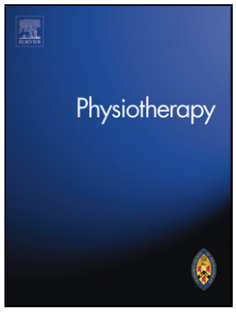

Evaluating the clinical decision making of physiotherapists in the assessment and management of paediatric shoulder instability

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Title

Evaluating the clinical decision making of physiotherapists in the assessment and management of paediatric shoulder instability

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Abstract

Objective: To elicit what information and clinical decision-making processes physiotherapists use in the assessment and management of paediatric shoulder instability

Design: Qualitative study. A modified nominal focus group technique, involving three clinical vignettes, was used to elicit physiotherapists' decision-making processes.

Setting: Physiotherapy departments from across four separate clinical sites

Subjects: Twenty-five physiotherapists, (18F:7M), ranging from two to 29 years post qualification.

Outcomes measures: Thematic analysis. The initial round of coding was used to draw up a quantitative assessment of the diagnoses and map information used for clinical decision-making against the International Classification of Functioning (ICF) framework.

Results: The themes identified related to 'Differences in diagnoses, classification and diagnostic processes', 'Diagnostic process occurs over a long period of time', 'Management and prognosis are influenced by a number of factors' and 'Diagnostic test choices and prognosis influenced by factors beyond the patient injury'.

Conclusion: Current methods of assessment are prone to bias and error and maylead to inconsistent or delayed provision of essential care. Further work is needed to develop methods of measurement and frameworks which can accurately identify relevant physiological mechanisms and personal factors associated with shoulder instability as a part of the assessment/diagnostic process.

Contribution of the Paper

- There was considerable variation in the assessment and management of paediatric shoulder instability between physiotherapists
- Classification systems, frameworks and treatment/management pathways were not widely used.
- Existing methods of measurement in clinical assessment were limited in their ability to inform decision-making and the current terminology used lack precision.
- Clinical decision-making processes were also influenced by several factors beyond the patient injury, introducing potential sources of bias, most notably with reference to gender.

Keywords

Paediatric Rehabilitation, Upper extremity (arm), Instability, physiotherapy, clinical decision making,

Introduction

Shoulder instability – the complete or partial dislocation of the shoulder joint – is an impairment that presents across multiple health conditions and may stem from a number of etiologic causes e.g. acquired neurological or musculoskeletal injuries, congenital anatomical predispositions, neurological or degenerative neuromuscular diseases(1-3). Several anatomical, physiological and psychosocial mechanisms may contribute to shoulder instability, it is generally classified according to the presence or absence of a preceding traumatic event and labelled as traumatic or atraumatic instability respectively, although this distinction is not always possible.

Whilst there is a bimodal age distribution associated with individuals in their third and ninth decades of life, (4, 5) shoulder instability can affect children from any age, although it though is most commonly observed in adolescents between 14 and 16 years (6, 7). The condition has short term associations with pain, decreased movement and activity limitations. Longer-term complications are recurring instability and, in traumatic instability a risk of early onset of shoulder arthritis, although the long-term effects of recurrent atraumatic instability episodes are not well documented and it is possible there may be some changes to the joint (7-11). Assessment and management of paediatric shoulder instability is complex, failure rates for preventing further recurrence in both traumatic and atraumatic instability are high, with between 40% to 100% of children experiencing repeated instability although significant variation is reported for both groups(6, 8, 12). For many a formal diagnosis is delayed and patients may experience multiple episodes of instability prior to presenting to a clinician, although this is more likely in atraumatic cases (6, 13, 14). Current treatment favours conservative rehabilitation, typically administered by physiotherapists, and aims to address the predominant factors contributing to the presentation. Surgery is not routinely considered while the patients are still developing given potential risks of damage to the bony growth plates.

Poor prognoses for patients may plausibly be due to delayed and/or inaccurate diagnoses, and inappropriate treatment selection (15). There are many models available for the diagnosis (3, 16-28) and management (15, 16, 29-33) of shoulder instability, but clinical practice is not routinely drawing on these models. Existing models and guidelines recognise that the underpinning evidence base used to inform clinical decision making is limited and heavily informed by expert opinion (24, 32, 34).Clinical reasoning processes draw upon subjective reports by the patient and clinical tests to

come to a diagnosis. However, the underpinning decision-making process in diagnosis and management of shoulder instability are not explicit. There is a need to understand the underpinning clinical reasoning that informs the resource expensive diagnostic processes, e.g. multiple health care visits with delayed or inappropriate investigations, to improve prognoses (8, 9). The aim of this study was to investigate the clinical decision-making process undertaken by physiotherapists presented with vignettes of paediatric shoulder instability to elicit the types of information used to make clinical decisions around the assessment and management of the condition. This research is part of a wider study which investigated the development and use of health care technologies for informing clinical decision making in paediatric shoulder instability (35).

Material and methods

Ethical approval was gained from the University Ethics Committee Review. Participants were recruited within their capacity as physiotherapists, with an interest in paediatric shoulder instability. A single focus group of approximately 90 minutes were run at each site using modified nominal focus group techniques, using the first three stages from Harvey and Holmes (36). Clinicians were presented with three vignettes (Table 1) describing hypothetical young patients with cases of shoulder instability. This method was selected as it is reliable and allows for the development of scenarios in which selective but realistic components of a disease presentation can be used for standardisation across settings and specialties (37). This method has been used in shoulder instability research (38)and is common for testing competencies of health care professionals and more recently in the training of artificial intelligence in healthcare(39). Therapists discussed vignettes one at a time, and the order of discussion was randomised to ensure that the most experienced clinician was not always able to answer first or influence the other therapists. A flip chart was used during the session to record individual responses and facilitate discussion during the event. After an initial round of individual responses, therapists were given time for group discussion and elaboration on earlier answers. Seed questions were also provided to encourage therapists to discuss and evaluate their clinical decision-making processes (Table 1). The seed questions also contained prompts related to the use of additional healthcare technologies, some of which are not routinely used in the management of shoulder instability, and development of system specifications which have been reported elsewhere (35).

Focus group sessions were audio recorded and transcribed verbatim and then analysed using NVivo software (12) . To ensure all major themes were identified and that a level of data convergence was achieved, the study aimed to complete a minimum of four focus groups (40). Data analysis was made up of three main stages. Thematic analysis, following Braun and Clarke (41), was conducted by

a single researcher (non-clinical author) and were then verified with another researcher (clinical author). The non-clinical author undertook a period of reflexivity prior to beginning the analysis to identify potential bias or elements which might influence the quality of the research. The clinical author also acted as a source of professional knowledge throughout the analysis period.

The defined themes and preliminary analysis were put before the wider author panel and discussed in relation to the research aims. Their clinical experience was used to enhance the analysis by providing greater clarification and context to each of the themes, and this discussion furthered the practical relevance of the study by considering the wider implications within the clinical sphere.. In addition to the thematic analysis, the initial round of coding was used to draw up a quantitative assessment of the diagnoses and map information used for clinical decision-making against the International Classification of Functioning (ICF) framework (42). Therapist transcriptions were labelled according to anonymised participant identifiers (Ppt#). Data for this study was presented according to the standards for reporting qualitative research reporting guidelines (43).

Table (1) Summary of clinical vignettes and seed questions used in focus groups

Vignettes*	Seed questions
Vignette 1 **Subjective assessment** Patient is a 16-year-old female presenting with worsening right shoulder pain. Recurrent episodes of instability/ partial shoulder displacement for the last 6 years. Not sure about the direction of instability. Competitive netball and swimming since age 12 with onset of pain at age 14. Had multiple physiotherapy sessions over the years for managing exacerbations. Referred by GP for recent worsening of shoulder pain. **Objective assessment** • Beighton score 4/9 (bilateral elbows and knees) † • Scapular dyskinesis apparent on physiological movements i.e. flexion, abduction. • Reluctance to elevate arm through range. Limited active range of movement end ranges of elevation with pain.	***Could you please answer the following questions:*** **1. What is your diagnosis for this patient?** (Please provide your clinical reasoning i.e. information used to support your diagnosis, associated mechanisms of injury and alternate diagnosis excluded with justification) a. How would you classify this patient? b. Would you use an existing framework/classification system, and if so which one? **2. What other information/ assessment methods/ investigations would you like to have to inform your diagnosis and management plan?** a. Would you consider 3D motion capture/ electromyography/ neurophysiologist referral and what information would you want? **3. What would your management plan and prognosis for this patient be?** (Please provide your clinical reasoning i.e. information used to support your management plan/prognosis) a. Is this informed by any clinical pathways or best practice guidelines?
Vignette 2 **Subjective assessment** Patient is a 14 year old male. Contact injury to left shoulder 3 days ago during a rugby match. Tackled opposing player with arm out, felt shoulder come out of place, reduced by itself. Presented to the emergency department. X-ray nothing abnormal detected. No previous shoulder injuries. Referred for rehabilitation. **Objective assessment** • Positive apprehension relocation test. • Beighton score 2/9 (bilateral knees) † • Limited active range of movement in all planes with limited muscle strength compared to right	
Vignette 3 **Subjective assessment** Patient is a 17 year old female referred for recent episode of shoulder instability and pain following collision in basketball 2 months ago. Felt shoulder pop out and in when diving for a ball on the ground. Did not attend emergency department. Unable to recall previous significant episodes of trauma. History of similar feelings previously but less severe. Unclear around the level and direction of displacement. Previous episodes associated with normal daily tasks and sports but did not affect activity or participation. Referred by GP to Physiotherapy for shoulder pain and queried shoulder dislocation. Separate referral to orthopaedic consultant pending appointment date. **Objective findings** • Positive apprehension relocation test. • Beighton score 5/9 (Bilat elbows, knees and hands flat to floor) † • Full active range of movement with pain end of range elevation.	

*Clinical vignettes were informed by the literature and clinical experience and structured to reflect a range of subjective and objective features associated with shoulder instability Further information is provided in appendix 1.
† Joints in brackets indicate where subjects received points on Beightons test i.e. where hypermobility was present

Results

A total of 25 participants, seven males and 18 females, divided unequally over four sites, were included in this study. The sites were comprised of one University Teaching, two District General and one Specialist Orthopaedic Hospitals. All of the sites had specialist shoulder services with Consultant Physiotherapists who were competent in triaging and assessing upper-limb caseloads including shoulder instability. Participants were all physiotherapists, based in the UK and working in the public healthcare sector across the primary and secondary care settings. Years of experience (range 2 to 29 years) and levels of specialism (Consultant (n=6), Advanced (n=6), Specialist (n=12) and Rotational (n=1)) varied between and within groups. All participants had mixed caseloads which included shoulder instability patients apart from three therapists. Themes extracted from the data are listed in Box 1.

Box 1. Themes extracted from the data

- Differences in diagnoses, classification and diagnostic processes
- Diagnostic process occurs over a long period of time
- Management and prognosis is influenced by a number of factors
- Diagnostic tests and prognosis influenced by factors beyond the patient injury

Differences in diagnoses, classification and diagnostic processes

There was variability in the range of diagnostic terms and approaches used, both within and between sites, with all three vignettes having more than 10 diagnosis elements (Table 2). Whilst some diagnostic convergence was seen in each case, this often focused on one component of the injury e.g. direction of instability, there were also elements of contradiction e.g. Vignettes 1 and 3 were classified as being both traumatic and atraumatic. During the diagnostic process, discussions leading to no agreement was common (e.g. the importance of the Beighton score or presence of dyskinesis). In these cases, discussions often centred around the relevance of the factors and their role as primary causes of the patient's instability, a secondary complication or incidental finding.

Table 2 – Lists of the labels, mapped against the ICF framework, used to diagnose the vignettes

ICF DOMAIN	Vignette 1	Vignette 2	Vignette 3
Health condition	Shoulder instability	Shoulder dislocation	Shoulder instability
	Recurrent	Subluxation / dislocation	Recurrent (shoulder instability)
		First time	Subluxation
		Instability	Subluxation/dislocation
		Shoulder injury	Acute on chronic instability
		Subluxation	Subacute
		Spontaneously relocate	
		Acute	
		Unilateral	
Body Structure and Function	**Imprecise structural components = The anatomical parts of the body**		
	Atraumatic / Non-traumatic		[Underlying] Atraumatic
	Mildly Traumatic	Traumatic	Traumatic
	Multidirectional	Anterior	Multidirectional
		Inferior	
	Interior [sic]	Antero-inferior	
	Posterior		
	Functional*		
	Structural influence / injury / pathology	Structural	Structural [change]
		Soft tissue trauma	Query dislocation with soft tissue injury
			Ligament sprain, inhibiting muscle control
	Hypermobility background, Structural laxity		Underlying hypermobility or a borderline hypermobility
			Not able/willing to firmly classify/unclear/difficult/mixed /etc.
	Impingement		
	Secondary pain		
	Rotator cuff involvement/ rotator cuff tendinopathy / rotator cuff pathology		

	Secondary cuff pain		Secondary rotator cuff pain/rotator cuff related pain
	Precise structural components = The anatomical parts of the body		
	Capsular laxity	Capsular tear ± labrum	Capsular laxity
	Weak rotator cuff		
	Tendinopathy		
	Function: Physiological / Psychological functions of the body systems		
	Muscle patterning	Limited muscle strength secondary to pain	Muscle patterning (lack of control)
	Poor coordination		Ligament sprain, inhibiting muscle control
	Muscle imbalance		
Personal	Voluntary		Habitual
	Psychosocial factors		

* within this context "functional" is used in relation to instability in the absence of any contributing structural defects (19). This is not consistent with the ICF definition which is used in reference to all body functions, activities and participation (44).

Underlined words = indicate which component of the statements is related to that ICF domain

Each row represents a label used for diagnosis or similar labels used in diagnosis

When mapping factors used for diagnosis against the ICF framework, the primary focus was on the categories of

- Body structure and function (structures involved, position of the limb, anatomical considerations such as congenital bony morphology and laxity), i.e. impairments.
- Activity leading to impairments (biomechanical demands of the sport/ activity, mechanism of the injury and effect on tissues and volume of load)
- Personal factors, when considered, centred around patient reported injury history and description of symptoms.
- A gender bias towards adding psychosocial components to adolescent females was identified (Box 2).

Box 2. Example of additional psychosocial component being attributed to female vignette 1

Facilitator: Can you just expand on what you mean by psychosocial and how that could feed into your diagnosis?

Ppt #9: I think it's probably something that we see quite a lot in this group of patients, so 16-year-old females who are going through puberty. Um, there's certainly… Thinking the evidence, we'd probably agree that this… we see quite a lot, um, where there might be other, other factors that are, are influencing , her shoulder problem and this is a, a way of it manifesting itself really. So, um, things like bullying, or…

Ppt #6: Pressures from school.

Ppt #9: Problems in school or moving up.

Ppt #6: Bad times, yes, anxiety, stresses, yeah.

Ppt #9: Yeah, or not coping with the training regime, or not wanting to do that.

Ppt #6: Hm-mm.

Ppt #9: This is a way out to lots of other issues.

Ppt #7: Family dimen, fam, family dynamic.

Ppt #6: Oh, I haven't thought about that, but actually relations, yeah. We see that all the time.

NB: Personal factors were inferred by the physiotherapists and not explicitly outlined in the cases.

Across all vignettes, the patient was identified as the primary source of information with physiotherapists wishing to seek out further clarification regarding mechanism, timeframe and history of the presenting or previously related injuries. This included questions related to the initial onset, subsequent presentations/recurrences, direction of instability, aggravating and easing factors, and previous management (investigations and rehabilitation). The demands associated with activities of daily living and the relevant sporting activities were also identified as requiring further elaboration. In some cases, e.g. vignette 2, therapists considered additional questions to exclude other pathologies such as concussion or neural injury, although this was not universal and was based on previous clinical experience. This use of personal experiences and senior members of the department as references for diagnosis was a recurring theme within the data.

Objectively, physiotherapists identified wanting to observe movements and features of the shoulder girdle including posture, proprioception, active range of movement and associated scapular control or symptom reproduction. They wanted to test the integrity of the shoulder joint and surrounding structures through passive range of movement, assessment of strength (globally at the shoulder and

for specific structures e.g. the rotator cuff) using clinical scales e.g. MRC/Oxford scale, and through palpation and orthopaedic tests (sulcus, load shift and apprehension relocation tests). The tests were also used as a way of identifying if therapists could reproduce any features of the patient's instability. Several alternate pathologies were considered plausible or probable whilst some pathologies were excluded on the basis that they were considered implausible (Appendix 2). Whilst some consistency was identified within centres, there was no consistency between centres and across vignettes.

Less than 50% of therapists were able to identify any frameworks for classification and management of shoulder instability. In cases where classification frameworks were identified, the most frequently mentioned was the Stanmore triangle (34). Majority of the therapists did not use any of the listed classification systems, perhaps most clearly indicated in box 3.

Box 3. Therapist quote related to the use of classification systems

PPt #5: "And then what framework do I use in classification system? Uh, [Ppt 5]'s fly by the seat of her pants framework. So I don't, I don't use any." – [Vignette 1]

The most common diagnostic method was to *"just go by what the patient presents*". In most cases the physiotherapists sought to classify the injury using a *"narrative classification"* whereby the presentation of shoulder instability was described as having a primary cause with secondary complications e.g. *"muscle guarding"* or *"soft tissue injury"*. There was also a tendency to avoid absolute classifications and qualify the presented diagnosis *"high likelihood"* alongside listing other potential diagnosis which should be considered e.g. *"can't rule out a Bankart"*.

Despite variability in diagnostic process, unity within the in department and trust in intra-mural staff relationships was a sub-theme. During the discussion process there were very few disagreements, and these were only related to one component of the diagnosis. This was verbally confirmed and structurally apparent in the format of the group as responses were structured as a group rather than individuals (box 4).

Box 4 – Therapist quote illustrating agreement and structured group responses

PPt#2 - "I'd agree with a lot what you said, not surprisingly." [Vignette 1]

The first speaker within the group often provided detailed answers which were then followed by shorter, confirmatory statements from other therapists, usually followed by addition of a small detail. During these responses it was not clear which component therapists were agreeing with and often therapists only agreed with no further elaboration.

In cases of uncertainty, groups often had one person who acted as a reference point. The reference individuals were usually the more experienced or senior members in the department who were consulted regularly for their advice regarding management of patients outside of the focus group setting. Typically, the reference individuals provided longer detailed answers and alluded to the use of research or evidence to support their answers.

Diagnostic process occurs over a long period of time

Although tentative diagnosis were made at the end of every assessment, therapists indicated that a confirmed diagnosis would emerge over several sessions, spanning weeks or months rather than in a single appointment. Justification for the additional subjective and objective features was centred around exploration of possible drivers for the patient's presentation or testing of assumptions formed as a part of the clinical reasoning process. In some cases, physiotherapist identified wanting to expand their assessment e.g. neurological or distal joint assessment, depending on other considered diagnosis for suspected nerve injuries or connective tissue disorders respectively. As a part of the assessment process, physiotherapists commonly expressed a desire to see if they could modify the patient's presentation within a session as highlighted by statements such as *"seeing if a bit more cuff activation has any effect on the symptoms as well"*, *"weight bearing to facilitate proprioception"*.

Most therapists only considered technology-based tests or referrals as a potential future option if the original assessments and rehabilitation were unsuccessful, best displayed in the following quote (box 5):

Box 5. Therapist quote illustrating dependency of referrals on outcome of physiotherapy

> *PPt#11: "we might not go for an MRI, an MRI straight away. See how they get on over the next few weeks. Um, and if they had any neurological symptoms, then look at the conduction studies" – [Vignette 2]*

There were some exceptions to this, therapists described not waiting to refer if the patient was an *"obvious"* case, but in general they were more likely to undertake *"a few treatment sessions before [they] started considering those other investigations"*. An MR arthrogram was the most sought out investigation but was conditional on a patient's inability to progress with rehabilitation and there was no consistent practice regarding this.

Management and prognosis influenced by a number of factors

Considerable variation in management plans and rehabilitation strategies were identified. Management approaches most often focused on patient presentation, whereby therapists looked to address the assumed impairments underpinning instability. Some therapists discussed using a more global approach "*Also looking at other muscles you know are we looking at glutes and everything as well…"*, whilst some looked to target specific anatomical structures e.g. *"focusing on the scapula"*, or *"activating the cuff"*. Similarly, to the diagnostic process, some treatments were debated e.g. Vignette 2, regarding the provision of a sling within and between sites. In cases in which management plans were questioned, rebuttals were often made with the use of published evidence. The exercise principles and related impairments identified are listed in table 3. Therapists also included education, coaching, getting the patient *"on board"*, involvement of wider family and trying not to *"over-medicalise"* things.

Table 3. Exercise principles discussed alongside assumed or proposed impairments

Cases where exercises were explicitly linked to an impairment i.e. directly linked to a proposed mechanism for instability to be addressed	
Exercise type	**Impairment identified/assumed**
General / progressive strength programme	Hypermobility
	Weakness causing altered movement pattern
Isometric muscle exercises [activity focused]	Pain
Cases where exercises were not explicitly linked to an impairment i.e. not directly linked to a proposed mechanism but provided to encapsulate a range of potential mechanisms*	
Exercise type	**Impairment identified/assumed**
Activity modification focused e.g. avoidance of some movements/positions [early on]	Altered proprioception Altered range of movement Altered muscle activation/recruitment Altered movement pattern - scapular control / dyskinesis - associated with pain / instability - nonspecific / general Hypermobility Reduced strength/weakness Posture Pain Sensation of apprehension/ positions of vulnerability
Strength focused e.g. progressive strengthening [guided by symptoms of instability and pain] / General strength programme/ Isometric muscle exercises [strength focus]	
Postural / Positional control focused e.g. scapular setting [weight and non-weight bearing] / change the position of the scapula / changing the thoracic spine	
Range of movement focused e.g. general range of movement /encouraging to get to end of range	
Proprioception focused [weight bearing / "core"] e.g. Core stability exercises [to influence the shoulders], four-point kneeling, press up position	
Proprioception [non-weight bearing focused] e.g. gym/ Pilates ball/ "proprioception rich, low load" /Two-point discrimination [therapeutic rather than diagnostic], use of visual feedback such as mirrors, working on "reactiveness", "possibly also the cortex using visual stimulation or timing"	
Muscle activity focused e.g. Exercises to "activate/engage" the cuff/ "Cuff facilitation" / "Facilitation of posterior cuff"/ Change activation sequencing/ amount of activity	
Compound/ Multi-segmental upper and lower limb / Multi-task orientated exercises e.g. "functional" / bilateral/ contralateral/ multitasking activities/ trying to involve the kinetic chain† / "Reflex type movements" – unstable surface, throwing balls at them and catching and throwing them back / stepping up with a theraband / recruiting different posterior slings	
Sports specific/ targeted rehabilitation e.g. tackling technique, maintaining cardiovascular fitness/ skill specific	

* It was not possible to map exercise(s) selection to a specific impairment or set of impairments given the tacit nature of clinical decision making. Additionally, there was insufficient detail regarding exercise dosage to allow for mapping of the range and programme types used.
† defined by one participant as *"using muscles in the lower limb and trunk. The same time as movements of the shoulder in this case"*

When questioned regarding the use of existing protocols or best practice guidelines less than 50% of therapists reported using any form of programme, of which the Derby instability programme (31) was the most mentioned. Similarly, to the use of classification systems, therapists reported using components of this to inform their management rather than as an absolute framework. Physiotherapists also identified basing their treatment around concepts or exercises derived from continuing professional development courses delivered by other physiotherapists.

Prognosis was based on duration and severity of symptoms e.g. number of dislocations/subluxations, response to prior treatment (during and between sessions) e.g. *"severity of pain in the initial stages"* and "*how quickly he gets his range back"*, and previous healthcare episodes, successful or otherwise.
The domains of body structure and function (structural changes to the labrum, bony morphology and associated structures, pain), activity (volume and level of activity) and personal factors (age, gender, motivation, compliance, social situation, family relationships and, psychosocial) were considered.

Diagnostic test choices and prognosis influenced by factors beyond patient injury

Diagnostic test choices and prognoses were influenced by factors additional to the described injury. Therapists often discussed the trade-off between idealistic and realistic management for diagnostic tests and prescribed rehabilitation. The main factor which influenced selection of diagnostic tests was cost. Time implications were also linked to cost, specifically, time required to conduct tests, availability of time in appointments and overall time for referral and duration on waiting lists. A number of therapists commented that they would only recommend referral for further tests if attempts to rehabilitate the patient had first proven unsuccessful or there were significant concerns.

Selection of diagnostic tests was also influenced by the patient's sports ability, outcome goals, and in some cases the outcome goals of parents and family. The aetiological causes of instability i.e. traumatic versus atraumatic were not stated as significant in decision making. Patients engaged in competitive sport were more likely to have referrals for technology-based objective testing in a shorter time frame compared to those competing at school or recreational levels. There was no

consistent practice regarding onward referral with noticeable differences in practice e.g. vignette 2, where surgical referral was discussed given their level of sport, but this not extended to the other vignettes. Existing guidelines which differentiate between minimum levels of investigation for traumatic and atraumatic shoulder instability were not referenced by participants (24, 32).

In most cases, therapists identified the patient as being likely to have a positive outcome with physiotherapy. This is consistent with some published literature investigating rehabilitation protocols for both traumatic and atraumatic instability, although evidence is limited by study design, length of follow up and heterogeneity in outcome measures (29, 31, 45). The overall prognosis of the patient, differential diagnostic process and perceived effectiveness of treatment were influenced by physiotherapists pre-existing knowledge (including experiential learning) and evidence within the literature, notably statistical likelihood of reoccurrence (box 6).

Box 6. Quote illustrating therapists prognosis with reference to statistical likelihood

> *Ppt #18: "You can get rid of that apprehension then you convince yourself yep, he's going to be great. But statistically, he's probably going to re-dislocate in the next 12 months. He's got about 80 to 90% chance of re-dislocation." – [Vignette 2]*

Therapists also frequently identified that patients were more likely to have a poor prognosis or limited engagement in rehabilitation relating to situations where there was disagreement between healthcare professionals regarding overall management (box 7).

Box 7. Quote illustrating potential poor prognosis associated with disagreement between healthcare professionals

> *PPt #2: "But if people say two contrasting things, GPs saying one thing, consultants say another thing, physiotherapists say another thing, that's a recipe for disaster for any patient." – [Vignette 1]*

Irrespective of the reported statistical likelihood of recurrence, a positive prognosis for patients was considered in cases where compliance levels were good, suggesting that patients *"will improve but [they need] to put the work in"* and emphasising the additional time it would take to recover if the patient chose to ignore the advice. The patient's willingness to comply was suggested to be linked to

their lifestyle and family willingness to support their recovery, with sports being a significant driving force to comply with rehabilitation and recovery.

In these focus groups, psychosocial influences were generally perceived to be only relevant for the female vignettes. Prognosis was perceived to be poorer for teenage girls because "*They've got, you know, hormonal, hormonal rages going on, they've got loads going on in life."* which was suggested to influence their likelihood to carry out the recommended rehabilitation faithfully. Whilst there was some discussion regarding psychosocial factors affecting the male vignette (2), these were much less frequently mentioned and centred around apprehension around restoring range post the traumatic injury. Participants in our study were predominantly female (72%, n=18) and there was no evidence to suggest that gender biased attribution of psychosocial influences was as a result of the therapist's gender.

Discussion

The aim of this study was to investigate the clinical decision-making processes undertaken by physiotherapists presented with hypothetical cases of paediatric shoulder instability to elicit the types of information used to make clinical decisions around assessment and management. No unified structured approach for assessment or management was identified. This variability in practice likely stems from the limited use of classification systems and an agreed set of physiologically valid criteria for assessment. Therapists reported limited awareness and utility of existing classification frameworks, despite more than 18 proposed classification systems in the literature (18). Given that therapists had limited knowledge of existing classification systems, reasons for not using them were not widely discussed. Existing guidelines and models are predicated on a clear distinction between traumatic and atraumatic aetiology which is not always possible (table 2) and was intentionally included in the construct of Vignette 3 to reflect the complexity of this impairment. Participants experiences reflected this and highlights a limitation of existing models and guidelines. In cases where these were used, therapists used them as a rough guide rather than absolute classifier. This suggests existing classification systems have limited clinical applicability possibly stemming from their complexity e.g. system proposed by Magnuson et al (46) and the Stanmore triangle (34). It was evident from discussions that the relevance of some factors to presentations of shoulder instability e.g. shoulder dyskinesis and Beighton score, remain debated. Existing processes and tests used in clinical assessment are inadequate given that they lack sensitivity and specificity (47, 48). Further work is needed to identify agreed relevant

factors/mechanisms for shoulder instability and appropriate methods of measurement which can be used to help clinicians in diagnosis and decision-making (35).

Clinical assessment was constructed around observation-based inferences which have not been validated or may be inaccurate (box 8) i.e. the association between observed movement variations and impairments are not proven. The risk of error associated with movement based observation is high(48) and is known to result in misclassification of patients (19). Mechanism of action for patient presentation and treatments was rarely discussed and clinical reasoning processes were not explicit, with practice assumed to be universally understood or standard e.g. *"usual physio assessment"*, *"wrong picture".*

Box 8 Quote illustrating therapist inferring physiological processes from a movement (attempting to observe muscle activity [1])

> *Ppt #1: "…activation of, of muscles, so certain muscles that are driving the instability potentially. So, looking at upper traps slightly overactive, um, lats underactive, other things like that really" – [Vignette 1]*

Assumptions developed during assessment are known to inform treatment selection and this was evident within our study, where therapists sought to provide exercises addressing the presumed drivers for patients presentations (49). The assumptions extended to the overall patient prognosis, where whilst the majority of therapists viewed patients as having a positive prognosis with physiotherapy, this only related to improvements in some of the assessed features e.g. increased range of movement rather than prevention of another instability episode and there was no consensus regarding timeframes.

Decisions were not evidence based with less than half of all therapists reported using any evidence-based protocols. Decision-making was also influenced by a series of embedded biases i.e. personal experiences, conforming to group dynamics (group think) and senior members of the department (medical hierarchy) e.g. "*Um, I think good prognosis. But now PPt# 18 has said that, I'm thinking perhaps not [laughing]"* (50, 51). The lack of an established evidence base and robust guidelines may also account for the variable and poor treatment outcomes in this group (6, 52), best captured in the following statement (box 9).

Box 9. Therapist quote illustrating limited evidence available for informing practice

> *PPt #2: "Again, it's a lack of clinical pathways to advise therapists here in general. I'm sure around the country, people do lots of different things with these patients. I'm sure there's been a lot of uniformity to, to approaching these patients. And I've seen trends change over the years as well. First of all, let's, let's focus on the glenohumeral joint, then focus on the scapula. Then focus on both. Then focus on kinetic chain. So things come in trends without, really a lot of evidence to back up what, what we've been doing over the years." - [Vignette 1]*

[1] Muscle activity can be measured/quantified using electromyography in the unites of millivolts (mv). Measurement of this feature is not possible with visual observation

In the absence of evidence, therapists identified using other therapists or courses for informing practice. Whilst courses and conversations are known to inform practice, this is questionable given the limited evidence and outcomes observed in this patient group (53). It is acknowledged that personal experiences are a normal part of the clinical reasoning process (49, 54), however our findings suggest that these factors may be contributing to inaccurate diagnosis and bias or erroneous decision-making. This was most evident with respect to gender where the female vignettes were assigned psychosocial attributes which negatively impacted their prognosis, despite limited evidence to support psychological factors being specific to gender (33, 55). There is a risk that factors responsible for poor outcomes are erroneously attributed e.g. blaming the patient regarding compliance and poor outcomes, as identified by one therapist (box 10).

Box 10 Quote illustrating factors which may influence patient outcomes

> *PPt #18: "So, I think, you know, you lose these… This group of patients are the ones that I think you lose the follow up really easily. And it's really hard to keep them on board. So, they're really challenging. But potentially, they could do very, very well. I think you have to be careful we don't blame them for non-compliance when actually, a lot of it comes down to how well we can make them buy in to what we're trying to get them to do."– [Vignette 3]*

Unity in the department, extending to a distrust of other healthcare practitioners, modes of medicine or technological methods of measurement used outside of the department may likely limit the information used to inform clinical decision-making and inconsistent or delayed provision of essential care.

Box 11 Quote illustrating unity in the department and distrust of other healthcare professionals or delayed provision of essential care

> *PPt #2: "I would agree with that. Again, the GP referred to orthopaedic consultant which may not be the right thing to do. Because that can suddenly escalate things and then they do get investigations and suddenly a problem's found that it's not necessarily a problem. So, sometimes it's, it's not the best thing to do. But, yeah, obviously the GPs doing it in her interest, but yeah, is that wise at this moment in time really? "– [Vignette 3]*

Factors which contributed to the lengthy diagnostic processes were selection of the simplest assessment option which was perceived to be cost saving (i.e. physiotherapy versus technology-based measures) and the watch and wait/ trial and error approaches expressed by therapists. Clinical decision-making therefore appears to be concerned with the immediate episode of care and reflective of the biomedical model i.e. focusing on impairments or activities which lead to impairments. Cost was calculated against a very narrow domain e.g. cost of a single episode of care, as a result the broader cost implication associated with delayed treatment (e.g. productivity and managing complications) were not considered i.e. lifetime cost.

Limitations

It is recognised that other healthcare providers and sectors, in addition to public sector physiotherapists, are involved in the assessment and management of paediatric shoulder instability. Therefore, practices within these domains may be different to those identified in our study. As a part of our study we were unable to identify a minimum dataset of factors used for clinical decision-making. This is likely due to the tacit and semi tacit decision-making process observed and modified nominal technique used, whereby therapists were not required to vote for the ranking of identified factors. However, based on the implicit decision making and high levels of agreement, the additional steps may have been redundant and still not resulted in a robust set of well-defined and physiologically accurate factors. Alternate methods such as action research methodologies, semi-structured interviews and Delphi technique may allow for identification of a minimum dataset relevant factors, however it is important that these are physiologically accurate. The modified nominal focus group technique and randomisation was selected to mitigate against existing medical hierarchy and encourage individual responses and discussion. However, responses in our study were structured as a group and elements of medical hierarchy were still evident. Use of the nominal focus group methodology in groups comprised of different departments and sites may encourage more varied discussion and debate.

Considerable variation in practice was identified for the assessment and management of paediatric shoulder instability. Classification systems, frameworks and treatment/management pathways were not widely used, possibly as a result of their complexity or limited evidence base (24, 32). Existing methods of measurement in clinical assessment are limited in their ability to inform decision-making and the current terminology used lack precision. Consequently, these may negatively influence

diagnostic accuracy and compound errors in decision-making which may affect treatment outcomes. Clinical decision-making processes were also influenced by several factors beyond the patient injuries presented in the vignettes, introducing potential sources of bias, most notably with reference to gender. Further work is needed to develop methods of measurement and frameworks which can accurately identify relevant physiological mechanisms and personal factors associated with shoulder instability as a part of the assessment/diagnostic process. This may subsequently allow for appropriate treatment allocation and inform the processes surrounding rehabilitation and further management according to first principles.

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Conflict of Interest Statement

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