

## RESEARCH ARTICLE

# Beyond guidelines: A qualitative clinical stakeholder study of optimal management of anterior cruciate ligament rehabilitation

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## Abstract

**Aims:** This study gathered expert perspectives in the management of anterior cruciate ligament (ACL) rehabilitation to explore current practice, variations in care and optimal management strategies.

**Materials and methods:** This was a qualitative semi-structured interview study. The participants' experiences were considered in terms of their roles as employees, managers, clinicians and professional gatekeepers. Purposive and snowball sampling were used to recruit physiotherapists and orthopaedic surgeons. Participants were included if they had a proven record in clinical management or research involving ACL patients. Persons were excluded if they could not speak English. Interviews were conducted in person, via skype or over the phone at a time convenient to the participant. Data was analysed using a framework analysis and critical realist approach.

**Results:** Results included 24 interviews that were conducted with 19 physiotherapists and 5 surgeons. Themes of variation in current care and optimal care were explored including subthemes of patient centred practice, evidence based medicine, resources, self-management, multidisciplinary teamwork, training and expertise were explored. Participant's perceptions of current care were that it was a location 'lottery' that significantly varied for patients across the UK.

**Conclusions:** Stakeholders identified that optimal management should be patient centred and incorporate adequate equipment, specific training for physiotherapists and a closely communicating multidisciplinary team. Research is needed to explore cost effective models of optimal rehabilitation that include return to sport strategies.

## KEYWORDS

anterior cruciate ligament, health resources, knee, physical therapy modalities, rehabilitation

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## 1 | INTRODUCTION

Rupture of the anterior cruciate ligament (ACL) is a common injury, especially in the active population (Moses et al., 2012). In the UK the incidence is estimated at 30 per 100,00 (Bollen, 2000). This study was focussed on rehabilitation after surgical reconstruction which is still the most common management strategy for a ruptured ACL (Anderson et al., 2016; Bollen, 2000; Spindler & Wright, 2008) with estimates as high as 75% choosing surgery (Swirtun et al., 2006). Recovery can be a lengthy physical and psychological process (C. L. Ardern et al., 2016) with an estimated 55% returning to the same pre-injury activity levels (Ardern et al., 2014; Grindem et al., 2016). The evidence on which treatments are effective for promoting functional recovery has evolved substantially in recent years. Passive strategies like bracing and continuous passive motion are no longer routinely advised, while strength and neuromuscular training, to enable control of the body in complex movements, have emerged as cornerstones of rehabilitation (Agre et al., 1987; Kruse et al., 2012; Lobb et al., 2012; van Melick et al., 2016; Wright et al., 2008a, 2008b).

Despite this knowledge and the availability of a number of published rehabilitation protocols to guide practice (Herrington et al., 2013; Myer et al., 2006), there is no UK consensus on management of ACL rehabilitation. As with many soft tissue surgeries, much may be left to clinician decision making which may be influenced by experience, local service priorities such as cost and staffing levels, and interpretation of the evidence. Research shows that effective rehabilitation depends on specific resources such as gym equipment, time with patients (per session and duration of care) as well as availability of specifically skilled clinicians (Dunphy et al., 2020). It is evident that lack of access to these components may contribute to significant variation in how ACL rehabilitation is delivered (Beard, 2017; Greenberg et al., 2018; Kapoor et al., 2004). While some variability in care arises from patients themselves who experience physiotherapy in different ways (Bernhardsson et al., 2017; MacDonald et al., 2013; Östlund et al., 2001) other factors worthy of exploration may be local culture, values and team structure in physiotherapy and orthopaedics (Côté et al., 2009; Nilsen & Bernhardsson, 2013; Scurlock-Evans et al., 2014). This study therefore focuses on the opinions of physiotherapists and orthopaedic surgeons to illuminate the 'grey information' which is information generated in clinical practice that is not commonly documented in the literature but may none the less be an important part of understanding factors affecting optimal ACL rehabilitation (Adams et al., 2016).

It has been suggested that variability in practice may contribute to suboptimal outcomes in this population (Fausett et al., 2022; Greenberg et al., 2018; von Aesch et al., 2016). This highlights the need to explore variability in current practice and to identify unwarranted variability as well as what participants consider to be optimal care. In this context 'optimal' refers to the most favourable

criteria for delivering rehabilitation, taking into account the needs of the patient, the evidence base and the capacity of the service. In the absence of published evidence on how rehabilitation after surgery for a ruptured ACL is delivered in the National Health Service (NHS), experts and experienced clinical staff are best placed to provide insights into current practice.

This study aimed to collate expert perspectives on ACL rehabilitation care in the UK, to identify variations in care, underlying factors and explore optimal care strategies. The objectives were:

- To explore current practice in ACL rehabilitation
- To understand orthopaedic surgeon and physiotherapist participants' views on the contextual factors that influence care, including barriers to, and facilitators of, optimal care
- To use these data to suggest a set of criteria for optimising rehabilitation after ACL surgery.

## 2 | METHODS

### 2.1 | Design

This was a qualitative semi-structured interview study. It took place in the National Health Service, which is a healthcare system in the UK designed to be free at the point of entry, as well as associated private clinics commissioned to provide care to NHS patients. The study was based on the ontology of critical realism, whereby known realities are weighed with a knowledge of how people interpret external realities through their own thoughts and feelings about them and synthesised to give the deepest level of understanding (Archer et al., 2017; Fletcher, 2017). The participants' experiences and opinions were considered in terms of their expertise in management of adult ACL post-operative rehabilitation and their many competing roles such as team leaders, clinicians and gatekeepers of professional ideals, aiming to identify a set of criteria to optimise care. It was reported in line with the Consolidated criteria for Reporting Qualitative research criteria (Tong et al., 2007).

### 2.2 | Patient and public involvement (PPI)

This research was designed under the advisement of the NIHR CLAHRC Patient and public Involvement (PPI) group. A data analysis PPI clinic was also conducted and participant's analysis was included in the findings.

### 2.3 | Eligibility criteria

Inclusion: Physiotherapists and surgeons with expertise in clinical management or research involving ACL patients.

Exclusion: Persons were excluded if they were unable to speak and read English or provide informed consent.

## 2.4 | Sampling

Purposive sampling was used to recruit participants with expertise in ACL management in the NHS, or seeing NHS patients in the private sector (Palinkas et al., 2015; Ritchie et al., 2013). Some participants were identified by their reputation where they had published relevant work or had a reputation through on line on-line content/blogging, others were identified through the National Ligament Registry (NLR) and a snowball method where one participant come recommend another, was used (Biernacki & Waldorf, 1981). Emails were sent that introduced the lead author and study concept briefly. Potential participants were followed up with phone calls if they hadn't responded to the email. Finally, to represent areas with different demographics, emails and phone calls were placed to Trusts not mentioned on the ligament registry. This was done by selecting from a map of NHS Trust areas and choosing areas that were not represented on the NLR. In total 45 individuals or departments were contacted. A signed Health Research Authority (HRA) consent document was obtained from each participant.

## 2.5 | Data collection

Interview questions were informed by systematic reviews in the field and clinical experience of authors. The topic guide was focussed on answering the objectives and was pilot tested twice and refined (Appendix 1). It covered the areas of current practice, barriers and facilitators of optimal care and supporting self-management.

Interviews were conducted in person, via skype or over the phone by the lead researcher (ED, physiotherapist). Although the phone and skype mediums had limitations, they were useful in overcoming geographical boundaries. The interviews were audio recorded on an encrypted dictaphone. The lead author kept a reflexive diary of each interview and analysis to inform consistency and rigour.

## 2.6 | Interviews

Interviews lasted approximately 40 min. Data saturation was discussed in the team after 21 interviews and agreed at 24. Details of participants are in Table 1. Given that the community of professionals in the UK who specialise in this field is small, we have elected not to include further identifiable data. Sixteen interviews were undertaken by phone, five face-to-face and three by video.

## 2.7 | Data analysis

Data were analysed using The Framework Analysis method as described by Gale et al. (Box 1) (Gale et al., 2013).

### Box 1. Steps of Framework Analysis (Gale et al., 2013)

- Step 1 - transcription.
- Step 2 - Familiarisation with the interview.
- Step 3 - Coding.
- Step 4 - Developing a working analytical framework.
- Step 5 - Applying the analytical framework.
- Step 6 - Charting the data into the framework matrix.
- Step7 - Interpreting the Data.

Transcription was undertaken by the lead researcher for five transcripts and the remainder of the interviews were transcribed by an approved professional transcription service. Familiarisation was done through field notes and memos created when replaying audio files of interviews. Data were coded using the NVIVO software package to organise and analyse data (QSR International Pty Ltd. (2015) NVivo 11 (released in 2015)). The lead researcher (ED) coded the manuscripts to identify themes and synthesise data. A co-author (KB) independently reviewed the data and a sample of coding was checked by three independent qualitative researchers. The analytical framework was developed based on the ACL evidence base. Inductive and deductive reasoning was used to code data to the appropriate theme and give depth to the framework. The process was still thematic and allowed for the inclusion of a more inductive process where ideas that emerge from the data can be added to the framework if not already included. Codes, acategories and themes were reviewed within the research team and discussed with two PPI representatives. We interrogated the key concepts and looked to understand relationships in the data and potential causality.

## 3 | FINDINGS

### 3.1 | Themes

Anterior cruciate ligament rehabilitation was perceived to vary significantly across the UK (Figure 1). Based on their experience participants described a location 'lottery' for patients that notably affected the care they received. Most clinicians were confident that they provided quality care; however, they identified challenges to delivering what they believed to be optimal care. These challenges included insufficient time with patients, inadequate availability of equipment, a poorly communicating multidisciplinary team (MDT) or

TABLE 1 Participant characteristics.

Participant ID	Job role	Employer(s)	Experience	Location
1 PM	P and MTL	NHS + Private	Research + Clinical	Large metro area
2 PM	P and MTL	NHS	Clinical	Small metro area
3P	P	NHS	Clinical	Large metro area
4P	P	NHS + Private + Sport	Clinical	Town/Rural
5P	P	NHS + Private	Clinical	Small metro area
6 PM	P and MTL	Private + Sport	Clinical	Small metro area
7S	S	NHS + Private + Sport	Research + Clinical	Large metro area
8P	P	NHS + Private + Sport + Military	Clinical	Town/Rural
9P	P	NHS	Research + Clinical	Small metro area
10P	P	Private Provider + Sport	Clinical	Town/Rural
11SM	S and MTL	NHS + Private	Research + Clinical	Large metro area
12 PM	P and MTL	NHS AQP	Clinical	Town/Rural
13S	S	NHS + Private	Research + Clinical	Large metro area
14S	S	NHS + Private	Research + Clinical	Large metro area
15 PM	P and MTL	Private + Sport	Clinical	Large metro area
16S	S	NHS + Private + Sport	Research + Clinical	Large metro area
17 PM	P and MTL	Private	Clinical	Large metro area
18P	P	NHS	Clinical	Town/Rural
19 PM	P and MTL	NHS AQP	Clinical	Small metro area
20 PM	P and MTL	NHS + Private + Sport	Research + Clinical	Small metro area
21P	P	NHS	Research + Clinical	Small metro area
22 PM	P and MTL	NHS + Private	Research + Clinical	Town/Rural
23P	P	NHS + Sport	Clinical	Large metro area
24 PM	P and MTL	NHS	Research + Clinical	Small metro area

Abbreviations: AQP = Any Qualified Provider, (>750,000 = large metropolitan, >100,000 = small metro, <200,000 = town/rural), MTL = manager/team lead, NHS = National Health Service, P = physiotherapist, S = surgeon.

lack of specific expertise in ACL rehabilitation (Box 2). Discussion centred on ways to manage these challenges and optimise ACL rehabilitation care.

### Box 2. Themes

- Pathways of rehabilitation – current practice.
- Optimal Care Evidence-based practice Patient-centred practice.
  - Unwanted variation.
  - Supporting self-management.
  - Rehabilitation Facilities /Equipment.
  - Multidisciplinary teamwork.
  - Training in advanced rehabilitation skills.

### 3.1.1 | Pathways of rehabilitation

The participants were asked to describe their current practice and pathways of care in their locale to satisfy objective 1. Their experiences showed that there were multiple pathways into ACL rehabilitation and that there were a variety of local norms regarding time available/scheduled with a physiotherapist (Figure 1). Some pathways were dedicated to ACL rehabilitation where other ACL patients were managed in groups of patients with a range of conditions (Figure 1).

### 3.1.2 | Optimal care—Evidence-based practice

Most participants felt their service was driven by evidence-based practice, validated outcome measures and clinical audit. They frequently cited research guidelines and were knowledgeable on the depth of literature for standards and outcomes.

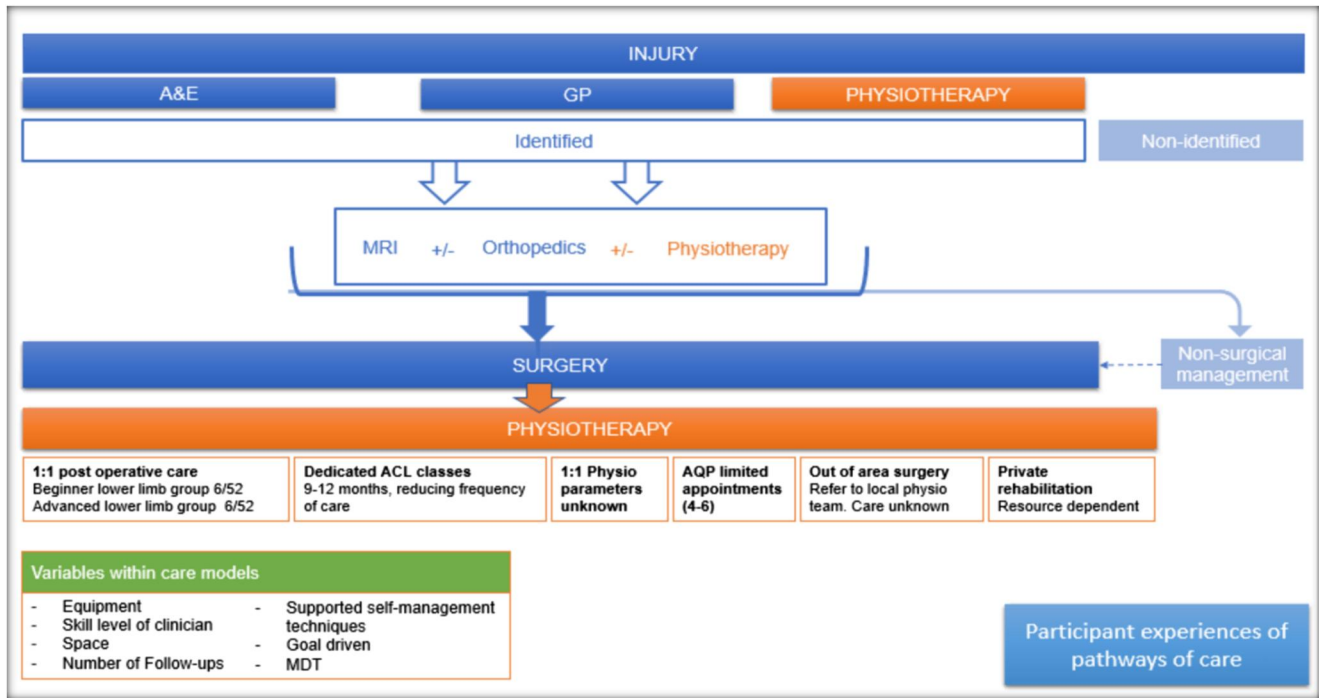


FIGURE 1 Participant experiences of pathways of care

Something like the Core Outcome Measures in Effectiveness Trials guidelines will define success in quite a specific way. We've got the patient-reported (outcomes), we've got function, we've got strength, we've got instability etc. I think we do have guidelines to help guide us as to what criteria we might want to put together in test battery in order to determine success. 22 PM.

They also expressed a knowledge of the limitations of the evidence base, which is sometimes criticised for poor quality or unclear reporting.

You very rarely see any data in the paper on how many times the patient attended, for instance, and what their compliance was with the home programme. 21P.

The literature has demonstrated efficacy of a criteria-based progression, where progress is based on individual ability, rather than time since surgery. The former approach is safer and encourages engagement with rehabilitation at each stage. Clinicians and managers described that criteria-based progression can present challenges for service planning with some patients taking much longer than others to reach goals. Some clinics appear to blend the two strategies while others undoubtedly retained the time-based approach to care which troubled one participant.

You've had your six classes in the intermediate class. You're moved on to the advanced. Sometimes they will

struggle, have problems. Maybe not have achieved their goals. They've got to get the basics or the fundamentals so they're achieving full extension or a good range of movement in flexion, improving muscle control. Whereas they're just moved on very quickly. 24 PM.

In cases where patients are progressed according to time without an individual assessment, deficits are masked which could lead to pain, reduced function and satisfaction with the knee.

The problem of not measuring ... clinics will invest in electrotherapy but not have any way to measure strength. Leg extension etc. There was some person come in and she was doing loads of stuff ... because she was at 6 months. She was doing all this stuff because that was the marker where she should have been at. There was a 40% deficit in her quads! She was doing loads of jumping and running and turning and stuff and she wasn't able to cope with it. She had lots of anterior knee pain. 1 PM.

### 3.1.3 | Patient-centred practice in rehabilitation

Patient-centred practice (PCP) was seen as an essential components of good quality care. Patient-centred practice included individualised goal setting, assessment and rehabilitation. Clinicians highlighted the heterogeneity of the patient group despite their seeming similarities.

One physiotherapist broke down some of the criteria he considers with each individual.

What type and what level of sport they are trying to get back to, if that's what they're getting back to at all, their level of physical functioning prior to injury and their exercise history, as it were, or experience, and the extent of concurrent injuries and things like that. 3P.

The majority of physiotherapy participants managed ACL patients in an exercise class environment for at least some portion of their care. Classes were thought to be clinically and cost effective but both orthopaedic and physiotherapist participants felt that ensuring patient-centred care could be a challenge. Sufficient time and staff numbers to ensure individual patient reviews within this context were considered important.

Nothing bugs me more. I know I give patients protocols as a broad outline, but if they're then given a very standard, printed-out sheet that is not in any way criteria-based, that bugs me a bit because patients can be enormously different. 16S.

I feel all too often in this country with any of our rehabilitations for lower limb, the main patient complaint that I hear is that, We're just simply given a sheet of paper and told to go away. 21P.

Clinicians who worked in private and NHS settings, commented that due to funding and resource constraints affecting duration and frequency of follow up, it was not as easy to be patient-centred in the NHS.

I think the important thing, alongside that, is to try to individualise it to the patient. Again, I think I've got far more scope to do that in a private practice model than we might have in the NHS setting. 22 PM.

Without appropriate assessment, review and progression, problems are known to occur. A physiotherapist who worked in an orthopaedic follow-up clinic described encountering patients who have not been given individualised care but left 'drifting'.

They haven't seen a physio for 6 months, they've been drifting in classes. That to me is a failure of those patients. If those patients went through more of a structured service, more of a streamlined service that would target a lot of those issues. Potentially that is a cost saving and a success for the surgery and a success for the patient getting back to what they want to be doing. 24 PM.

### 3.1.4 | Unwanted variation

A recurring theme was the idea that the quality of care received by patients depended on where they lived. Resources for rehabilitation differed both between and within trusts. A phenomenon described in several areas of the country was that in one trust, several sites can pick up patients after surgery from the same hospital. Some of these were spacious and well-resourced while others were cubicles or small rooms in primary care sites. Patients were distributed according to address rather than suitability.

"we've got one which is a very small cottage hospital ... They haven't got the space, they haven't got the facilities or the equipment. So, they are trying to make the best of a bad job with the facilities they've got really. On the flip side, in \*\*\*\*\*, you've got two very big gyms, very well equipped. 24 PM.

One participant described that they were picking up patients from out of area because they were rumoured to be the only one in the area with the resources for rehabilitation. This participant was concerned that this could stress their resources even further. They

Technology mentioned by participant	Function
Physiotec	Exercise Prescription Software
Technogym	Exercise Prescription Software
Simpleset	Exercise Prescription Software
Physiotools	Exercise Prescription Software
TRAK	Education. Exercise Prescription Software, BCTs
Hudl/Ubersense	Video analysis software
My recovery	General advice and general exercise
YouTube Pages	General advice and exercises
Gurus on FB or YouTube	Advice and general exercise
Rehab My Patient	Exercise Prescription Software

TABLE 2 Digital tools of supported self-management

Abbreviation: TRAK = Taxonomy for the Rehabilitation of Knee Conditions.

suggested there was a need for a greater standardisation to improve care across the board.

We certainly don't want the \*\*\*\*\* (hospitals) either side to think that we think we're better ... It's a pain for the patient to travel that extra distance and we haven't got the extra capacity. If we're doing well, it's others that need to come into line. 2 PM.

### 3.1.5 | Supporting self-management

Participants often addressed the need to engage and educate their patients as part of optimal care. They discussed using a variety of approaches to support the patients to retain information and improve self-management. Both surgeons and physiotherapists discussed the use of technology as part of standard care. They highlighted the benefit of using online strategies to educate patients, to encourage exercise performance and to engage and motivate patients. While some physios mentioned a preference for drawing exercises or taking photos of the patients doing their exercises, there were a significant number of exercise websites mentioned as tools of supported self-management (Table 2).

Physiotherapists identified the role of digital tools to empower patients. They discussed supporting patients to improve their self-management and be more independent with exercise. One participant highlighted how a website can take the patients rehabilitation forward even when the physiotherapy environment has reached its limit.

Websites and apps can go beyond what the clinic and the clinician can offer in person. For example, if the clinician doesn't have a gym or much rehabilitation equipment, but the patient has athletic goals, then the website can facilitate the advanced learning. 21P.

### 3.1.6 | Rehabilitation facilities/equipment

Participants were clear that gym facilities were an essential requirement for effective rehabilitation of patients. Equipment was needed to meet the evidence-based guidance for loading, neuromuscular control exercise and batteries of functional outcomes. When probed about evidence behind the need for gym equipment, physiotherapists and surgeons referred to principles of strengthening and rehabilitation. Physiotherapists also referred to breaking down sports-specific tasks into gym-based drills to practice complex movement patterns.

If you don't have so much as a leg extension machine or a leg press, how are you really going to test the

strength of a top athlete? How are you going to know? If somebody can squat, let's say they can leg press 100 kilos on one leg and 85 on the other, they're huge numbers. You're not going to pick that up if you're just testing them in single leg squats. 4P.

Clinicians describe being frustrated by the gap between the evidence-based guidance for ACL management and the lack of facilities to deliver the care they believe in.

I do feel we're somewhat limited. If I was to go from using function-based rehabilitation again, you know using literature and good evidence-based practice, there's certainly a stage I'm going to get to in my rehab and say, "Right," I wouldn't tell the patient but ideally, I'd be doing x, y and z right now but I just physically can't because I've just not got the facilities to do that. 10P.

One clinician stated that the resources she wanted to have to improve care were highly unlikely to be made available due to lack of finance.

"I think, ultimately, yes, what we'd like is a little bit more sophisticated equipment. So from that perspective, we're in a gym that looks like it's from the 1970s... obviously, you just haven't got a cat in hell's chance of getting anything like that here". 18P.

### 3.1.7 | MDT working

A dominant theme in interviews was the importance of the relationship between the surgeons and the physiotherapists who manage ACL patients. Surgeons highlighted the need to know and trust their physiotherapy team. Physiotherapists reflected that roles where they collaborated closely with their orthopaedic colleagues led to better patient care. Both groups reflected on communication improvements in recent years and the importance of this relationship to good care.

I think it's impossible to actually do a good job if you're not able to collaborate with the physio. It's simple, I mean I just don't think, without a joined up pathway is, I think people get lost. 7S.

I think we seem to be getting on better with orthopaedics than we ever have. I think our stock is at the highest it's been for a long time with ortho. 2 PM.

Physiotherapists working in orthopaedic clinics were a notable phenomenon in the NHS and these clinics were seen by participants as key to improved knowledge, communication and respect. This improved way of working was seen as hugely positive by participants who were involved.

So what I've done in my NHS practice, so I actually have now an Extended Scope Practitioner who works with me in clinic who basically sees patients in clinic as a normal member of staff, but is a sort of link into the physio department. So I have a very close relationship with the NHS, with the physio department, and that works very, very well. 7S.

Yes. That's probably improved a lot more over the past couple of years. We now have a physio that works in clinic for a short period of time. We've got some new, keen consultants that we've built some good links with... So we do have that clear pathway back to them, if we're having any problems. 18P.

### 3.1.8 | Training in advanced rehabilitation skills

Physiotherapy participants highlighted the importance of skilled clinicians and the need to train and supervise staff who may only take on ACL patients for a short time. They also described beliefs and preferences in their teams that influence how rehabilitation is delivered across the service. Participants identified that advanced rehabilitation skills are not a priority in all services and local culture may influence whether or not physiotherapists are trained to deliver advanced rehabilitation.

Clinical staff often move through different roles every 6–9 months, known as rotations. Clinicians were sympathetic to the learning needs of 'rotational' junior staff but reflected on the implications for the patients.

Are we expecting band five and sixes to just know? I know I was a band five, expected to just rehabilitate someone back to sports, which is not really... is that acceptable really? Is that fair to the patients? 10P.

One participant discussed a cultural shift, where he noted some junior physiotherapists identified more strongly with their role as discharge planners than having responsibility for advanced rehabilitation, regardless of patient goals.

It's that sort of end stage stuff, isn't it? And I think there is a bit of controversy about where the NHS starts and stops with that. Certainly our juniors, it's really interesting when they come in as newbies and they say, "I think I should stop now," and you say, "But the patient hasn't achieved what they came here to do. Why are you stopping?" And then they're like, "That's not my role." 24 PM.

Another participant explained that he already employs sports therapists to deliver rehabilitation for NHS ACL patients. The participant explained that sports therapists were trained in advanced rehabilitation concepts and he suggested that for many physiotherapists, they did not consider this part of their role.

I think also, there are not many trained strength and conditioning physios around. It's a bit more of a new movement to consider strength and conditioning within physio. 12 PM.

For other physiotherapists, exercise prescription and rehabilitation are seen as the most fundamental skills of physiotherapy. Some participants argued that in a time when evidence for effectiveness of other modalities has changed practice, exercise therapy and rehabilitation are cornerstones of the profession.

It was always important, movement and things, but now...your ability to assess and prescribe exercise is, potentially, more important than your ability to do manual therapies, or other complementary side of things, I'm not sure that that's always been there. 3P.

In fact, I've been, anecdotally, with my colleagues now, saying for years that if we paid as much attention into how we assess and prescribed exercise, as to how many forces and angles and neurophysiological effects and that, that we pay to manual therapy in such a way, I think that our profession would be in a better state. 19 PM.

## 4 | DISCUSSION

### 4.1 | Principal findings

Participants shared a broad agreement about the principles that should underpin optimal care in ACL rehabilitation. The patient should be at the heart of care. Communication between physiotherapists and orthopaedics is vital. Adequate resourcing of care substantially impacts ability to deliver evidence-based practice.

Evidence-based management strategies required proper resourcing for positive outcomes and the prevention of long term sequelae and further injury risk (Ardern, 2015; Button et al., 2006; Culvenor et al., 2016; Frobell, 2012; Frobell et al., 2015). Within clinical teams an uncomfortable relationship was suggested between pressure to discharge patients from care and a lack of knowledge of advanced rehabilitation. Where resources and knowledge are lacking, participants have identified a culture of early discharge without responsibility for return to sport goals. Although the management of capacity and demand is delicate, the relationship between these contextual factors may prove key in identifying services with operational barriers to optimal rehabilitation.



A previously unidentified contextual factor was the challenge and frustration that clinicians express when reconciling their roles as professional gatekeepers of orthopaedic and physiotherapy specialities with their role as leaders in a cost conscious health care environment. Participants' experiences depict that some are troubled by the perceived schism from the long held principle of patient-centred goals and evidence-based practice. Local health policy and clinical resources were implicated as a causal mechanism for services that felt limited in their ability to deliver evidence-based practice. One participant summarised that the progressive defunding of local services caused him to question how physiotherapy care is now valued in his Trust. Though this account might not be unique to ACL rehabilitation, it was a noteworthy reflection on the experience of progressive defunding.

The relationships between orthopaedics and physiotherapy was seen to be at an all-time high, due to extended scope roles and physiotherapists often working in orthopaedics clinics. Participants highlighted this as a critical factor in the provision of good care and sited the combined clinics as the ideal environment to foster teamwork.

## 4.2 | How this research fits with and builds on previous literature

Other studies that focussed on clinician opinion of ACL management identified similar findings of variation in care and inconsistent application of the evidence (Fausett et al., 2022; McRae et al., 2011), as well as the importance of joined up physiotherapy-orthopaedic care and ambiguity around return to sport rehabilitation (von Aesch et al., 2016). This study uniquely explores the extent of variety in care models and how clinical staff identify and work to reconcile the gap between guidelines for ACL rehabilitation and essential resources such as time, equipment and adequately trained staff. This 'grey information' (Adams et al., 2016) is rarely reported in ACL clinical trials and descriptions of interventions but it is fundamental to understanding how rehabilitation practice is conducted in the real world.

The principles of biopsychosocial and PCP are well established. Putting the patient and their goals at the heart of care (Weston, 2005; World Health Organization, 2001). Previous surveys of clinical opinion on ACL management also emphasised the importance of biopsychosocial patient-centred care (Fausett et al., 2022; von Aesch et al., 2016), however this UK-based study explored the challenges associated with reconciling PCP with limited resources. In some cases, the long term implications of resource management appeared to have created a cultural shift within physiotherapy teams where resource management is prioritised over evidence-based later-stage rehabilitation and patient-centred care. The move to earlier discharge and patient self-management is not well understood or well described in the literature and requires further research to be better understood.

The evidence-based approach to ACL care is criteria-based progression through phases of care that align with biological and

functional recovery (Adams et al., 2012; Grindem et al., 2016; Kruse et al., 2012; Myer et al., 2006; van Melick et al., 2016). Other qualitative and survey studies show that variation and inconsistency are common in ACL rehabilitation management and may be contributing to suboptimal outcomes (Fausett et al., 2022; McRae et al., 2011; von Aesch et al., 2016). This study was the first to show that adherence to evidence-based practice was just a part of what constitutes optimal care. Clinicians identified the need for adequate gym equipment and depth of rehabilitation knowledge to deliver ACL rehabilitation. Consistent application of the guidelines requires these resources. The correlation between strength, motor control and positive outcomes were cited by participants as justification (Grindem et al., 2016; van Melick et al., 2016) as well as the need to monitor and measure progress towards known criteria (Lynch et al., 2015). It was known that those who pass return-to-sport criteria significantly reduce the risk of re-injury to the graft (Kyritsis et al., 2016; Paterno et al., 2012; Webster & Hewett, 2019); but testing return-to-sport criteria requires strength equipment and other modalities for physical outcomes (Clare L Ardern et al., 2016; Lynch et al., 2015). This illustrated the importance of availability of resources as a tool of assessment and monitoring against known criteria for progression in ACL care.

Participants also discussed supporting patient self-management as part of optimising care, by using technology for patient education and advice, for exercise technique, instructions and for recording outcome measures. Evidence shows other rehabilitation models where digital has been used as an alternative to access 'hard to reach' populations or offer a cost effective alternative to face to face follow ups (Chughtai et al., 2019; Farmer et al., 2017; Ottaviano et al., 2011). In trusts where face-to-face or personalised care was significantly limited due to resources, integrated use of digital health tools could go some way to supporting the patients to access the best evidence and information and to self-manage. Although much of the technology discussed in this study was used in ad hoc way rather than integrated fully into the care plan.

In line with previous research, participants clearly valued a multidisciplinary approach to orthopaedic rehabilitation (Momsen et al., 2012; Speerin et al., 2014) and emphasized the risks associated with poor MDT co-operation (von Aesch et al., 2016). Both participant groups lauded the experiences of physiotherapists working in orthopaedic clinics for improving communication and patient care. This was supported by evidence that hospitals where physiotherapists work collaboratively in orthopaedic clinics were not only cost effective but had improved inter-professional understanding (Comans et al., 2014; Hattam, 2004). Leonard et al. discussed that effective communication was fundamental to high quality care and to patient safety (Leonard et al., 2004).

## 4.3 | Strengths and limitations

The strength of this study is that qualitative interview methodology allows the exploration of critical issues that are affecting ACL care in order to explore the phenomena that may be causal. By purposively

targeting clinical leads, experts and researchers around the country, the interview methodology facilitates a wide-ranging exploration of the factors that are influencing the variations in care. The use of snowball sampling methodology as part of this study, regarding recruiting orthopaedic surgeons, has potentially biased the sample. The surgeons that recommended one another may hold similar professional values and attitudes.

## 5 | CONCLUSIONS - IMPLICATIONS FOR CLINICAL PRACTICE, POLICY AND RESEARCH

### 5.1 | Implications for clinical practice and policy

Local strategies to ensure appropriate training and adequate rehabilitation equipment are needed in services that manage patients after ACL surgery. Clinics that are treating patients without this, may be apt to advise patients of the limits of their care environment and suggest alternatives including digital tools. A cooperating and well communicating MDT was strongly emphasised. Physiotherapist roles in orthopaedic clinics are noted to be particularly favoured by participants in fostering teamwork and communication, towards higher quality care. Research is needed to explore cost effective models of rehabilitation that include return to sport strategies.

#### AUTHOR CONTRIBUTIONS

All authors, Emma Dunphy, Fiona L. Hamilton, Kate Button and Elizabeth Murray have contributed meaningfully to each of the following. Have made substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data; Been involved in draughting the manuscript or revising it critically for important intellectual content; Given final approval of the version to be published. Each author should have participated sufficiently in the work to take public responsibility for appropriate portions of the content; and Agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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#### CONFLICT OF INTEREST

The authors declare that there is no conflict of interest that could be perceived as prejudicing the impartiality of the research reported.

#### DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

#### ETHICS STATEMENT

HRA approval was obtained on 10<sup>th</sup> of October 2017. Integrated Research Application System project ID: 227964.

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## Appendix

### Topic Guide

**Toward criteria for optimal management of Anterior Cruciate Ligament rehabilitation programmes** A qualitative study of key stakeholder opinion

1. About how many ACL patients does your service see?
2. What is your ACL rehabilitation service like? Pathway
3. Does it have a structure? (stages, goals, criteria)
4. How do patients come to your service? Via ortho/ via gp/via a&e
5. How soon post operatively do you see patients?
6. Do you follow a protocol
7. Can you say how often patients are seen? How long are patients seen over months? How long per individual session?
8. What influences that answer?
9. Do you have an opinion on the skill level of clinicians who run classes? What is the skill level required?
10. Do you think access to facilities matters? Do you have a budget for equipment?
11. Do you see rehabilitation changing in line with financial pressures in the current NHS climate?