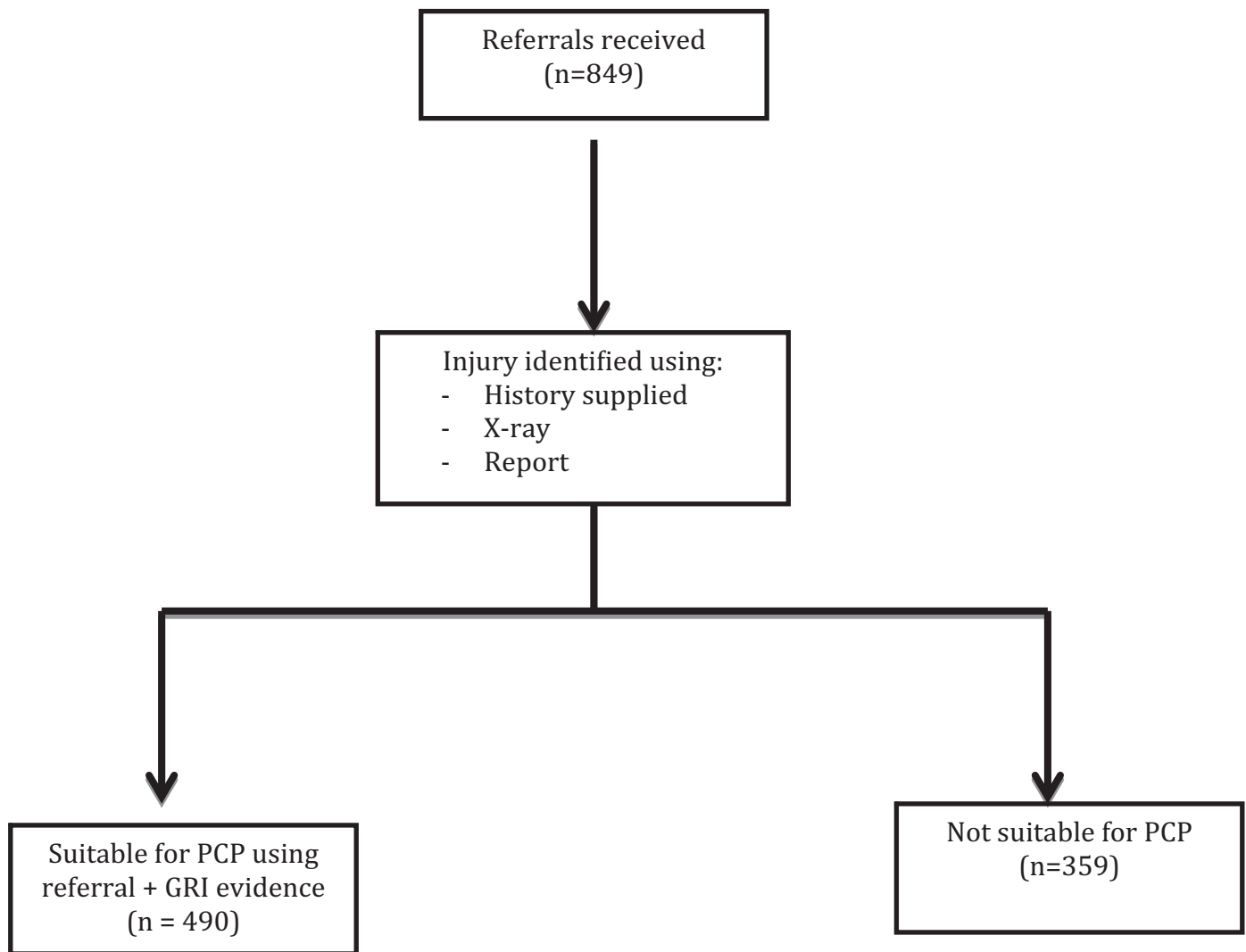


Figure 1. Selection criteria for suitability for PCP management.

treatment in the fracture clinic.^[8-10] Rather than placing such fractures in a plaster, a soft bandage or splint is a suitable and safe treatment option, and in fact may be seen as more favorable in regards to a quicker return to previous level of function and range

of motion.^[11,12] Koelink et al conducted a study looking at referrals directly from an ED to a PCP for management of these fractures.^[13] Findings from the study revealed that children managed via a PCP returned to full level of activities at 4 weeks

Table 1

Selection criteria for conditions deemed suitable for PCP.

Upper limb	Lower limb
<ul style="list-style-type: none"> • Radius and ulna buckle fractures <ul style="list-style-type: none"> • Midshaft clavicle fractures with minimal shortening and no skin tenting • Metacarpal and phalanx fractures with no significant displacement or angulation • Wrist sprain with no radiological evidence of fracture • First time shoulder dislocation • Volar plate injuries (<25% of joint articular surface involved) • Grade 1/2 Acromioclavicular joint sprain • Radial neck with no displacement or radial head dislocation • Elbow injuries: <ul style="list-style-type: none"> – Supracondylar- non displaced – Fat pad sign with no radiological fracture • No injury found i.e. “sore limb” with no radiological evidence of fracture 	<ul style="list-style-type: none"> • First instance of patella dislocation with no fracture <ul style="list-style-type: none"> • Knee sprain- soft tissue only • Non displaced buckle fibula fractures • Metatarsal and phalanx fractures- non displaced or those with no significant angulation or shortening • Ankle injuries: <ul style="list-style-type: none"> – Weber A – Tibia avulsion injuries – Ankle sprain / avulsion • No injury found i.e. “sore limb” with no radiological evidence of fracture

Table 2
Paediatric upper limb presentations to fracture clinic at both sites.

Upper limb paediatric injuries			Upper limb paediatric injuries		
Redlands			Logan		
Results	% of total		Results	% of total	
Count total	197		Count Total	201	
Radius and ulna buckle	87	44.2%	Radius and ulna buckle	70	34.8%
No injury found	47	23.9%	No injury found	41	20.4%
Metacarpal/carpal/phalanx Fracture non op	24	12.2%	Metacarpal/carpal/phalanx fracture non op	36	17.9%
Midshaft clavicle	17	8.6%	Midshaft clavicle	25	12.4%
Volar plate injury- non operative	3	1.5%	Volar plate injury- non operative	9	4.5%
Radial head / neck with no significant displacement	8	1.0%	Radial head / neck with no significant displacement	3	1.5%
Shoulder dislocation	2	1.0%	Shoulder dislocation	1	0.5%
Grade 1/2 acj sprain	1	0.5%	Grade 1/2 ACJ sprain	3	1.5%
Supracondylar- non operative	2	1.0%	Supracondylar- non operative	0	0.0%
Proximal humerus- non operative	1	0.5%	Proximal Humerus- non operative	0	0.0%
Elbow sprain	0	0.0%	Elbow sprain	1	0.5%
Wrist / carpus sprain	5	2.5%	Wrist / carpus sprain	0	0%
FTA	15	8.2%	FTA	32	15.9%

and parents reported a higher degree of satisfaction based mainly on clinic location and wait times.^[13] Interestingly a cost and safety benefit in the PCP was also highlighted as most patients referred to the PCP require just 1 visit and very few had repeat radiographs which is in contrast to some orthopaedic fracture clinics leading to increased health care costs and exposure to radiation.^[14] Managing a distal radius buckle fracture via the PCP would be a safe and viable alternative to the traditional fracture clinic pathway.

The most common lower limb injury deemed suitable for the PCP care was ankle sprains (8%). These include medial, lateral and high ankle sprains as well as distal fibular fractures not involving the growth plate.^[15] It has been shown that the treatment of such injuries are safely and effectively managed with removable ankle splints rather than any casting or immobilisation.^[16] Boutis et al compared these 2 treatment methods and found that a removable ankle brace is more effective in respect to recovery of physical function, return to baseline activities and patient preferences.^[17] The convenience of a brace over a cast was also highlighted in the study and with appropriate education, patients can be instructed when a brace could be removed thereby avoiding follow up in busy orthopedic fracture clinics. This has

the added benefit in cost savings for both the patient and hospital outpatient department.

One hundred two (21%) of PCP suitable patients had the diagnosis of “no injury found” with many having no symptoms at time of review. This can be time consuming for the patient in regards to attending unnecessary outpatient appointments and also affecting orthopaedic fracture clinics with costs and wait times. The majority of FTA’s occurred with PCP suitable injuries (67%). The FTA rate in the PCP suitable group was 6.7%. This implies that these injuries may have often resolved within a short period of time and patients feel comfortable with no further review. This FTA rate would be lower in the paediatric subgroup compared to adults due to parental concern as well as children less likely to report the resolution of injuries. In a traditional FC model, FTA and “no injury found” referrals are seen in a FC, which can be counterproductive for both patient and outpatient departments. A PCP would be an effective management pathway as it would provide a follow up system to alleviate parental concern as well as ensure resolution of symptoms.

When comparing the findings to the adult subgroup in the study conducted by Cleary et al, there is the similarity in the high number of referrals deemed suitable to be managed via a PCP.

Table 3
Paediatric lower limb presentations to fracture clinic at both sites.

Lower limb paediatric injuries			Lower limb paediatric injuries		
Redlands			Logan		
Results	% of total		Results	% of total	
Count total	39		Count Total	53	
Ankle injuries	18	46.2%	Ankle injuries	21	39.6%
Metatarsal fracture	12	30.8%	Metatarsal fracture	8	15.1%
No injury found	8	15.1%	No injury found	6	15.4%
Phalanx fracture	2	5.1%	Phalanx	6	11.3%
Fibula	0	0.0%	Fibula	1	1.9%
Knee including soft tissue	0	0.0%	Knee including soft tissue	5	9.4%
Patella dislocation	0	0.0%	Patella dislocation	4	7.5%
Tibia	1	2.6%	Tibia	0	1.5%
FTA	1	2.6%	FTA	9	17.0%

Interestingly, the paediatric subgroup appears to have a larger proportion of suitable injuries (57.7%) compared to the adult population (40%).^[6] This may be attributed to the large potential of bone and ligament remodeling in a paediatric patient and the fact that many paediatric injuries are benign in nature.^[18] Both pediatric and adult patients exhibit a high FTA rate in the PCP suitable injuries (6.7% v 25% respectively). This finding highlights the self-resolving nature of these types of injuries, and when appointment times are taken up with these referrals, patients requiring urgent orthopaedic input may then be delayed in being seen.

5. Limitations

While we maintained data accuracy and consistency by the use of standardised proforma and definition, this can result in injuries being categorised broadly with expected loss of detail.

Categorizing the referrals is via a virtual process, guided by history, radiography report and imaging alone. If this is inadequate, patients may have been incorrectly categorized as suitable for the PCP when in fact they should be seen at a FC. One un-accredited registrar performed the study solely at Logan Hospital and another at Redland Hospital with no cross-checking of the recorded data. This may have led to differing interpretation of clinical data and incorrect categorization into the 2 study groups. It may also add to the variability in presentation numbers between the 2 sites. The relative risk between the 2 sites of such an incorrect categorization was calculated using 2 x 2 contingency tables and found to be 0.91.

Referring to a FC is dependent on the hospitals ED doctors as well as GPs in the community. Therefore the need for a referral to a FC is reliant on how confident the initial treating doctor is in managing these often simple injuries. There was also no documentation whether these injuries were discussed with an orthopaedic doctor at time of presentation, which may influence whether a patient is referred to a FC or given advice and managed by the ED doctor or GP solely. Logan hospital unlike Redlands Hospital offers a 24 hour orthopaedic consultation service which may prompt emergency doctors to call for advice on certain injuries, and if minor, result in advice and discharge directly from the ED with no follow up in FC. This may contribute to variability in presentation numbers across the 2 sites.

As it is a retrospective study, it is not possible to identify and exclude those with multiple attendances. We are also not able to ascertain those FTA's who may in fact have been seen at another facility.

6. Conclusion

A potential 57.7% reduction in paediatric outpatient FC attendances could be achieved with the implementation of a PCP. The pathway is based on published criteria and experiences from other institutions abroad. Such a pathway has the potential to reduce the burden on an orthopaedic outpatient department and allow resources to then be re-directed to optimize referrals requiring specialist orthopaedic input. The time, convenience and cost savings would also be significant for parents. Differing from a virtual fracture clinic set up, the PCP utilizes the expertise of various health professionals for ongoing review and management of certain orthopaedic injuries to ensure resolution of symptoms as well as addressing patient and parental concerns. Cleary et al showed the potential benefit a PCP would have in the adult

population on hospitals FCs. With this study now providing evidence that a PCP would also be beneficial within the paediatric subgroup, there is potential for significant cost savings to be achieved for a hospitals' orthopaedic outpatient department if a PCP would be implemented.

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