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## **Abstract**

*Objectives:* To elicit healthcare practitioners' views on treatment following sport-related knee injury in young adults (18-35) and the potential for individuals to self-manage joint health.

*Design:* Semi-structured interviews were audio-recorded, transcribed and analysed systematically using an inductive approach.

*Setting:* South West UK.

*Participants:* Twelve healthcare practitioners with experience of treating young adults.

*Main outcome measures:* Understanding how healthcare practitioners treat young adults following knee injury and to what extent individuals may be able to self-manage knee health.

*Results:* Participants' perceptions were encapsulated in three consistent themes: [1] Treating patients; [2] Maintaining physical activity; and [3] Education and support. All participants described how staying physically active and maintaining a healthy weight were integral to conserving knee health, and that post-injury education was necessary to "empower" patients to self-manage knee health. A need for greater access to support, advice and guidance for patients was also articulated.

*Conclusions:* Healthcare practitioners should tailor their treatment to young adults to account for individual characteristics, aspirations for sport and exercise participation, and their emotional wellbeing. Fulfilment of individuals' educational and supportive needs is key to the establishment of self-management behaviours that may help to conserve knee health.

*Keywords:* *knee injury, knee osteoarthritis, osteoarthritis treatment, health self-management*

## **Highlights**

- Knee health post-injury may be contingent upon tailored treatment that fulfils patients' informational and supportive needs.
- Our findings support the need for self-management strategies and techniques to address knee health following injury.
- Digital technology could supplement healthcare to enable users to conserve knee health and improve quality of life.

## **Background**

Osteoarthritis (OA) is the most common joint disease worldwide, and is a leading cause of chronic pain and disability(11). Between 1990 and 2010 there was a 64 percent increase in years lived with disability attributed to OA(28), making it the fastest growing cause of disability globally(6). OA is linked with high comorbidity rates (e.g., obesity and heart disease) and affects approximately 8.75 million people in the UK(1). Knee OA, which contributes 83 percent of the OA burden(28), is multifactorial with the two most established etiological factors being previous joint injury and obesity(19). Although knee OA has been the subject of significant research interest, most of this has focused on older adults who are highly symptomatic and/or eligible for total joint replacement. Joint replacement is an effective treatment for symptomatic end-stage disease, but functional outcomes can be poor and the lifespan of prostheses is limited(11). Therefore, disease prevention and the treatment of early OA should be prioritised.

Amongst younger adults, sport-related knee injury is associated with an increased risk of post-traumatic osteoarthritis (PTOA) – a type of osteoarthritis (OA) affecting young people with a history of joint injury. There is evidence that three to ten years following knee injury, individuals as young as 15 to 26 years old have a 3.8-fold increased risk of being overweight or obese, a 2.1-fold increased risk of being less physically active and an 8.5-fold increased risk of MRI-defined OA compared to their uninjured peers(31). Currently there are no disease modifying treatments for PTOA and prevailing management is to passively await final ‘joint death’, necessitating joint replacement (end-stage treatment). This means that individuals with early onset PTOA, whilst awaiting medical intervention, typically experience declining quality of life, comorbid health conditions, and symptoms that will place a chronic burden on health services across their lifespan(6). To highlight, 4.7 million people in the UK over the age of 45 have sought treatment for OA and between 1990-2010 disability due to OA increased by 16 percent. It is estimated that the annual direct cost to the National Health Service (NHS) is £5.2 billion(7), and the overall burden of OA is expected to increase as the population ages. OA is also the leading cause of absence from work, costing the UK economy more than £18 billion annually(6). Therefore, identifying appropriate early interventions for

young people with / at risk of PTOA is an important goal, both for maintaining individual health and wellbeing, and for minimising socioeconomic cost and a rapidly growing demand on limited healthcare resources.

Physiotherapists and other healthcare practitioners in the field may assist in secondary prevention of PTOA by promoting physical activity, addressing knee confidence, and educating at-risk individuals about long-term joint health. However, there is currently a lack of consensus around long-term self-management strategies for young adults following knee injury. Whilst there is evidence to support the benefits of education, exercise, lifestyle physical activity, and weight management, as well as evidence-based techniques such as increasing joint range of motion with manual therapy and biomechanical interventions such as braces(10)(30), recommendations for the ongoing self-management of knee health following injury rehabilitation are seldom given by healthcare practitioners(16). Therefore, research is needed regarding the guidance that should be given to young adults to conserve their knee health following injury, including strategies and techniques for improving function and managing symptoms. This guidance should be balanced, taking account of the need for positive messages about physical activity to maintain joint health, whilst acknowledging the risks of developing or exacerbating symptomatic PTOA. In addition, more research is needed to understand how self-care could augment frontline care provision, thereby reducing the burden on services and / or increasing the efficacy of treatment.

The aim of this study was to investigate healthcare practitioners' experiences of treating young adults following knee injury and to explore opportunities for self-management of joint health to reduce the risk of PTOA development (or delay disease progression). These insights will inform the development of interventions that address the informational and treatment needs of young adults following acute knee injury, ensuring that they promote appropriate symptom self-management and signpost users to the type of care they need, when they need it (thereby improving patient outcomes and health service burden).

## **Methods**

Ethical approval for the study was given by the authors' Research Ethics Approval Committee for Health (Reference Number: EP 18/19 024). Written consent was obtained from all participants prior to interviews.

### ***Participants***

Physiotherapists and other healthcare practitioners were recruited using a purposive sampling strategy based upon inclusion of participants with a variety of different experiences, knowledge and demographics. Potential participants were invited to take part if they were accredited practitioners with experience of treating young adults following knee injury. To ensure that our sample reflected real world settings, participants represented a variety of healthcare practitioners with different levels of expertise in treating this population. A maximum variation sample was recruited using a combination of purposive, convenience, and snowballing techniques(20). It was anticipated that between ten and 15 participants would give a sufficient range of experiences and depth of data to reach data saturation(13, 17). A convenience sample of healthcare practitioners were contacted for potential involvement and advertisements were placed in local healthcare establishments. An email was sent to respondents with information about the study and interviews were arranged with those who agreed to take part. Recruitment and interviewing continued until data saturation was reached and no new themes emerged. Each participant who gave their consent to take part in the study was assigned a unique reference number (e.g., HCP001).

### ***Semi-structured interviews***

Semi-structured one-to-one interviews were conducted by the lead researcher (RW). These interviews focussed on participants' experiences of treating young adults aged 18-35 following intra-articular knee injury. A topic guide (Appendix 1) was used to guide the interview process and steer the dialogue. The questions were designed to be flexible, open-ended and broad, while focussed on the topic in order to elicit rich responses from participants(5). Participants were free to say as much as they wished. Memos were taken during the interview process to enable the author to determine

characteristics of participants, which provided further insight into potential themes(5). All interviews lasted between 30 minutes and one hour.

### **Data analysis**

The interviews were audio recorded and transcribed verbatim to facilitate analysis. Interview data were analysed using inductive Thematic Analysis, a process guided by the methods suggested by Braun and Clarke(3, 4). The focus of the analysis was to organise the data in a meaningful way according to the *a priori* aims of the study, as well as to allow for the identification of topics and issues of importance to participants. NVivo (QSR International; Version 12 Pro) was used to help organise, code and explore the data. To ensure reliability, two researchers (RW,GY) first familiarised themselves with the transcripts, then independently coded all of the transcripts, compared analyses, and resolved any differences through discussion. Following this, the lead researcher (RW), with over five years' experience of health services research, organised the coded data into themes, which were reviewed by a second researcher (GY), a research-focussed Sports' Therapist. The themes, their names and explanations were continually refined through discussion between the researchers to ensure that they were distinct from other themes, internally coherent and consistently applied. The process of thematic development was aided by a process of peer debriefing whereby deduced themes were discussed amongst all of the authors to ensure trustworthiness of the analysis. To ensure that potential biases did not occur on the part of the lead researcher, a research diary was also kept. This enabled a reflexive approach to data collection and analysis, and provided insight which in turn helped to inform data analysis(15). This study is reported in accordance with consolidated criteria for reporting qualitative research COREQ(25).

### **Results**

Seven female and five male healthcare practitioners were recruited to take part in interviews. Six of the participants were Physiotherapists, two were Sports Psychologists, two were Strength and Conditioning Coaches, one was a General Practitioner (GP), and one was a Consultant Knee Surgeon. All of the participants had at least five years' post-qualification experience, ranging

from five years to 34 years' experience in their profession. The Physiotherapists, GP, and Consultant Knee Surgeon had all worked in both public and private healthcare, and all of the participants had worked in the UK for most of their career. Participants gave nuanced accounts of their experiences of treating young adults following a sport-related knee injury and discussed a range of issues encountered during the treatment process. Discussions focussed primarily on treatment related to acute need injury, with frequent reference to treating patients following anterior cruciate ligament (ACL) rupture. Three themes emerged from the analysis pertaining to these experiences: [1] Treating patients; [2] Maintaining physical activity; and [3] Education and support. Each theme included sub-themes which are presented with illustrative data extracts (see Table 1). The first theme was *treating patients*, in which participants discussed the importance of individualising treatment, managing patient expectations, and addressing the emotional impact of injury and knee confidence issues. Theme 2, *maintaining physical activity*, centred on exercise adherence during rehabilitation, returning to sport, and changing sport to stay active. Theme 3, *education and support*, captured the importance of education around knee injury and empowering individuals to self-manage their knee health. Anonymised participant quotes were used to illustrate themes.

**Table 1.** List of themes and sub-themes

*Theme 1. Treating patients*

**“From elite sport people to weekend warrior-type people”**

There was a recognition amongst participants that everybody is different and that this should be reflected in their treatment following knee injury. For instance, it was acknowledged that patients come from different sporting backgrounds “*from elite sport people to weekend warrior-type people*”, and they have different drivers for addressing their knee health: “*people need managing completely differently ... taking a more holistic approach to them and their lifestyle, and what they can fit in and what they want to achieve*” (HCP005). This holistic approach included accounting for individual characteristics such as age, which could affect rehabilitation time, baseline strength and



cardiovascular fitness, to inform rehabilitation load as well as the potential for lifestyle factors, such as occupation, to impact knee health:

*“He’s an office worker: there are things that we’ve discussed like not sitting for long periods of time, getting up and moving around frequently, and we’ve discussed the whole physiology about what happens with the knee and how we need to keep it strong.”* (HCP008)

Some participants described the more nuanced role that lifestyle factors could play in recovery and knee-related health, with inactivity rather than activity having a mediating effect on symptoms:

*“They could be consistently running 5K every day and have never had a problem and then suddenly then become more inactive in the day because they have work commitments or they’ve been travelling a lot – so helping to recognise if other aspects of their lifestyle could be affecting the knee (rather than the running).”* (HCP001)

In addition to physical factors, participants alluded to the role of psychosocial processes in rehabilitation and recovery, asserting that *“understanding what makes people feel good, or feel confident, is really important and should be the focus of what you try to deliver”* (HCP002). In relation to this, it was suggested that tailored treatment should be sport-specific: *“what everybody should have, is they should have physiotherapy and rehabilitation which gets them back to sport-specific exercise. So, if you are a Saturday tennis player, your rehab should include getting you onto a tennis court and rehabbing you such that you can play tennis”* (HCP009).

Finally, participants recognised the need to tailor their messaging to individuals. For example, when discussing prognosis, it was suggested that patient age was often directly related to a more conservative attitude towards health: *“Some people are at that kind of age where they think they’re invincible and they have always recovered well from injury – so they don’t identify with a longer-term prognosis. Older people are a bit more health conscious and health aware and have more of a sense of preservation”* (HCP008). Thus, rehabilitation goals might be framed around return to sport in younger patients and long-term knee health amongst older cohorts. However, there was

general consensus that practitioners should positively engage patients with simple messaging rather than focusing on the adverse consequences of not adhering to a rehabilitation programme, or the risks of re-injury.

**“You have to reassure them that things are ok”**

Healthcare practitioners discussed the challenge of managing patient expectations, for whom the prospect of prolonged rehabilitation was often unexpected: *“they just don’t understand that a year of their life is going to be absolutely dedicated to their knee and their rehab, and the massive amount of time and just the impact on their life it’s going to be is quite a surprise to them”* (HCP010). The process of rehabilitation was exacerbated by the uncertainty surrounding recovery time, returning to sport, and longer-term knee health: *“I can think of one example of an athlete post-ACL reconstruction who was having niggles and thinking ‘I was told, eight-12 months turn around, so why am I still having problems?’ – so there is the lingering uncertainty”* (HCP002). Moreover, Physiotherapist participants felt that the responsibility of managing expectations rested with them primarily: *“GP’s tend not to give much detail, matter-of-fact and skeleton detail, and then it’s up to the physios to fill in the steps in-between, and then manage the expectations if recovery milestones are not reached”* (HCP001).

All participants recognised the emotional impact that injury could have on their patients, impacting patients’ athletic identity, as well as their broader sense of wellbeing. It was asserted that some patients lament their time out of sport: *“there are some people who it hits really like a loss – so they’ll go through a grieving process with it”* (HCP001), whilst others perceive their sport as central to their wellbeing: *“some people will use their sport as a way to improve their mood and mental health, or as a coping strategy for stress, anxiety and depression”* (HCP011). Thus, some practitioners considered their role to extend beyond physical rehabilitation to identifying coping strategies that could help their patients enhance their emotional wellbeing. For example, by encouraging their patients to remain socially involved in their sport, or by suggesting alternative ways in which patients could engage in competitive activity.

Participants also reported the need to address the issue of knee confidence in young adults following injury, which was widely seen as a psychological barrier to returning to sport. Knee confidence issues often persisted beyond the point of rehabilitation, affecting sports and exercise participation, and even impacting confidence to undertake everyday activities such as climbing stairs. Practitioners sought to address issues by listening to their concerns, providing reassurance: *“you have to reassure them things are ok”* (HCP003), and by adopting a staged approach to building confidence. This involved exposing patients to increased training loads and increasingly complex movements gradually over time.

*“They don’t have that confidence that they can push it to that pre-injury level, and so that’s when I just do the exercises to give them that confidence, and so normally I work with anybody that’s training with me on strength first, then power, then strength endurance, then agility.”* (HCP004)

## *Theme 2. Maintaining physical activity*

### **“Patients have got to get something out of it”**

Given the prospect of lengthy rehabilitation following injury and the potential need for ongoing management of knee symptoms, participants recognised the importance of developing exercise programmes with a clear rationale and rehabilitation strategies that really engaged patients. Whilst it was acknowledged that active young adults may be more motivated to adhere to an exercise regimen *“in that they’re surrounded by people who believe in sport and physical activity”* (HCP006), participants maintained that *“patients have got to get something out of it”* (HCP009); they needed to understand the benefits of what they were being asked to do. On a sensory level, the promise of pain relief was a clear benefit: *“pain is usually the biggest motivator”* (HCP004). However, the issue of motivation was particularly pertinent when patients faced a prolonged period on the sidelines: *“I think there’s a tendency to, you know, if it’s a long-term thing to lose motivation and see that end goal”* (HCP011). Participants suggested *“setting specific short-term goals and challenges, finding strategies that are time-saving, and explaining to them (patients) what it’s going to achieve”*

(HCP008). In team environments, competition was used as a rehabilitation tool: *“we pair them up, give them a bike each and it’s the first pair to accumulate 3km wins”* (HCP003). But competitive exercise was not perceived to be motivating for team players exclusively:

*“I’m a cyclist, so there are loads of people, many, many cyclists, they use Strava. And everything they’re doing, they look and compare themselves with other people and compare their numbers and all those sorts of things.”* (HCP009)

In addition, participants advocated *“varying exercise programmes so they don’t become boring, offering people a choice of locations to exercise, allowing people to choose when they exercise and so on”* (HCP002). This necessitated that participants recognised individual preferences and tailored rehabilitation strategies and exercise programmes to suit individuals: *“If you’re not a gym-goer that’s absolutely fine, but what kit have you got at home that we could utilise for you here?”* (HCP011). Finally, participants recognised that they had a role in facilitating life-long good habits by informing patients about the importance of maintaining knee health beyond rehabilitation:

*“Once you finish playing your sport, when you retire, it doesn’t stop there – you have to keep working and keeping that knee healthy ... you can help to educate them around how an injury will impact on their life in the short-term and over the long-term – and hopefully that will set in motion life-long good habits.”* (HCP003)

### **They ask themselves, “do I still have the ability to do this?”**

Participants described how a serious knee injury often presented a crossroads in a young adult’s sporting life: it was the trigger for decisions about whether to return to their sport, transition to a new sport, or focus on other aspects of their life. These decisions involved self-reflection, with physical injury challenging their sporting identity: *“So, injury might change your perception of how you see yourself as a player or an athlete – ‘Do I still have the ability to do this?, Am I still able to compete at this level? Will I ever get back again?’”* (HCP002). This was influenced by age and life-stage, with younger adults perceived as having a more acute sense of sporting identity (and more to lose with time out of sport): *“The younger they are the more difficult it is, because when you are an*

*18-year old you do two things: You go to school and you play sport, that's all you do. When you're 35, most people have got a job and kids so their world view is different"* (HCP009). Participants recognised that they had a role in this decision-making process, and that this required a balance to be struck between returning to their sport and safeguarding their long-term joint health:

*"For example, if you say to me, aged 25, I'm desperate to carry on playing rugby, I will say right, well how long for? They haven't thought about that. So, I then say so what about five years? And then at the end of that five-year period you take up cycling or canoeing or whatever it might be. So that's what we do. I try and tailor a specific sporting forward view for them."* (HCP009)

However, the importance of patient agency was also acknowledged: *"making them feel like it's definitely been their decision, not telling someone you can't run anymore – that is literally the worst thing you could ever say to a runner"* (HCP010). In this regard, practitioners sought to inform patients, focussing on the positive – what they could continue to do – whilst recognising their limitations, to enable them to make the right decisions for themselves. Finally, it was suggested that injury may sometimes be opportune: *"it might be that at the point of injury, they're already fed up with their sport, and that the injury is the right time to call it quits"* (HCP003). In such instances, injury could instigate a change of focus, with individuals turning their attention to another sport or other aspects of their life such their career or family. Moreover, a *"long and sometimes quite boring"* rehabilitation period could facilitate a transition into other realms.

### *Theme 3. Education and support*

#### **"People always have questions that they want answers to"**

It was widely acknowledged that patients have a paucity of knowledge surrounding their knee health following injury, resulting in uncertainty about treatment, ongoing management of joint health, and when and where to seek appropriate advice: *"Knowing who to go to, or who to talk to about it, which is where I get clients that just talk to me about it because they need to talk to someone about it"* (HCP005). Practitioners highlighted the importance of educating their patients

about their knee health, based on an accurate diagnosis, so that they could self-manage knee-related health as well as access the right resources when required. This often entailed the use of visual aids to describe knee anatomy and the nature of their injury:

*“I get all of the pictures out. I get all of the knee anatomy out and explain how it works, I show them muscles and how muscles are brilliant at supporting the knee. I show them the meniscus or the ACL, and explain the we’ve got to give it time to heal and most cases we’ll get some healing.”* (HCP007)

Some participants alluded to the fact that a greater understanding of knee injury and the process of rehabilitation, including the use of visual aids, could improve adherence to patient rehabilitation programmes and facilitate ongoing self-management of joint health: *“if you educate them in a way they understand about their own body, generally they are quite receptive to that”* (HCP004). Moreover, visual techniques could be also be used to augment rehabilitation programmes, helping ensure that individuals perform rehabilitation exercises correctly as well as increasing compliance: *“I certainly find taking video footage or photos really buys in, because it’s a picture of them. It’s an image of them doing it, and I think those that are visual learners really respond to that”* (HCP008).

Participants also reported that patients frequently had questions about knee symptoms, including those pertaining to pain, swelling, stiffness, and range of motion: *“People always have questions that they want answers to. One of the questions I always get asked about is clicking and swelling”* (HCP007). In particular, participants discussed the issue of knee pain and the way in which patients responded to it. Educating patients about the nature of their knee pain was seen as integral to striking the right balance between inactivity and over-exertion, both of which could be detrimental to knee health: *“You’ve got your people who do too little and then you’ve certainly got your people who do too much – and both ends of the scale are probably just as damaging as each other”* (HCP010). Some participants used the concept of pain scales with their patients to reassure patients to continue with their exercise programme: *“if it’s between 0 and 3 and the pain settles*

*down quite quickly, then you are absolutely 'A1' – keep going*” (HCP007), or as a measure of when to discontinue or moderate their activity: *“We use a general rule of thumb that keeping their pain and swelling between a zero to three out of ten scale is considered reasonable and anything that’s above that they have to adapt accordingly”* (HCP010).

### **“I think we need to empower people to manage it better themselves”**

Given the chronic nature of PTOA and the mediating factors in disease progression (e.g., obesity, physical inactivity), participants acknowledged the key role that patients have in self-managing their knee health in the long-term – *“for how the knee might be in 20, 30, 50 years, potentially”* – recognising that *“it’s part of managing their body in the same way that eating is part of managing their body”* (HCP011). In order to conserve knee health, there was a broad consensus amongst participants that people should *“keep active, focus on cardiovascular fitness, strength around the knee, and avoid having long periods of being sedentary”* (HCP001), as well as focusing on *“diet and particularly the influence of gaining weight”* (HCP011). Practitioners acknowledged their responsibility in educating patients: *“you’ve got to educate people and allow people to have confidence in their body”*, and in so doing ensure that they have the ability to self-care: *“I think we need to empower people to manage it better themselves”* (HCP006).

During the rehabilitation process, Physiotherapists prescribed exercise programmes and advocated bespoke routines to suit individuals so that they could be completed *“not just in the gym, but also in somebody’s bedroom”*, and *“making it so that it’s really palatable, so that you don’t need lots of equipment”* (HCP007). It was suggested that programmes should include targets and goals, tailored to individuals, and that goal-setting could be automated using wearable technology. This would also enable users to receive feedback on their progress and allow for incremental goals to be set: *“making it so it’s interactive as opposed to just one-directional”* (HCP008). Additionally, patients could take greater control of their rehabilitation through self-testing – monitoring their progress by testing their strength or range of motion when completing a range of tasks: *“We call them capacity*

*tests, so calf raises to fatigue, you know? How many calf raises can you do on your right versus your left? Or single leg bridges to fatigue, the single leg rise test” (HCP011).*

As well as exercise prescription and motivational support through goal-setting, participants discussed the potential for digital technology to provide a conduit for education and peer support during rehabilitation and beyond: *“a nice sort of in-between mix of medical advice and peer support, and just positive reinforcement that they’re doing the right things at the right times in the right stages, and keep going” (HCP010).* It was suggested that access to a community of peers who had been through the process of injury and rehabilitation could provide an important source of inspiration, or advice on strategies to manage knee health: to *“give people the opportunity to connect with others that have had a similar experience with the emphasis being on the positive side of things” (HCP011).*

## **Discussion**

The purpose of this study was to explore healthcare practitioners’ experiences of treating young adults following sport-related knee injury. Three common themes were identified: [1] Treating patients; [2] Maintaining physical activity; and [3] Education and support. Overall, participants described a paucity of support following acute knee injury in non-elite sports participants, with implications for long-term joint-health and related quality of life. This was exemplified by patients’ knowledge gaps in how to manage their knee health and manifest in patient inquiry regarding symptom management, prognosis and exercise prescription. Practitioners advocated for the need to take a heterogenous approach to treating patients to account for their individual characteristics (e.g., age, fitness level), type and level of sport participation, and their expectations of returning to sport. Recognising individual preferences and understanding underlying motivations was seen as essential in positively engaging patients in rehabilitation and ongoing attitudes towards knee health. Implicit within this was the ability to manage patient expectations, provide reassurance over issues such as knee confidence, and address the emotional impact that injury may have had on athletic identity. Additionally, participants alluded to the importance of



conveying the benefits of managing joint health to patients, whilst ensuring that strategies for conserving knee health were both satisfying (e.g., varied) and sustainable. The aftermath of injury sometimes resulted in people re-evaluating their return to sport: participants recognised their role in the decision-making process, addressing re-injury risk and / or supporting people to transition to another sport in order to stay physically active. Participants also recognised the uncertainty that was often associated with injury and long-term joint health. Various techniques were proposed to elucidate issues around knee health including the use of visual aids and pain scales. The use of such techniques could have a role in educating individuals, with the potential to enable joint health self-management. It was suggested that self-management could be facilitated through digital technology as a platform that could provide advice, guidance, and peer support.

The focus of both post-injury rehabilitation and PTOA treatment is to minimise pain and improve functionality, and exercise is recommended as the core non-pharmacological treatment(14). Divergence between the two is primarily associated with expectations. For example, whilst rehabilitation may be focussed on return to sport, established PTOA may necessitate a reduction sports participation, accepting a revised sporting role (e.g., coaching), or transitioning to another sport or physical activity regimen(10). Irrespective of prognosis, evidence suggests that exercises that increase strength, flexibility, and aerobic capacity are likely to be the most effective for rehabilitation(27) and knee OA in general(26). This is reflected in various exercise-based programmes designed to support patients through rehabilitation and / or to manage OA symptoms, including the 'The Good Life with osteoArthritis in Denmark (GLA:D™)' programme(23) and 'Enabling Self-management and Coping with Arthritic Pain through Exercise (ESCAPE-pain) programme(21). Whilst GLA:D is comprised of education and neuromuscular exercises delivered by Physiotherapists, ESCAPE-pain is a rehabilitation programme that helps people understand how exercise can improve physical and psychosocial wellbeing(21, 23).

Aligned to the views of participants in the current study, programmes such as these focus on patient education about the benefits of exercise and the potential for people to self-manage joint

health once instructed in how to do so. However, both GLA:D and ESCAPE-pain have been developed primarily for older adults and may not adequately address the needs of younger athletic populations, nor cater for individual characteristics. In a younger individual, recommendations should be based on the specific goal of treatment, as different exercises affect different aspects of pathology. For example, a rugby player may be most likely to benefit from muscle-strengthening exercises, because they reduce pain and risk of re-injury, which will allow him or her to return to sport; the long-term functional benefits of aerobic exercise may be less immediately evident in this case. What is clear is that it is important to tailor exercise regimens to the individual(2).

In addition to exercise prescription to alleviate post-injury symptoms or manage OA risk / disease progression, participants in this study alluded to the emotional impact of injury and the clear need to address psychosocial factors (e.g., knee confidence, loss of athletic identity), which can ultimately result in a failure to return to sport and a reduction in physical activity levels. Educational support has been used to target psychosocial factors in other OA cohorts by alleviating fears that exercise may exacerbate joint pain and damage, helping people to appreciate the benefits of exercise, and empowering individuals to become more confident in their ability to use exercise as a self-management strategy (e.g., the ESCAPE-pain programme)(8). A similar approach could be used to provide reassurance about knee confidence amongst young adults, as well as the information needed to inform positive choices around continued engagement in physical activity whether they return to sport, transition to another sport, or maintain healthful behaviours that reduce the risk of PTOA onset or progression.

The role of peer support in enhancing psychosocial wellbeing has also been widely recognised, as individuals with knee-related symptoms have been shown to find solace or inspiration in others who have had similar experiences(9). In a recent study by this research group, this sense of connectedness was sought from teammates who had previously experienced knee injury or from social media platforms, which included positive stories of rehabilitation and creative strategies for managing symptoms(29). The key for young adults with knee difficulties was that they were able to

access information to suit their specific needs and preferences(29). Thus, satisfying the informational and supportive needs of individuals may facilitate self-management of joint health. This echoes the theoretical underpinnings of Self-Determination Theory, in which individual behaviour is shaped by the satisfaction of three basic psychological needs of autonomy (feeling ownership of actions), relatedness (feeling connected to others) and competence (feeling capable to operate effectively)(22). A digital platform such as a smartphone app could address users' psychological needs by providing tailored informational and social support, thereby facilitating self-management of knee health.

As reported by participants in the current study, positively engaging individuals in managing knee health requires clear articulation of the benefits. People need to be convinced of the value of their actions (e.g., pain reduction, to expedite return to sport), they need clear instruction about what to do and how to do it, and why what they are being asked to do is beneficial (as discussed by the practitioners in this study). Knowing why and how to exercise or maintain a healthy weight helps form strong "implementation intentions"(12). Translating these intentions into behaviour then requires people to create "action plans" (where and when to carry out behaviours) along with "coping plans," (including a coping strategy) designed to mitigate against scenarios that might inhibit these behaviours(24). Establishing a positive attitude towards knee health can be facilitated if people self-monitor their behaviour and benchmark it against expectations (e.g., their level of physical activity compared with how physically active their peers are) and this includes factors such as goal setting, feedback, and support of performance and progress(18, 32).

This study explored the perspectives of a range of healthcare practitioners that treat young adults following knee injury. Those interviewed did not represent of an exhaustive list of healthcare practitioners who may be involved in the care pathway, and therefore insights from other professions may provide additional perspectives. Any consensus around long-term self-management strategies for young adults following knee injury would require another methodological approach (e.g., Delphi technique) with a pre-defined representative group of HCPS. A further limitation of this

study is that all participants were British and had spent the majority of their time treating patients in the UK health care system. Therefore, it is not known whether these findings are generalisable outside of this context. Moreover, as with all qualitative research, our cohort of participants was unlikely to be representative of all practitioners who have treated young adults following knee injury.

### **Conclusion**

Knee injury often has a short-term adverse effect on health-related quality of life, including pain and reduced physical function, but longer-term knee symptoms may persist and the risk of PTOA is increased. Healthcare practitioners discussed the aims of treatment, of which maintaining healthy levels of physical activity was key, and highlighted some of the issues with treating young adults who should be respected as individuals with distinct physical characteristics, motivations, and emotional needs. Effective treatment depended on satisfying individuals' informational and supportive needs. This was perceived to "empower people" to self-manage and joint health, and in turn could be facilitated through the use of digital technology.

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