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- Implementation of an orthopaedic triage service for osteoarthritis
- Framework for managing concussions in secondary schools
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PHYSIOTHERAPY NEW ZEALAND
Kōmiri Aotearoa

Are We Ageing Well as a Global Health Profession?

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The theme for World Physiotherapy Day, to be celebrated on 8 September 2025, is *The role of physiotherapy and physical activity in healthy ageing.* One of the key messages in this context is “Getting older does not mean you must stop or do less of what you enjoy. Healthy ageing means staying active, maintaining relationships and doing what you value as you get older” (World Physiotherapy, 2025c). To ensure successful outcomes from the campaign, the profession itself needs to be in good health by staying active, strengthening healthy relationships, and growing in a direction that not only meets the needs of the profession, but also contributes to improving global health outcomes. So how healthy is the global physiotherapy profession and how well are we doing?

Despite our age, the global profession is staying active! Next year World Physiotherapy (registered as the World Confederation for Physical Therapy, WCPT) celebrates its 75th anniversary, having held its first meeting in Copenhagen in September 1951. New Zealand was one of the 11 founding members. By 2007 there were 100 member organisations and membership has now grown to 129, representing more than 610,000 physiotherapists around the globe. Despite New Zealand’s comparatively small size, over the past 75 years members of the profession in New Zealand have been active internationally: Glen Park was WCPT president (1967–1970); others have taken on a range of leadership roles within World Physiotherapy, including positions on the executive board, congress programme committees, special interest groups, the Asia Western Pacific Regional Executive, and more.

Besides growth in membership and leadership, another sign of healthy ageing in the profession is the sharing of new knowledge. World Physiotherapy holds a congress every two years – over 4,000 delegates attended the World Congress 2025 at the end of May in Tokyo. The scientific programme included more than 60 hours of simultaneous presentations, conversations, and collaborations within the 145 main sessions, hundreds of ePoster and printed poster presentations, and networking sessions. Importantly, besides scientific outcomes from research into clinical practice, other themes including ethics, diversity, equity, artificial intelligence, Indigenous initiatives and sustainable physiotherapy were prominent. Such themes are important for the evolution of the global profession. In support of this, World Physiotherapy has policies, guidelines, and standards that are an integral part of the ongoing development of physiotherapy by informing education, professional practice, ethical and social issues, and planning (World Physiotherapy, 2025a). Furthermore, there is a growing global network for environmental physiotherapy, through the Environmental Physiotherapy Association. New Zealand has a prominent role in this Association: all four of the New Zealand education institutes that offer entry-level physiotherapy programmes are participants in the international network, which aims to include environmental physiotherapy, planetary health, and sustainability education in entry-level curricula. As well, Physiotherapy New Zealand is one of the supporting organisations (Environmental Physiotherapy Association, 2025).

Maintaining and fostering relationships is another component of healthy ageing. As the international voice of the profession, World Physiotherapy continues to strengthen its partnership with groups such as *Physiopedia* and *Pedro* – benefits are then passed on to individual physiotherapists within each of the 129 member organisations. Furthermore, World Physiotherapy collaborates directly with other international organisations including the World Health Organization (WHO) and the World Health Professions Alliance (WHPA). The latter, which comprises the international organisations for the medical, dental, pharmacy, nursing, and physiotherapy professions, is a powerful voice, speaking for over 41 million health care professionals (World Health Professions Alliance, 2025). During the WHO’s 78th World Health Assembly in Geneva in May, WHPA contributed to debates on matters such as the need to continue to support investment in health professionals and shared its concerns at an Assembly side event to reaffirm a critical message: “Investing in health professionals is not a cost, but a cornerstone of resilient, high-quality healthcare systems and the path to universal health coverage” (World Physiotherapy, 2025b).

Healthy ageing also involves sound investment in strategy, teamwork, and people. World Physiotherapy has recently invested in its own team by employing new staff whose role will include leading the implementation and evaluation of global development projects and initiatives (World Physiotherapy, 2025d). An important component of its role will be to strengthen inter-professional relationships, which is a key factor in improving health outcomes for the global population (World Health Organization, 2010).

At a country level, Physiotherapy New Zealand speaks for the profession, but as individual physiotherapists we all have a responsibility to support its work, to collaborate with other health and social care professions, and to ensure *The role of physiotherapy and physical activity in healthy ageing* has a positive impact on healthy ageing for all in New Zealand.

So, are we aging well as a global health profession? On reflection, as we near 75 years of age, we are staying active, strengthening relationships and collaborations, and beginning to focus more on what the profession values for a sustainable future. “Getting older does not mean you must stop or do less of what you enjoy” (World Physiotherapy, 2025c). Healthy ageing requires us all in New Zealand to actively contribute to the growth of the profession and, importantly, to promote physiotherapy as a key contributor to WHO’s goal of universal health coverage.

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Implementation of an Orthopaedic Triage Service for Osteoarthritis in the New Zealand Public Health System: Patient, Physiotherapist, Manager, and General Practitioner Perspectives

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ABSTRACT

To manage the increasing demand on orthopaedic services, health systems around the world have introduced osteoarthritis (OA) models of care led by specially trained physiotherapists. The community orthopaedic triage service (COTS) at the Bay of Plenty district health board (BOPDHB) was piloted to improve the patient journey through the health system. An outcome evaluation was undertaken to explore perspectives of patients, DHB physiotherapists, managers, and general practitioners (GPs) post implementation. Semi-structured interviews were conducted and data were analysed using thematic analysis. Analysis resulted in one overarching central organising concept: Changing the narrative about OA care delivery in the New Zealand public health system. This gave rise to three key themes: (1) Making OA a national health priority, (2) Optimisation of public health resources, and (3) Embedding best practice. Participants reported benefits including improved experience, easier access, and reduced hospital pressures. The COTS has the potential to bridge the gap between primary and secondary care; however, attention must be taken not to utilise a triage model as another barrier to accessing services.

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Key Words: Hip, Knee, Orthopaedic, Osteoarthritis, Triage

INTRODUCTION

Osteoarthritis (OA) is a worldwide, highly prevalent condition that causes loss of function, disability, and pain (Long et al., 2022). New Zealand faces an ever-growing problem with the prevalence of OA, with recent literature reporting a 116% increase in cases within Australasia in the last 30 years (Long et al., 2022). Due to the increased prevalence of the disease, New Zealand is struggling to manage the current demands of OA on the public health care system, particularly regarding the demand for first specialist appointments (FSA) with an orthopaedic surgeon (Bay of Plenty District Heath Board, 2022). In particular, the Bay of Plenty District Health Board (BOPDHB) continues to experience increasing referrals from general practitioners (GPs) into orthopaedic services, and the BOP strategic plan reports it cannot sustain its current patterns of resource allocation and ways of working (Bay of Plenty District Heath Board, 2022).

To manage the increasing demand on public health services, health care systems around the world have introduced OA models of care led by specially trained physiotherapists to reduce wait times and improve patient flow. These models have been shown to improve resource utilisation, access to services and care coordination, reduce wait times, and lead to better health outcomes (Button et al., 2019; Vedanayagam et al., 2021). Despite this, these models have only recently been introduced and evaluated in the New Zealand public health system (Gwynne-Jones et al., 2018). In 2020, the BOPDHB piloted a community orthopaedic triage service (COTS) to address the ever-increasing demand for referrals for hip and knee OA into orthopaedic services. The COTS was an extension of the orthopaedic service in which specially trained orthopaedic physiotherapists assessed and triaged patients with hip or knee OA onto appropriate non-surgical or surgical pathways. The service was independent of the hospital network and based in four community clinics within the Bay of Plenty region. A larger quantitative evaluation of the service has already shown that the COTS model can facilitate earlier assessment and access to appropriate intervention than the standard orthopaedic pathway, thus potentially improving the musculoskeletal health of New Zealanders (Stilwell et al., 2024). With the introduction of new care pathways, it is, however, critical to evaluate the patient's perspective on the care they receive and integrate the patient voice into decision making (Carr-Hill, 1992; Dickinson et al., 2015). Therefore, further evaluation using qualitative means was required.

Previous research evaluating OA triage pathways in Canada and Australia have considered patient perspectives using these models and found that patients report many positive experiences with these models of care (Cavka et al., 2015; Gibbs et al., 2020; Gillis et al., 2014). Within the New Zealand context, there are only a few recent studies that have explored this aspect (Abbott et al., 2019; Gwynne-Jones et al., 2018), with no studies evaluating these services delivered in a community setting. Therefore, the aim of this research was to explore patient, DHB physiotherapists and managers and GP perspectives of the COTS to understand how this model of care impacts the care experience within the management of hip and knee OA.

METHODS

The COTS model of care

The COTS was established as part of a larger orthopaedic transformation project at the BOPDHB. Although based in community localities, the service was delivered as a secondary care service. Patients accessed the COTS via a GP referral and this service was designed to be their initial appointment within the public health system (Figure 1). To be eligible for inclusion, patients must have undergone an initial assessment by their GP and been referred for orthopaedic consultation in secondary care.

At the patient's appointment, an examination by a specially trained physiotherapist was undertaken. Each physiotherapist had a minimum of a Masters-level qualification and had completed extensive in-house training with the orthopaedic team. Following their assessment, the patient was referred to the most appropriate intervention, which included any of the following: one-on-one physiotherapy, FSA with an orthopaedic specialist, activity with arthritis community rehabilitation programme, chronic pain team, or returned to their GP for ongoing care. The aim of the COTS was to improve access to musculoskeletal services through lower threshold criteria while utilising physiotherapists as an alternative pathway for orthopaedic patients with hip or knee OA.

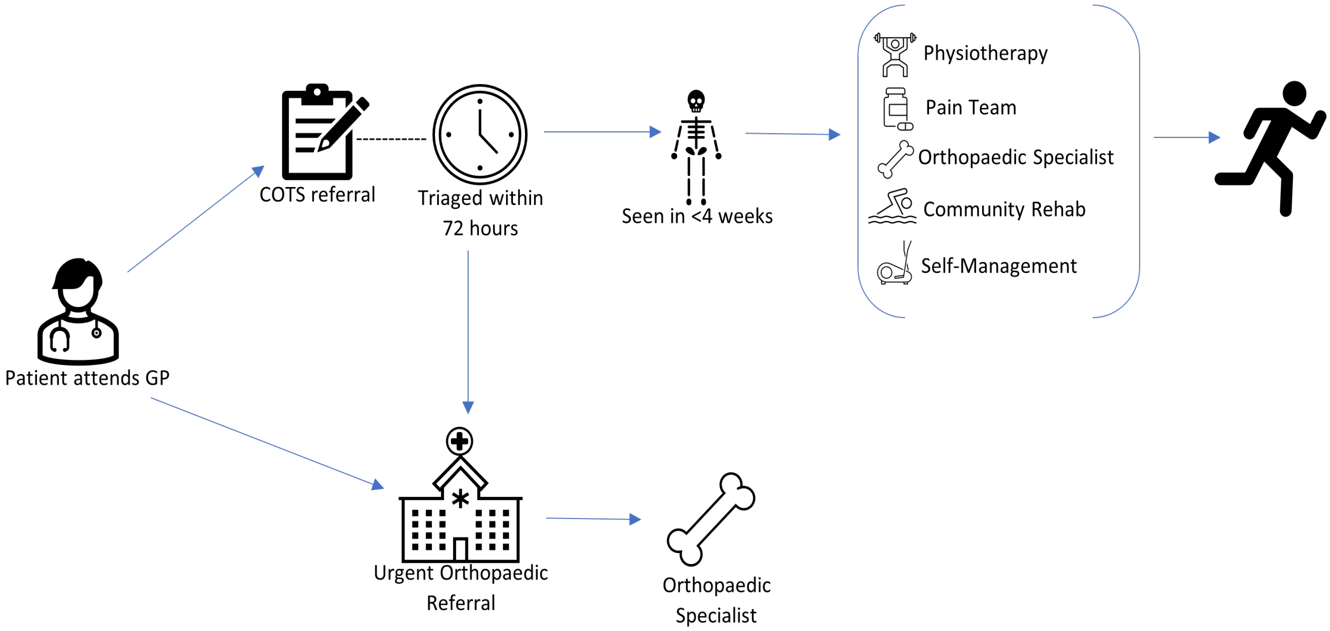
Evaluation study design

This study design was an outcome evaluation of the COTS, consisting of semi-structured interviews of people who had experienced the COTS model of care, people who used the traditional pathway, DHB physiotherapists and management involved in delivering the service, and GPs referring into the pathway. The evaluation was structured around the easy evaluation framework, which has been widely taught to the New Zealand public health workforce since 2007 (Adams & Neville, 2020). This has been used successfully as a framework for a number of research evaluations in a variety of health-related settings and highlights the role of formal evaluation in health care, specifically focusing on evaluations undertaken on projects, programmes, or policies (Dickinson et al., 2015; Wilkinson et al., 2014). The approach to this research is focused on the value branch of the evaluation tree based on the work of Scriven (1991) who considers the foundational description of evaluation as the systematic definition of merit, worth, or significance of a programme, project, or policy. Scriven (1991) states it is the work of the evaluator to make judgement about what is being evaluated.

This evaluation research methodology is guided by the theoretical world view of pragmatism. More recently, research has focused on pragmatism as a paradigm for social research

Figure 1

Flow Diagram Representing the Bay of Plenty Community Orthopaedic Triage Service (COTS) Pathway



(Allemang et al., 2022). While it is a relatively new emerging paradigm, it maintains focus on patient outcomes to produce socially useful knowledge (Cornish & Gillespie, 2009; Shaw et al., 2010). Given the significance of problem solving in research design, this new worldview offers an alternative epistemological paradigm (Allemang et al., 2022).

Interviews

Interviews as a method of research assume that the participant's perspective can add meaningful insights into the success or failure of a project (Dickinson et al., 2015). Semi-structured interviews were conducted over a 12-month period from 1 September 2020 to 1 September 2021 (Stilwell et al., 2024). The research was approved by the Auckland University of Technology Ethics Committee (reference number 20/36).

Participants

Participants for the interviews were recruited in four distinct subgroups, which included patients assessed in the COTS service, patients assessed in the standard orthopaedic service (non-COTS), DHB physiotherapists and management involved in delivering the service, and GPs referring into both services. These groups were chosen to represent the range of personnel involved in the development and utilisation of the service. Both COTS and non-COTS patients were included to allow for analysis of both pathways and to form a more comprehensive understanding of the impact on those involved. This is in line with other literature that has completed pre- and post-implementation data collection (Abbott et al., 2019). Recruitment occurred using criterion-based purposive sampling (Table 1) (Palinkas et al., 2013).

Potential participants were initially contacted by administration staff at the BOPDHB (Appendix A). Those who verbally agreed to be interviewed were forwarded to the primary researcher and sent information letters outlining the study details. Although there are no standardised sample-size criteria for qualitative studies,12–20 participants are generally considered sufficient to achieve data saturation of themes with a moderately homogenous group (Kuzel, 1999). At the time of the data collection, recruitment was limited due to COVID-19 restrictions, and this is a limitation of this research. In our study, data were collected from nine participants in the patient groups and eight participants in the staff and GP groups. The researcher deemed information richness had been achieved when repetitive codes were identified, and no new information or relationships were identified within the data (Rahimi & Khatooni, 2024).

Data collection

The interview team consisted of one lead researcher and two advisors with qualitative research experience. Individual face-to-face interviews were conducted by the primary researcher (JS) using semi-structured interview guides. The interview questions were designed specifically for each subgroup (Appendix B). The interview questions for subgroups 1 and 2 were guided by the work done by Waters et al. (2016) and Fennelly et al. (2020). The questions vary for subgroups 1 and 2 to account for the different referral processes for each group. The interviews for subgroup 3 were guided by the work of Wiles and Milanese (2016). These studies have previously conducted interviews of patients and stakeholders using orthopaedic triage clinics, and, after a critique of the methodology, the researchers deemed these to be critical pieces of work to guide their interview development. After each interview, JS reflected on the interview and debriefed with the advisors (DR, PL) to make note of additional probes and modifications to the interviews. This is a key principle in qualitative data collection and focuses inquiry and rigour of the research (Barbour, 2013).

As JS worked within the COTS at the time of the data collection, they acknowledged their insider perspective as they approached the interviews (Aburn et al., 2021). JS had not been involved in any of the care for the patients who were recruited. Before conducting the interviews, JS

Table 1

Sampling Criteria for Each Subgroup

Inclusion and exclusion criteria	Subgroup			
	1	2	3	4
Inclusion criteria				
Age (years)	> 45	> 45	> 18	> 18
Sex	Male or female [a]	Male or female [a]	Male or female	Male or female [a]
Ethnicity	At least one Māori participant	At least one Māori participant	Any	Any
Language	English speaking	English speaking	English speaking	English speaking
Sample	Patients	Patients	Staff	GPs
Exclusion criteria				
Language	Non-English speaking	Non-English speaking	Non-English speaking	Non-English speaking

Note. GP = general practitioner.

[a] At least one male and female required.

underwent a pre-assumption interview by a researcher external to the project and unfamiliar with the research aim and context. A pre-assumption interview is a way of gathering insights about matters of significance in the interviewee's world and to highlight any known and unknown assumptions, biases, and values that were subconsciously present before the interviews take place (McNair et al., 2008). This researcher used this to reflect on their assumptions following each interview. This process improved rigour during data analysis by exposing insights that directly impacted on the research process.

Data analysis

The data were analysed using thematic analysis as outlined by Braun and Clark (2006). Data were transcribed by JS into an electronic written format, which helped with the familiarisation process. Transcripts were then checked by another researcher (DR) and corrected if necessary. JS carried out inductive informed coding at a semantic level to address the research objectives. Each segment of data that was relevant or captured something interesting was coded using Microsoft Excel as described by Bree and Gallagher (2016). Open coding was used, which allowed for the development and modification of codes throughout the coding process.

Following the completion of coding, the research team met virtually to discuss the codes. Codes were grouped into broader themes, and multiple interpretations and outliers were reviewed and discussed using an iterative process (Carpenter & Suto, 2008). The primary researcher (JS) consulted the research team to test the development of relevant themes throughout the analytic process to reference their assumptions. Themes were then further reviewed, and data were gathered using spider diagrams. Finally, a thematic map was developed to illustrate the relationship between themes.

RESULTS

Data analysis of the interviews resulted in one central organising concept: Changing the narrative about OA care delivery in the New Zealand public health system (Figure 2). This gave rise to three main themes: Making OA a national health priority, Optimisation of public health resources, and Embedding best practice. The central organising concept captures the essence of the three main themes, which are based on core meaningful patterns within the data. The concept gives rise to the participants' voices on the impact of the COTS to reframe the current management pathways of OA within the New Zealand public health system. It encompasses the challenges and pitfalls faced by patients and clinicians in the current OA models of care and how adopting a new model of care can contribute to improved patient management in multiple dimensions. Below, quotes from participants are coded based on their subgroup (S) – with S1 referring to COTS patients; S2, orthopaedic patients; and S3, health professionals – and participant (P) identification numbers (Table 2).

Theme 1: Making OA a national health priority

Table 2

Descriptive Details of Participants in Each Subgroup

Group	Description/role	Sex	Ethnicity	Age	Length of interview (min)
S1P1	COTS patient	Male	NZ European	65–74	33
S1P2	COTS patient	Male	NZ European	75–84	19
S1P3	COTS patient	Female	NZ European	65–74	31
S1P4	COTS patient	Male	Māori	55–64	27
S1P5	COTS patient	Male	Māori	45–54	21
S2P1	Orthopaedic patient	Female	Māori	55–64	22
S2P2	Orthopaedic patient	Female	NZ European	65–74	32
S2P3	Orthopaedic patient	Male	NZ European	55–64	33
S2P4	Orthopaedic patient	Female	NZ European	65–74	30
S3P1	COTS physiotherapist, working clinically	Female	European	35–44	47
S3P2	Physiotherapy manager, non-clinical	Female	NZ European	55–64	38
S3P3	Executive director of allied health – physiotherapist, non-clinical	Female	European	45–54	37
S3P4	Physiotherapy manager, non-clinical	Female	NZ European	45–54	34
S3P5	Orthopaedic surgeon	Male	NZ European	55–64	36
S4P1	GP	Female	European	35–44	33
S4P2	GP	Male	NZ European	45–54	20
S4P3	GP	Female	European	35–44	32

Note. COTS = community orthopaedic triage service; GP = general practitioner; NZ = New Zealand; P = participant; S = subgroup.

This first theme was about the lack of consistency within New Zealand regarding OA pathways and the potential impact of the COTS on managing this challenge.

A nationwide change

There was consensus from staff and patients that the orthopaedic pathway in the treatment and management of OA nationally was failing, and more consistency was required throughout the country. A participant working in the pathway said, “There’s an inconsistency around the DHBs, around the country, with how many patients are accepted in different regions” (S3 P5). Participants acknowledged how the COTS could address this challenge by standardising the delivery of care for patients with OA: “I think it’s a really good pathway, but I think there needs to be some major reinvention, overhaul of the system” (S3 P2).

Challenges to service delivery

Participants reported challenges to the service delivery for patients with OA, predominantly due to the dichotomy of the New Zealand health system. Participants commented on how the current structure of the health system formed barriers to accessing appropriate treatment for their OA. For example, “Initially the first thing was ACC and that was a cartilage thing [referring to affected joint] and after about five or probably more than that years, it [referring to affected joint] was doing its thing again but wasn’t ACC, it’s confusing” (S1 P1). This was also acknowledged by staff who said, “because of the way the health system is in New Zealand, we have ACC and DHB [funding], it’s difficult to navigate for patients” (S3 P2). Participants commented how having a triage model using physiotherapists could help with these challenges as “DHB physios are much more attuned to chronic ailments and treating arthritis and understanding what gets surgery” (S3 P2).

Theme 2: Optimisation of public health resources

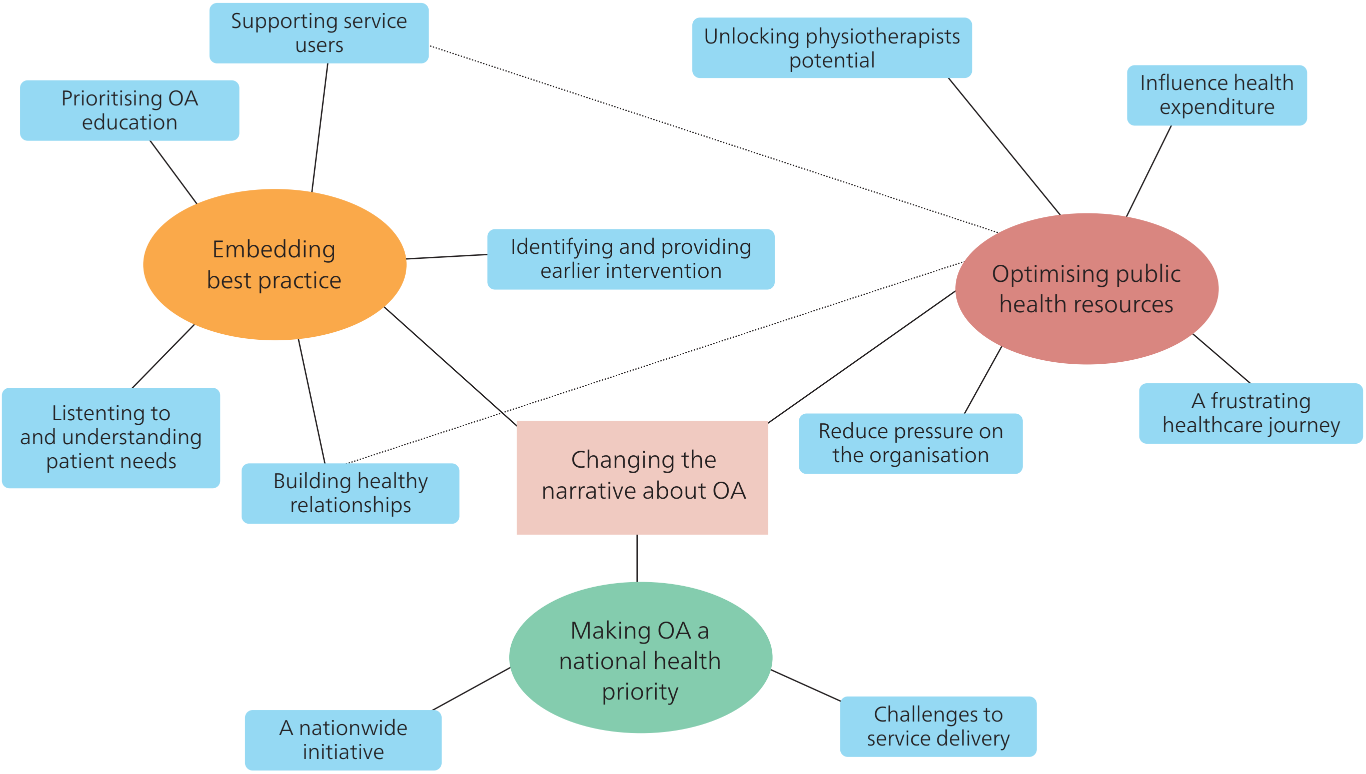
Within the second theme, participants commented on the impact of the COTS directly to the public health system, staff, and resources.

Unlocking physiotherapy potential

Participants felt the COTS has the potential to impact the future direction of the physiotherapy profession, including developing advanced practitioner education pathways, shifting professional boundaries, raising the physiotherapy profile, and setting the standard for OA care. Overall, participants using the COTS model, found they were satisfied with the care provided by the physiotherapist. Two participants commented that “I didn’t feel like I was missing out on anything from not seeing a doctor at this point” (S1 P3) and “I didn’t picture her as a physiotherapist as such over anything else. She was there, she was doing a job” (S1 P1). Staff members were also unanimous in the ability of physiotherapists to be working in these roles, stating, “we are competent to do this, and we have the skill set to do this” (S3 P1).

Figure 2

Thematic Map of Theme and Subthemes



Note. OA = osteoarthritis.

Reduce pressure on the organisation

Participants across all four subgroups discussed the impact of the COTS to reduce pressure on the organisation, including providing care closer to home, reducing the pressure on GPs and on the orthopaedic workload. Overall, participants recognised how having a community service can reduce the foot traffic through the hospital, freeing up resources for acute care: "I can understand being in the hospital if you've got life-threatening things happening because they've got everything they need there but for these sorts of things I don't think it's critical" (S1 P4) and "Why would you want people driving into city where a hospital is situated if it's not needed? You know why do they need to go to a hospital?" (S1 P3). Additionally, participants commented that having physiotherapists working in these roles can reduce the pressure on the orthopaedic team, leaving them more time to perform surgery. One participant commented that there is "less pressure on the guys at the top who are actually doing the knee replacements and things like that, the surgeons. It frees up a lot more of their time" (S1 P4).

Influencing health expenditure

Participants commented on the ability of the COTS to influence health expenditure by substituting doctors with physiotherapists and reducing travel time for patients: "The most powerful point in getting the right service to the right patients in a cost-effective way is this gatekeeper role" (S3 P5) and "It's less expense because I imagine the surgeons' time are a lot more expensive than the physios' time" (S1 P3).

However, due to the resource needed to establish the project there were concerns from participants as to the impact of the COTS to improve cost effectiveness: "It's an improved service, I firmly believe that, how cost effective it is truthfully in terms of numbers and final outcome and what it costs, I don't know I haven't seen that data" (S3 P5).

A frustrating healthcare journey

Patients using the orthopaedic system commented on their frustration in using this pathway. They commented on the lack of follow up, structure, and discordance in the orthopaedic system: "It would be nice to know that there was somewhere you could go without the rigmarole of having to go through your doctor and then back through the specialist" (S2 P3). Participants also made comments on their frustration in the points system for accessing surgery and the discordance between the points system and their symptoms: "Quite confusing where the surgeon says I think this surgery would be the best thing for you and then when they input all the data it comes back oh no you don't qualify" (S2 P3) and "I don't see why you should go through a points system to see how bad it is, you know" (S2 P2). Another participant commented specifically on the lack of orthopaedic follow up, saying, "it would be quite good if they said look, we will see you again in 6 months or 12 months and review, you know, how things have gone rather than having to start the whole process again. Erm, quite upset and frustrated again" (S2 P1).

Theme 3: Embedding best practice

Theme 3 reflects participants' concordance on the contribution of the COTS in being able to deliver evidence-based practice as recommended for patients with OA. Participants highlighted the impact of an evolving COTS service from both a personal and health care delivery standpoint.

Identifying and providing earlier intervention

Participants commented on how the COTS was superior at identifying and providing earlier intervention in OA care compared with the orthopaedic pathway. This was discussed in two accounts, including being seen earlier within the disease process and timely access to care. One COTS patient commented specifically on how important it was to understand early what is going on to improve long-term outcomes: "I know a lot of people that would have come in here years ago and probably have been able to do something more you know before you get to the stage of replacement" (S1 P5).

All participants involved in the COTS model were satisfied on how quickly they were seen. For example, one participant was impressed by how short the wait times were to receive an appointment through the COTS: "I was seen at the GP, and she sort of said you will hear and next minute, I expected months with what's going on, but it was more like weeks rather than months, very impressed" (S1 P3). One participant commented on their previous experience of waiting to see an orthopaedic surgeon saying that "it would be nice to know earlier rather than later that this [OA] is causing the problem. So, the waiting time for that [seeing orthopaedics] is too long" (S2 P2). Staff members also commented on the reduced wait times, with one physiotherapist saying:

> Previously a patient would have waited months, seen the GP, then waited months to see an orthopaedic surgeon, sat in clinic for ages and had a shortish appointment with a registrar or consultant or a bit of both, and been given a brief message as to what was wrong with them (S3 P2).

Prioritising OA education

Participants noted that the education they received from the physiotherapist was very helpful, allowing a better understanding of their condition. Participants in the orthopaedic group highlighted the lack of available information when seeing doctors and attributed this to the lack of time provided in their appointment. Patients who had been seen in the COTS were satisfied with the amount of information they received and how this positively impacted on their management: "She explained everything really well. Did the examinations and everything so yeah, no that was good. Yep. She covered everything that you sort of needed to know" (S1 P4) and "I felt she sort of explained a lot of things that, like I say with everything connected and the knees clicking and how I can't put my socks on" (S1 P5).

Listening to and understanding patient needs

Participants said that the COTS was a positive experience in listening and understanding patient needs when compared with the previous pathway. They attributed this to having more time to spend with the physiotherapist who engaged in active listening, prioritised their OA, and took them seriously. Participants in the COTS said that the physiotherapists were easily approachable and able to spend more time with them than other health care providers: "It made me feel a little bit happier that you know that obviously you're being listened to which was a better experience than when I saw the GP" (S1 P2).

Staff and GPs also said that patients who had used the COTS felt listened to in their appointment, and their needs were met. One GP said, "the patients were positive about the waiting times, they were positive about the thoroughness of the assessment and were very positive about kind of the variety of options that were available" (S4 P2). An orthopaedic surgeon commented that "for many people COTS is a superior experience because they're not looking for surgery, they're looking for somebody to listen and advise" (S3 P5).

Building healthy relationships

Participants commented on the importance of strong relationships between physiotherapy and orthopaedics and the potential impact of the COTS in shifting hierarchical boundaries, building trust, improving communication streams, and gaining respect. One participant stated that "I think continued acceptance from orthopaedics, what we will see as this continues to be successful is that we will have, an increase in relationships with consultants." (S3 P4). In addition, GPs commented that the model can help improve the relationships between primary and secondary care: "I think what we will see, as I'm hoping this continues to be successful, is that we will have an increase in relationships between providers" (S4 P2).

Supporting service users

Participants felt the COTS could provide support in the management of patients with OA. There was positive feedback from GPs that the service could provide them with additional support including assisting with further diagnosis and clinical decision making around musculoskeletal pain: "I think, having allied health involved in assessment of areas where they're really skilled is really appropriate" (S4 P1) and "Having another option, a way to look at something is quite useful" (S4 P3).

Participants also expressed satisfaction with the service in its ability to provide support to patients with OA: "Having that support [from the COTS], yes I probably react better and put more into it if I'm not doing things alone" (S1 P1), compared to those using the orthopaedic system: "It would be nice to know that I was in the system and there was support, more support for ongoing care" (S2 P2).

DISCUSSION

The aim of this research was to explore patient, DHB physiotherapists and management, and GP perspectives of the COTS in order to understand how this model of care impacts the care experience within the management of hip and knee OA. To the best of our knowledge, this is the first time an orthopaedic clinic delivered by specially trained physiotherapists has been established independent of a hospital network in New Zealand. This type of service offers several potential advantages, including providing patients access to earlier intervention, reducing pressure on hospital waitlists, and supporting service users.

Despite the prevalence and financial burden of OA, the New Zealand public health system has yet to adopt a national model of care for OA management. Current OA management around the country has been described as fragmented and episodic, with "little inter-disciplinary collaboration to support optimal care" (Baldwin et al., 2017, p. 79). Key reports around the world identify the management of musculoskeletal disease, such as OA, as a major health priority (European Action Report, 2017). The clinical care standards for knee OA released in Australia provide a focus on improving the standardisation of care across the country and have led to several Australian states developing local models of care to guide service delivery (Australian Commission on Safety and Quality in Health Care, 2024; New South Wales Agency for Clinical Innovation, 2012). Related to Theme 1, participants in our study describe how the COTS model may have an impact on improving the consistency of OA care in New Zealand by standardising the delivery of care for patients with OA and removing access barriers. Adoption of similar models of care across the country has the potential for a positive impact on the musculoskeletal health of New Zealanders.

Optimisation of health resources was identified as Theme 2. This has been long recommended in New Zealand health documents. For example, in 2011, a Ministry of Health document stated the importance of training alternative health professionals to free up the time of specialists to manage more complex patients (Stott et al., 2011). Ministry of Health policy also supports transformational changes through collaboration between varied professionals co-designing clinical pathways to improve patient access and their journey within the public health system (Ministry of Health, 2011). Additionally, the 2011 musculoskeletal workforce services review supported the integration of specially trained physiotherapists into first contact models due to their expertise in managing musculoskeletal conditions (Ministry of Health, 2011). Previous research, conducted in a clinical environment in other high-income countries, has evaluated physiotherapist delivery of FSAs and has found this model to be acceptable in their care trajectory (Button et al., 2019). Physiotherapists are professionally competent in working in these models, including their agreement in treatment recommendations, diagnostic concordance with orthopaedic surgeons, and investigative accuracy (Aiken et al., 2008; Décary et al., 2017; Decary et al., 2016; Desmeules et al., 2013; MacKay et al., 2009). Similarly, our study participants generally had positive views of the triage model of care, with participants supporting the use of physiotherapists to provide FSAs. Overall, our patient participants were not concerned about which health professional they saw. Using specially trained physiotherapists to complete the roles previously undertaken by doctors in OA care could be a favourable option for integration into clinical practice in a New Zealand context.

New Zealand's health system has been reported as providing highly fragmented, poorly coordinated care to service users (Goodyear-Smith & Ashton, 2019). This arises because service users receive care from a wide range of professionals working in many provider organisations and often in siloed situations. An ongoing policy challenge has been to determine how to reduce such fragmentation and achieve more integrated and coordinated care that provides a smooth transition between primary and secondary health services (Cumming, 2011). Previous literature has identified that an OA joint clinic can satisfactorily bridge the gap between primary and secondary care and has received welcome support from GPs (Abbott et al., 2019).

Other research has identified that physiotherapists with specialist training are well-accepted members of the orthopaedic workforce, enhancing integration between primary and secondary care services (Vedanayagam et al., 2021; Williams et al., 2019 . Although funded by secondary care, to the best of our knowledge, our study is the first to report on an orthopaedic triage service delivered by specially trained physiotherapists in New Zealand to provide this model in a community setting. In our study, participant opinion was that the COTS could help GPs and patients navigate the complexities of the public health system. The present study raises the possibility that a triage model can improve the care transition from primary to secondary services through the application of a specialist interface assessment service.

Finally, participants identified several advantages of the COTS with respect to Theme 3 and its ability to embed best practice. Early access to care from a health professional with the appropriate clinical assessment skills and knowledge base has been highly regarded in the literature (Gillis et al., 2014). While many strategies have been put in place to try to reduce waiting time across the country, wait times for initial assessments in orthopaedic services in New Zealand remain longer than anticipated (Cook, 2022). Data have shown waiting times for FSAs have trebled since 2020 due to the rising population and the COVID-19 pandemic (Abbott et al., 2022). Additionally, when a patient waits longer than six months to be seen, there is a risk of significant functional decline (Mahon et al., 2002). This includes important loss of functional mobility and health-related quality of life (Morris et al., 2017; Morris et al., 2018). Reduction in wait time for first assessment is a positive outcome demonstrated in the literature for triage models of care managing hip and knee pain when the physiotherapist acts as a gatekeeper to orthopaedic services (Aiken et al., 2009; Cavka et al., 2015; Doerr et al., 2012; Farrar et al., 2014). Consistent with these findings, and in line with Theme 3, our participants valued the reduced wait times and less travel associated with the COTS model. Participants were pleased with the short wait time in the COTS and felt this contributed to their overall positive experience using this pathway. The average wait time to be seen in COTS was 37 days compared to 156 days in orthopaedics, with a statistically significant difference ($p < 0.0001$) in mean waiting times (Stilwell et al., 2024). Adoption of this model has the potential to improve access by identifying and providing earlier intervention for patients with hip and knee OA.

While this study does contribute to the understanding of the perspectives of a new model of care, it has some limitations. Due to COVID-19, there were smaller subgroups than initially anticipated, which limits the strength of the data. Additionally, as all participants are from a single DHB, caution needs to be exercised when generalising the results to other regions. Finally, the primary researcher (JS) worked as a clinician within the service at the time of the data collection. Although the researcher took steps to reduce bias, this still must be considered when interpreting results.

CONCLUSION

This study has contributed to knowledge on patient, DHB physiotherapist, manager, and GP experiences around an emerging OA model of care in the New Zealand public health system. Our data have shown that participants see potential impact of the COTS, including its ability to improve access, support service users, and reduce hospital pressures. The model also has the potential to bridge the gap between primary and secondary care; however, attention must be taken not to utilise a triage model as another barrier to accessing services. Finally, this study provides a case example that could inform future community models of care in a New Zealand health context.

KEY POINTS

1. This research provides qualitative data on patient, DHB physiotherapist, manager, and GP experience around an emerging OA model of care in the New Zealand public health system.
2. Participants in this study saw benefit in the community orthopaedic triage service (COTS), including its ability to improve access, support service users, and reduce hospital pressures.
3. This case study informs future community models of care in a New Zealand health context.

DISCLOSURES

No funding was obtained for this study.

CONFLICT OF INTEREST

The primary researcher is also a physiotherapist employed by the BOPDHB and worked in the COTS during the time of the data collection.

PERMISSIONS

This study was granted ethical consent by Auckland University of Technology Ethics Committee (reference number 20/36). No additional permissions are required for this manuscript.

CONTRIBUTIONS OF THE AUTHORS

Design conceptualisation and methodology; validation; formal analysis, JS, DR and PL; Data curation, JS; Writing – original draft, JS; Writing – review and editing, JS, DR and PL.

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Appendix A

RECRUITMENT PROCESS

Subgroup	Recruitment process
1 and 2	Participants who fit the inclusion criteria to be interviewed were identified and initially contacted by orthopaedic administration staff and their information was forwarded to the primary researcher. Within 72 hours following their COTS or orthopaedic appointment, the primary researcher made initial contact with the participant regarding the research study via telephone. Interested patients were provided with relevant information via an information leaflet and verbally by the researcher. This included the reason they were selected to be interviewed, the purpose of the study, and details on what the interview will involve including length of time (DeJonckheere & Vaughn, 2019). In addition, the researcher followed the required ethical principles and informed the participant that withdrawal from the interview would be permissible at any time, participation was voluntary, and information gathered would remain anonymous. The participant was then given the opportunity to ask any relevant questions and allowed 48 hours to process the information. After 48 hours, participants were contacted again and given another opportunity to ask any questions. If they were willing to participate, an interview was arranged within two months of their initial appointment at a time and location that was convenient for the participant.
3	Participants in Subgroup 3 were purposefully selected by the primary researcher as important staff members in the development of the COTS. Potential interview participants were sent an explanatory invitation by email, with participant information by the primary researcher who sought locality approval and ethical clearance regarding the appropriateness for this recruitment process. Information in the invitation email included the reason they were selected to be interviewed, the purpose of the study, and details on what the interview involved including the length of time and format of questions (DeJonckheere & Vaughn, 2019). In addition, the potential participant was informed that withdrawal from the interview would be permissible at any time, participation was voluntary, and information gathered would remain anonymous. If they were willing to participate, an interview was arranged at a time and location convenient for the participant. The primary researcher did not have a professional, managerial, or operational responsibility for the participants recruited. This was to minimise any conflict of interest or power relationship.
4	Participants in Subgroup 4 were purposefully selected by the primary researcher as GPs within the Bay of Plenty region who had experience referring into the COTS and the orthopaedic service. Potential participants were sent an explanatory invitation by email via their individual practice manager. Information in the invitation email included the reason they were selected to be interviewed, the purpose of the study, and details on what the interview involved including length of time (DeJonckheere & Vaughn, 2019). In addition, the potential participant was informed that withdrawal from the interview would be permissible at any time, participation was voluntary, and information gathered would remain anonymous. If they were willing to participate, an interview was arranged at a time and location convenient for the participant.

Note. COTS = community orthoapedic triage service.

Appendix B

SEMI STRUCTURED INTERVIEW QUESTIONS AND PROMPTS

Subgroup 1

We are aware that you have recently had an appointment with a physiotherapist about your hip or knee OA. We are interested in your journey in the health system and how you found this experience.

A. Clinical journey

1. What do you understand about your current condition?
2. What has your journey been so far in the management of your hip/knee?
3. What health professionals to date have you seen for your hip or knee OA?
   [Prompt: Have you seen anyone else?]
4. Prior to this appointment, have you had any experience using the public system for your hip or knee OA?
5. Prior to this appointment, have you seen anyone through the private or ACC system about your hip/knee?

B. Appointment and expectations

Your GP referred you to the community orthopaedic triage service (COTS) for assessment of your knee/hip: Can you tell me…

6. Approximately how long were you waiting for the appointment?
7. What did you expect from your recent appointment with the physiotherapist?
   [Prompts: Why? Did it meet those expectations?
   Were you informed about what would happen in the appointment?]
8. Can you explain to me what happened in the appointment?
9. What was your experience of this appointment?
   [Prompts: Did you get any advice, diagnosis, treatment, investigations?]
10. How did you feel about seeing a physiotherapist?
    [Prompt: Why?]
11. Would you prefer to see a different professional about your hip or knee pain?
    [Prompt: Why?]
12. Did the appointment differ to your appointment at your local GP?
    [Prompts: What makes it different/the same? Are there any advantages/ disadvantages?]

C. Outcome of the appointment

13. How did the appointment either meet your needs or not meet them?
    [Prompt: Was it worthwhile?]
14. In what way did you find the appointment valuable?
15. What is the plan for the management for your hip/knee pain?
16. Are you confident that your hip/knee pain will be managed following this appointment?
    [Prompt: What makes you feel that way? Do you think there will be a positive outcome?]
17. What advice would you give about improving the value of this service to the health system?
18. What would you like to see improved in this pathway?

Subgroup 2

We are aware that you have recently had an appointment with an orthopaedic specialist about your hip or knee OA. We are interested in your journey in the health system and how you found this experience.

A. Clinical journey

1. Firstly, can you tell me what you understand about the problem in your hip/knee?
2. Before you saw the specialist recently, can you tell me what experience you have had with your hip/knee?
   [Prompts: If this was not their first experience in orthopaedics – what was your previous experience? How did that make you feel? How did you find the service?]
3. What health professionals to date have you seen for your hip or knee OA?
   [Prompts: Have you seen anyone else? How did they make you feel?]
4. What has been your previous experience of seeing a physiotherapist about your hip/knee?

B. Appointment and expectations

5. Prior to your appointment, what did you expect to happen?
   [Prompts: Why? Did it meet those expectations?]
6. Approximately how long were you waiting for the appointment?
   [Prompts: How did this make you feel? Do you have any feedback on the time you waited?]
7. When you arrived at your appointment, what happened initially?
   [Prompt: How did you feel about this?]

8. What was your experience of the appointment with the orthopaedic doctor?
   [Prompts: Did you get any advice, diagnosis, treatment, investigations? How did this make you feel?]
9. How did you feel about the amount of time you spent with the doctor?
10. How did you feel about seeing an orthopaedic specialist?
   [Prompt: Why?]
11. How did this appointment compare to your GP appointment?
   [Prompt: In what way was it different/the same?]
12. Would you have preferred to see a different health professional?
   [Prompt: Why?]
13. In what ways was this appointment different to the one at your local GP?
   [Prompts: What makes it different/the same? Are there any advantages/disadvantages?]

C. Outcome of the appointment

14. How did the appointment either meet your needs or not meet them?
   [Prompt: Was it worthwhile?]
15. In what ways did you find the appointment valuable?
   [How did you find this service?]
16. From this appointment, what is the plan for the management for your hip/knee pain?
17. Are you confident that your hip/knee pain will be managed?
   [Prompt: What makes you feel that way? Do you think there will be a positive outcome?]
18. What other models of care do you think could be more valuable for people with OA?
19. Overall, how did you find this experience/journey?
20. What is your opinion on the orthopaedic service as you have experienced it?

Subgroup 3

I am aware that you have been involved in the development of the community orthopaedic triage service (COTS) project at the Bay of Plenty District Health Board (BOPDHB). I am interested in your experience of being involved with the project and how you think this service will impact the DHB and its population.

A. General questions

1. What is your role in the project?
2. How long have you been involved?
3. In your words, can you describe to me what the project involves?
4. How would you describe your experience in the project so far?

B. Now questions

5. As it currently stands, how would you describe the current position of the project?
6. What are the problems the team are currently trying to solve in this project?
   [Prompt: Are there any others?]
7. In your opinion, which is the most important to solve and why?
8. How do you see this project impacting on the current problems you have identified?
9. In the short term, what do you see as the most important outcomes for the project?
10. How do you think this type of model will impact the DHB?
11. How do you think this type of model will directly impact on patients using the public system?
12. In your opinion, will this model have any impact on other models of care?
13. How does this model impact on care delivery for patient who identify as Māori?
14. From your perspective, what has been the most challenging part of the project so far? And why?

C. Questions about the future

15. In the long term, what do you think the impact of a successful project will have to the DHB?
16. What do you think the long-term impact will be on the service users?
   [Prompt: Are these different? Why?]
17. What does success look like for you and your team?
18. Moving forwards, what do you see are the major obstacles or impediments to the success of the project?
19. What worries do you have about the project moving forwards?
   [Prompt: Why?]
20. What advice would you give to other DHBs trying to implement this type of project?
21. If you were to start this project again, would you approach it differently? And why?

D. Other

Is there anything else that I haven’t asked you that you would like to say?

Subgroup 4

We are aware that you have been referring patients with hip or knee osteoarthritis to the community orthopaedic triage service (COTS) at the Bay of Plenty District Health Board (BOPDHB). I am interested in your experience of using the service.

A. Questions about the past

1. Prior to the implementation of the COTS service, how would you describe the major joint OA referral pathway in the Bay of Plenty?
2. How often would you use the major joint OA referral pathway?
3. What was your previous experience of using this pathway?
   [Prompts: Were there any problems with this referral pathway? Are there any others? Which of these is the most important to solve?]

B. Now questions

4. How long have you been referring into the COTS service?
5. In your words, can you describe to me what the referral pathway involves?
6. Have your referrals increased since the implementation of the new service?
7. How would you characterise the patients you refer into the service?
8. Thus far, what is your experience of referring patients via this pathway?
9. What are the problems you have experienced with this new service?
   [Prompt: Are there any others?]

C. Questions about the future

10. What do you think the impact of this pathway will have to the DHB and its service users?
    [Prompt: Why?]
11. What worries do you have about the pathway?
    [Prompt: Why?]
12. What are the major obstacles or impediments to the success of the pathway?

D. Other

13. Is there anything else that I haven’t asked you that you would like to say?

Easy When Everyone is on Board”: Implementing a Framework for Managing Concussions in New Zealand Secondary Schools

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ABSTRACT

We implemented a FRAmework for maNaging Concussions in 12 New Zealand secondary Schools (FRANCS) in 2022 and 2023. The aims of this study were to describe the characteristics of students with concussion utilising the framework and to assess the implementation outcomes as reported by the school stakeholders. Assistant research fellows (ARFs) met weekly with students with concussion, assessing the mechanism of injury and concussion-related symptoms. An implementation survey was administered to school staff at the end of each year. Demographic data, concussion characteristics, and implementation outcomes were summarised. Open-ended survey questions were analysed using content analysis. Eighty-two students (23 girls) diagnosed with a concussion met with the ARFs. Most concussions were sports related (89%). The *Mdn* (range) Concussion Symptom Score at the first and last meetings were 22/75 (0, 53, $n = 84$) and 6/75 (0, 55, $n = 31$) respectively. Twenty-one of 24 school stakeholder ratings suggested that FRANCS was successfully implemented, and 22 would use FRANCS beyond project completion. Support provided by the ARFs and FRANCS’ processes were highly valued. Challenges included lack of time and inconsistent buy-in from some students, parents, staff, and coaches. FRANCS can be adapted to individual schools’ contexts and buy-in, and good communication processes are needed from all members of the school community to sustain the processes.

Sole, G., Badenhorst, M., Mossman, K., Caya, R., Zoellner, A., Sutherland, C., Skilton, D., Salmon, D., Keung, S., Lucas, P., Thompson, K., & Walters, S. (2025). "Easy when everyone is on board": Implementing a framework for managing concussions in New Zealand secondary schools. *New Zealand Journal of Physiotherapy, 53*(2), 52–68. https://doi.org/10.15619/nzjp.v53i2.452

Key Words: Adolescent, Brain Concussion, Implementation, Methodology, Secondary Schools

INTRODUCTION

Mild traumatic head injuries (concussions henceforth) in adolescents are a concern globally and in Aotearoa New Zealand (Theadom et al., 2020). Recent Accident Compensation Corporation (ACC, New Zealand's no-fault personal injury insurance scheme) data found that adolescents (≤ 19 years of age) accounted for 37% of all concussion claims over a 12-month period (Accident Compensation Corporation, 2022). Most adolescents who sustain a concussion recover within 14 days, and can return to learn with no or minimal academic support by 10 days (Putukian et al., 2023). Yet around one-third of adolescents have been identified with persistent post-concussion symptoms, defined as symptom-reporting extending beyond a four-week period (Schneider et al., 2021; Thomas et al., 2018; Zemek et al., 2016). Symptoms can include ongoing fatigue; heightened emotions that impact on concentration, school, and sport performance; and reduced overall quality of life (Valovich McLeod et al., 2017; Wan & Nasr, 2021).

Early, appropriate care and staged return to learning (RTL) and activity are critical for recovery following a concussion (Anderson et al., 2021; Davis et al., 2017; Kontos et al., 2020; Putukian et al., 2023). A systematic review suggested 13–56% of students with a concussion benefit from academic support, particularly those with higher acute symptom severity, longer symptom duration, migraine history, prior concussion (for males), younger age (less than 12 years old), high cognitive activity, and low or inappropriately high physical activity levels early after sports-related concussions (Putukian et al., 2023). RTL and return to sport (RTS) can occur in parallel (Patricios et al., 2023), but full RTL should precede unrestricted or full RTS (Accident Compensation Corporation, 2025; Post et al., 2021).

Academic support for RTL may include environmental adjustments (e.g., modified school attendance, rest breaks, limited screen time), physical adjustments (e.g., avoiding contact, collision, or falls), curriculum adjustments (e.g., extra time to complete or reduced assignments or homework), and testing adjustments (Fetta et al., 2023; Putukian et al., 2023). Yet academic adjustments and return-to-activity guidelines are implemented inconsistently in schools (Carson et al., 2014; Ha et al., 2020; Valovich McLeod et al., 2017). Teachers and school administrators often feel ill-equipped to implement RTL protocols (Romm et al., 2018). Findings from the New Zealand Rugby Concussion Community Initiative corroborate that graduated RTL guidelines were seldom implemented effectively in New Zealand secondary schools (Costa et al., 2024; Salmon et al., 2024), despite concussion-related guidelines being available from the New Zealand Ministry of Education (Te Tāhuhu o te Mātauranga – Ministry of Education, 2019).

Countries such as Canada and the United States of America (USA) have developed online resources for teachers, school staff, and students, and have implemented concussion guidelines in schools (Doucette et al., 2016; Hachem et al., 2016). Similar work in online resource development has also been done in other countries (Robins et al., 2023). Facilitators for such guidelines included the appointment of a concussion policy lead at each school, ongoing education strategies for specific stakeholder groups, and schools fostering relationships with healthcare providers (Mylabathula et al., 2023). Challenges for RTL guidelines include lack of school policy and staff education and poor communication processes (Anderson et al., 2021; Fetta et al., 2023; Gioia, 2017; Shepherd et al., 2024). A framework for managing concussion in schools is needed to address the gap from evidence to practice in New Zealand.

We used a community-based participatory action research (CBPAR) approach (Savin-Baden & Howell-Jamjor, 2013) to co-design a framework for concussion management in schools (for a full protocol, please see Salmon et al., 2023). This was conducted in four phases (Figure 1). In Phase 1a (2021), we co-designed a pilot framework with stakeholders from six schools (Salmon et al., 2025); the next year, we implemented FRANCS with five secondary schools (Phase 1b), evaluated the processes, and refined the framework based on the results of the evaluations (Phase 2); during the third year, we implemented FRANCS in more schools to determine the transferability of the framework to other contexts (Phase 3), and undertook a second round of process evaluation at the end of that year (Phase 4).

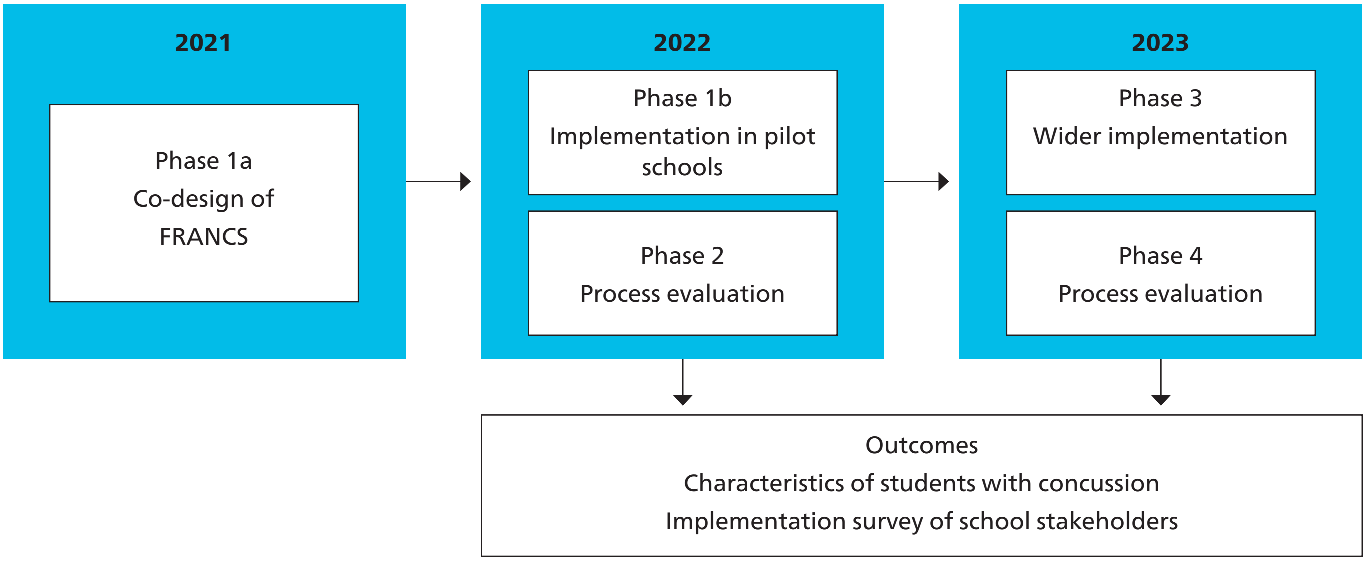
The research questions of this descriptive study were "What were the characteristics of student users of FRANCS during the implementation?" and "What were the school stakeholders' ratings of implementation outcomes?" Thus, the aims were, first, to describe the characteristics of students with concussion utilising the framework and, second, to assess the implementation outcomes as reported by the school stakeholders across the two years of implementation (2022/2023).

METHODS

We used a systems thinking (Hulme & Finch, 2015) and a realist process evaluation approach (Pawson et al., 2005) for this implementation study (Salmon et al., 2023). An iterative process of inquiry and analysis was used, exploring the implementation context, the mechanism by which FRANCS operated, and the characteristics and outcomes for students who sustained a concussion following the implementation of FRANCS (Prashanth et al., 2014). The University of Otago Human (Health) Ethics committee approved the study (reference number D23/046), and all participants (and

Figure 1

Development, Implementation, and Evaluation of Outcomes of the FRANCS



parents for students < 16 years old) signed written informed consent or gave verbal recorded consent.

Phase 1b – Recruitment of schools

For Phase 1a (2021), we had worked with a convenience sample of six schools in Auckland and Dunedin to co-design a framework for concussion support in secondary schools (Salmon et al., 2025). The schools had been part of the New Zealand Rugby Concussion Management Pathway and thus already had a working relationship with selected members of our team (Salmon et al., 2021). We approached their principals to determine availability to also participate in Phases 1b and 2 in 2022. Three schools in Otago agreed to take part. The two Auckland-based schools declined due to the complex post-COVID-19 environment. Two schools in Hawkes Bay were then invited and agreed to participate in Phases 1b and 2. The five school principals were approached again towards the end of that year to determine whether their school would be able to participate in Phases 3 and 4 in 2023.

Eighteen additional schools were approached to be included in Phases 3 and 4 to test the transferability of FRANCS. These were selected based on the geographical proximity to research team members, allowing regular visits to the schools. Seven schools agreed: two in the wider Dunedin metropolitan area, three in North Otago, one in Hawkes Bay, and one in Auckland. Twelve schools initially agreed to participate; however, one withdrew due to consequences of environmental flooding in Hawkes Bay in February 2023. Thus, 11 schools participated in Phases 3 and 4. In total, 12 schools contributed towards implementation and evaluation of FRANCS across the two years of the study.

An assistant research fellow (ARF) was appointed for each region (Auckland, Hawkes Bay, Dunedin, North Otago). Their responsibilities included liaising with schools, assisting with adapting the FRANCS framework to the individual school's contexts, supporting the school staff throughout the year, providing concussion education to stakeholder groups identified by each school, meeting on a weekly basis with students who had sustained a concussion, collecting demographic and concussion-related data, and leading interviews and focus groups throughout the year with key stakeholders.

Phase 1b – Recruitment of participants

School stakeholders included principals or rectors, teachers and deans, special needs coordinators, school administrators and nurses, and sports coordinators/directors. The principals forwarded names and contact emails of relevant school stakeholders the research team could liaise with. Selection of the stakeholders was thus based on the principals' judgement for the most suitable staff members. Central to FRANCS was the identification of a "concussion officer" within each school who could coordinate communication between family, students with concussion, the teaching and support staff, healthcare providers, and the research team (Salmon et al., 2025). The concussion officer could be a school nurse, administrator, teacher, or sports/coaching team member, depending on the school's existing processes.

The concussion officers were asked to forward project information to students who had sustained a concussion and their parents/caregivers and invite them to participate. Contact details of those who agreed were forwarded to the research team. Students (and their parents/guardians) were eligible to participate if they had sustained a suspected or confirmed concussion due to any mechanism, sustained either while at school or not.

Phase 1b – Implementation

Members of the research team worked with school representatives at the beginning of each year to discuss and define implementation strategies, roles, and responsibilities of specific stakeholders, adapting the framework to each school's context. A process checklist (Appendix A) was provided to establish communication lines and key milestones for defining RTL and RTS processes in discussions among staff and coaches. ARFs met regularly with the key stakeholders until such processes were established and provided support throughout the year.

The ARFs consulted with key school stakeholders to determine convenient days and times for brief education sessions. These included presentations to students at school assemblies, parent evening meetings, sports coaches, and teachers at staff meetings, delivered by the ARFs using resources prepared by the research team. Schools were encouraged to share information about the study and FRANCS in regular parent newsletters throughout the year.

Phase 2 – Process evaluation

Throughout both school years, the ARFs collected data from consented students who had sustained a concussion and their parents/caregivers on a weekly basis until the student had successfully completed the RTL protocols. Where possible, the data included RTL and RTS time-points, mapping students' healthcare access (for example, assessment and/or sports clearance by GPs), and compliance with each aspect of the framework. Weekly symptom measures included the Concussion Symptom Severity Score of the New Zealand Rugby Sport Concussion Assessment Tool (Salmon et al., 2022). The Concussion Symptom Severity Score includes 25 symptoms rated on a 4-point Likert scale, with a total score of "75" indicating the maximal symptom severity and "0" indicating no symptoms. Research Electronic Data Capture (REDCap), hosted at the University of Otago, was used to collect the data. Once the student had fully returned to learning, the ARF invited them and their parents to an interview to determine their perspectives of the benefits and barriers of FRANCS. The analysis of these interviews will be reported in a subsequent paper.

As part of Phase 2, we developed an implementation survey with 5-point Likert-style questions, administered to key school stakeholders, evaluating key implementation outcomes (see Table 1 for outcomes' definitions, Proctor et al., 2011). Open-ended questions explored the stakeholders' responses to the Likert scale ratings. We invited school staff involved in the FRANCS implementation to complete the questionnaire via REDCap (Proctor et al., 2011). Descriptive demographic details of all school staff participants were captured.

Phase 3 – Intervention mapping for wider implementation

We revised FRANCS based on Phase 2 results. In 2023, we implemented the revised framework in the four schools that formed part of Phase 1b (the fifth school withdrew from the study due to environmental challenges), and seven additional schools to test the transferability of FRANCS.

Phase 4 – Second round process evaluation

We used the same process followed in Phase 2 to evaluate the implementation of FRANCS in the 12 schools that participated during the 2023 school year.

Statistical analysis

Demographic and concussion-related injury data of participants across both years were pooled and summarised (Phases 2 and 4). The number of sessions with the ARF, first and final Concussion Symptoms Severity Scores, and days from injury to the first and final sessions were compared between sexes using Mann Whitney U tests.

School stakeholder survey data of Phases 2 and 4 were also pooled and were analysed by providing the *Mdn* of the 5-point Likert scale and percentage of responses in the two most favourable ratings ("1", "2"). Content analysis was used to analyse open-ended responses (Graneheim & Lundman, 2004). Responses were coded inductively by one author and collated into potential categories and overarching themes. Themes were reviewed by the research team until final themes were defined and named. For each theme, barriers and facilitators for FRANCS were defined.

RESULTS

Schools

Characteristics of the 12 schools are outlined in Appendix B.

Students with concussion (Phases 1b and 3)

Demographic and concussion injury data, and Concussion Symptoms Severity scores were available for 82 students (57 boys, 25 girls; mean age 15.3 years, SD 1.7, range 12–18 years; Table 2). Two boys each incurred two concussions during the

Table 1

Evaluation Outcomes Assessed via Survey

Outcome	Definition
Acceptability	Satisfaction with the framework; content, complexity, comfort, delivery, and credibility
Appropriateness and feasibility	Perceived fit and actual fit; relevance; compatibility; suitability, usefulness; cultural responsiveness
Adoption	Uptake; initial implementation; intention to try
Fidelity	Degree of intended FRANCS implementation; adherence; quality of programme delivery
Penetration	Integration within school system, degree of adoption across schools
Sustainability	Extent to which FRANCS is maintained or institutionalised

Note. FRANCS = FRamework for maNagement of Concussion at Secondary Schools. Survey based on the work of Proctor et al. (2011).

study period, thus recording a total of 84 concussions. For 56% of the students, the reported concussion was their first. Around one-third of the students (37%) reported having had two or more prior concussions during their lifetime. Just over half (53%) of the concussions had occurred external to the school, and most (87%) were incurred while playing sports. Of the sports-related concussions, 62% had been incurred during rugby.

Around two-thirds of the students (65%) were seen by the ARF at school on a single occasion only, with one girl followed up weekly on five separate occasions. Around half of the cases ($n = 42$) were assessed by a medical doctor and five by physiotherapists, and that information was missing for 37 cases (44%).

Concussion outcomes (Phases 1b and 3)

The *Mdn* duration from the injury to the first visit was 13 days, with the maximum of 124 days for one student. Considering individual schools, it took between a *Mdn* of 7 days (School 3, Appendix B) and 26.5 days (School 12) for the first meeting with an ARF to occur. There was a large range of symptom severity throughout the monitoring period (Table 3, Figure 2). Compared to the boys, the girls attended more sessions, and reported higher symptom severity scores during the first session. For two students, their Concussion Symptom Severity Scores increased (regressed) from one assessment to the next; following this the ARFs informed the concussion officers and contacted the parents, strongly encouraging them to seek medical assessment for their child.

Implementation survey (Phases 2 and 4)

Twenty-three school stakeholders (mean age 50.0 years, SD 10.5; 17 females) completed the implementation survey, 10 at the end of 2022 (Phase 2), 12 at the end of 2023 (Phase 4), and one administrator during both years (24 survey entries). Most ($n = 21$) identified as New Zealand European (Pākehā), one as Tongan, and one as Australian. At least one stakeholder participated from each school: 10 sports directors (or coordinators), four administrators, two teachers and two deans, and one principal, deputy principal, physical education teacher, learning enhancement teacher, and school nurse. The implementation survey results are presented in Table 4.

Themes of open-ended question analysis

The following themes were identified from the open-ended implementation questions: (1) Existing policies and governance; (2) Buy-in and seeing value in the process; (3) Parent, student, and staff compliance; (4) Clarity of roles and responsibilities; (5) Reporting, communication, and awareness of process; (6) Resources, people, and time; (7) FRANCS process, resources, and education; and (8) Research team support and follow-up. These are described in Appendix C and as facilitators or barriers within the following implementation factors (Table 1).

Acceptability, appropriateness, and feasibility of FRANCS

FRANCS had high acceptability and was considered appropriate and feasible for schools (Likert scale *Mdn* of 1 or 2). Most found FRANCS was "easy" to implement (Question 1), useful (Question 2), and applicable (Question 3) for their school. The open-ended comments suggested that most of the schools had not had concussion processes prior to FRANCS (Appendix C). They valued buy-in from the school, parents, and students, and that FRANCS was a driver for student welfare following concussion. Processes were perceived to be clear and helped keep track of the students' recovery. The education sessions were considered helpful to improve concussion awareness and knowledge of various stakeholder groups. Barriers included clear processes not being established during the year of implementation, resources (staff and time), and lack of clarity around roles and responsibilities within the staff.

Adoption, fidelity, and penetration of FRANCS

Except for stakeholder compliance, the implementation attributes of adoption and fidelity were rated high (*Mdn* of 1 or 2). Most suggested they had sufficient resources and support for the implementation (Questions 5, 6). Twenty-one stakeholders found that FRANCS was "mostly" or "completely" successfully implemented (Question 7). Student (Question 9) and parent (Question 11) compliance had the least favourable scores (medians 3, "neither easy or difficult"), suggesting that penetration had not been achieved consistently.

Barriers included remaining challenges for reporting and communication pathways, resource and time challenges, and buy-in from various stakeholders. Suspected non-reporting of concussions by students or their parents, lack of feedback from the student or parents when they had been cleared by a healthcare provider or from teachers to the concussion officer about the students' progress, and lack of understanding of the possible serious consequences of premature RTL and physical activity still appeared to prevail. Finding times to check in with the students on a weekly basis was challenging. Lack of agreement around stand-down periods between different sports posed ongoing challenges.

Facilitators included an established caring student welfare environment within the school. Schools that already had an established support network, functioning internal communication processes, and that knew their students well (perhaps as in smaller schools) appeared to have found implementation easier. While implementation was "easy, straight-forward", sustaining FRANCS was dependent on sufficient staff availability. Having a school nurse on location was considered beneficial for implementation. Overall, the stakeholders appeared to report enhanced awareness of concussion and processes for gradual RTL and RTS.

Sustainability of FRANCS

Twenty-two stakeholders from 11 of the 12 schools reported they would use FRANCS beyond project completion, suggesting possible high sustainability (Question 12). Most comments suggested the framework was important for student welfare and it highlighted the seriousness of concussion to various stakeholder groups, largely improving buy-in. The process appeared to have helped some to keep track of students with concussion.

Table 2

Demographic and Concussion Characteristics of Students Progressing Through FRANCS

Demographics and concussion characteristics	*n*	%
Sex: Girls, boys	25, 57	30.5, 69.5
Ethnicity [a]		
New Zealand European/Pākehā	69	84.1
Māori	8	9.6
Pasifika	6	7.4
Other	7	8.5
Not declared/missing data	4	4.9
School year (*n* = 82)		
Up to and including Year 8	8	9.6
Year 9	15	18.5
Year 10	13	16.0
Year 11	13	16.0
Year 12	18	22.2
Year 13	14	17.3
Number of assessments with the research fellows (*n* = 84 concussions)		
1	46	55.4
2	24	28.9
3	8	9.6
4	3	3.6
5	2	2.4
Number of previous concussions during lifetime (*n* = 82)		
0	46	56.1
1	7	8.5
2 or 3	23	28.0
4 to 7	6	7.3
Missing data	1	1.2
Number of concussions during past 12 months (*n* = 82)		
0	64	78.0
1	9	11.0
2	7	8.5
3	1	1.2
Missing data	1	1.2
Location of current concussion (*n* = 84)		
External to school	43	53.1
At school	38	46.9
Missing data	3	3.6
Sports-related injury (*n* = 84)		
Yes	72	88.9
No	9	11.1
Missing data	3	3.6
Sports (*n* = 72)		
Rugby	44	61.1
Hockey	8	11.1
Football	5	6.9
Basketball	4	5.6
Waterpolo	3	4.2
Martial arts	3	4.2
Other (mountain biking, netball)	4	5.6
Missing data	1	1.4

[a] More than one ethnicity can be selected, thus total is > 82.

Table 3

Number of Assessments, Timepoints, and Concussion Symptom Severity Scores

Characteristic	All			Boys			Girls			*p*
	Mdn	Range	*n*	*Mdn*	Range	*n*	*Mdn*	Range	*n*	
Number of assessments	1.0	1, 5		1.0	1, 3		2.0	1, 5		0.003
Days from injury to baseline assessment	13.0	2, 124	82	12.5	2, 39	57	10.0	3, 55	25	0.503
Baseline CSSS [a]	22.0	0, 53	84	13.8	0, 53	59	30.0	9, 48	25	0.003
Days from injury to final assessment	27.0	11, 96	31	20.0	11, 48	18	41.0	14, 96	13	0.003
Final CSSS [b]	5.0	0, 55	31	4.5	0, 47	18	6.0	1, 55	13	0.523

Note. CSSS = Concussion Symptom Severity Score, with 25 questions rated on a 4-point Likert scale (0 = no symptoms; 75 = highest symptom level).
[a] Counts related to number of concussion cases (two males had two concussions each). [b] Includes only those with more than one assessment.

Figure 2

Concussion Symptom Severity Scores for Individual Participants (n *= 84 concussions)*

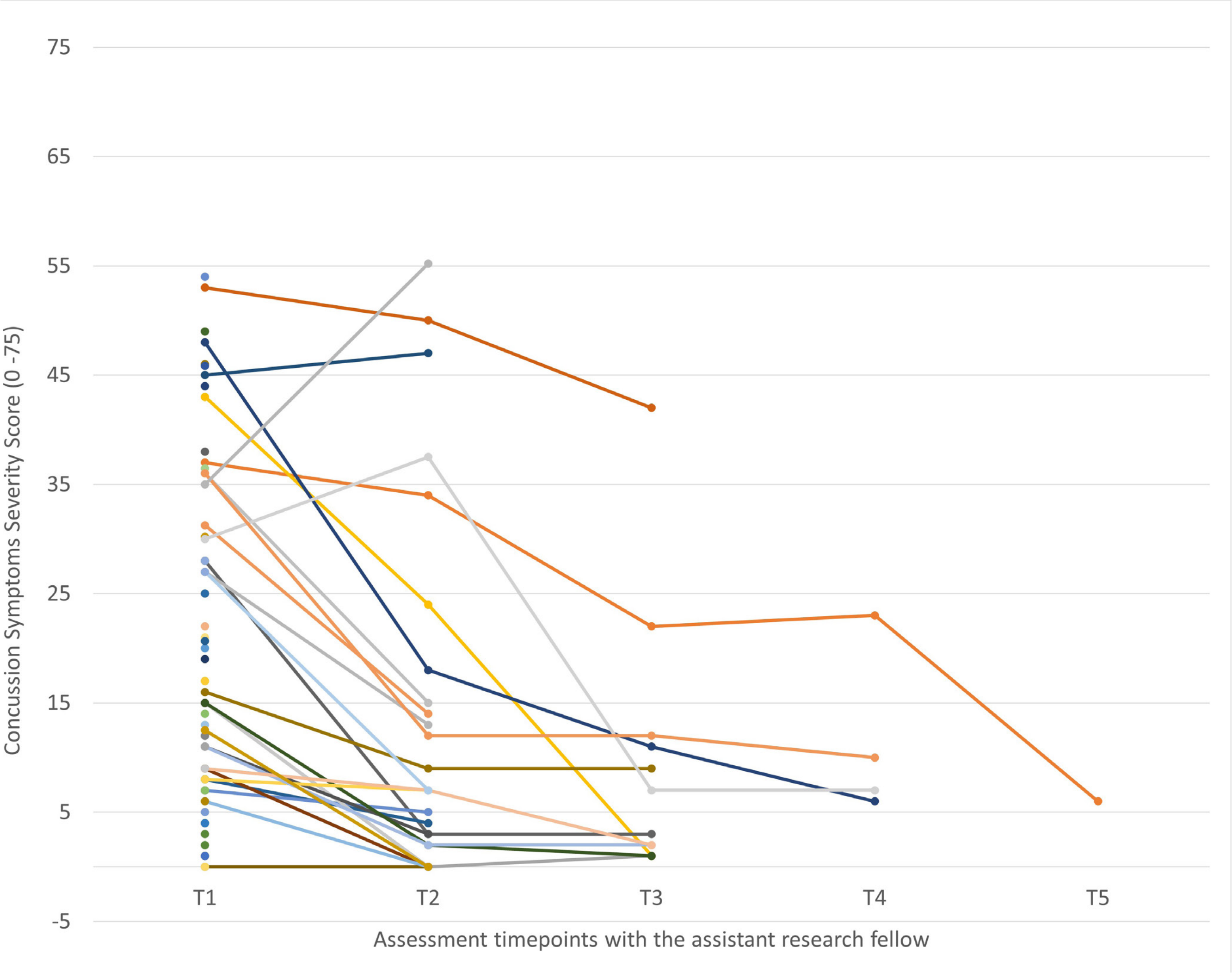


Table 4

Results of the Implementation Survey (n = *24 completed surveys)*

Implementation factor	Likert Scale	*n*	*Mdn* (min, max)	Open-ended question analysis main themes [a]
A. Acceptability, appropriateness, and feasibility				
1. Implementation ease: Overall, how easy or difficult was it to get FRANCS implemented in your school?	Extremely easy	7	2 (1, 3)	– Buy-in and seeing value in the process (B/F) – Resource, people, and time (B/F) – FRANCS process, resources, and education (F) – Support and follow-up from Research Fellows (F) – Concussion reporting, communication, and awareness of process (B) – Existing policies and governance (B) – Clarity around roles and responsibilities (B)
	Easy	11		
	Neither easy nor difficult	6		
	Difficult	0		
	Extremely difficult	0		
2. Usefulness: Do you think FRANCS is useful for managing concussion in your school?	Yes, completely	20	1 (1, 3)	
	Mostly	2		
	Unsure	2		
	Not completely	0		
	Not at all	0		
3. Applicability: Do you think FRANCS worked well/was applicable for all students? (students of any grade level, ethnicity or gender)	Yes, completely	17	1 (1, 3)	
	Mostly	6		
	Unsure	1		
	Not completely	0		
	Not at all	0		
4. Fit: Did you have to make any changes to FRANCS to get it to fit/make it acceptable to your school?	Not at all	11	2 (1, 4)	
	A little	8		
	Unsure	4		
	Somewhat	1		
	A lot	0		

Implementation factor	Likert Scale	*n*	*Mdn* (min, max)	Open-ended question analysis main themes [a]
B. Adoption, fidelity, and penetration				
5. Resources: Did your school have sufficient resources (staff / financial / expertise) for the implementation of FRANCS?	Yes, completely	10	2 (1, 4)	– Buy-in and seeing value (B/F) – Support and follow-up from research fellows (F) – Resources, people, and time (B/F) – FRANCS process, resources, and education – Concussion reporting, communication, and awareness of the process (B/F) – Compliance from parents and students (B) – Existing policies and governance (B) – Clarity around roles and responsibilities (B)
	Mostly	10		
	Unsure	2		
	Not completely	2		
	Not at all	0		
6. Support: Did you receive sufficient support to implement FRANCS in your school?	Yes, completely	18	1 (1, 3)	
	Mostly	4		
	Unsure	2		
	Not completely	0		
	Not at all	0		
7. Implementation success: Do you think FRANCS was successfully implemented in your school (i.e., getting FRANCS up and running in your school)?	Completely	8	2 (1, 4)	
	Mostly	13		
	Unsure	2		
	Not completely	1		
	Not at all	0		
8. Extent: To what extent did the school use FRANCS for the management of concussion?	Completely, used all aspects	10	2 (1, 3)	
	Partially, used most aspects	12		
	Unsure	2		
	Some, used some aspects	0		
	Never used FRANCS	0		

Implementation factor	Likert Scale	*n*	*Mdn* (min, max)	Open-ended question analysis main themes [a]
9. Students' compliance: How easy or difficult was it to get students to follow and comply with FRANCS?	Extremely easy	4	3 (1, 5)	
	Easy	6		
	Neither easy nor difficult	12		
	Difficult	1		
	Extremely difficult	1		
10. Staff compliance: How easy or difficult was it to get school staff to follow and comply with FRANCS?	Extremely easy	5	2 (1, 4)	
	Easy	9		
	Neither easy nor difficult	8		
	Difficult	1		
	Extremely difficult	1		
11. Parents' compliance: How easy or difficult was it to get parents to follow and comply with FRANCS?	Extremely easy	2	3 (1, 4)	
	Easy	6		
	Neither easy nor difficult	14		
	Difficult	2		
	Extremely difficult	0		
C. Sustainability				
12. Future Use: Do you think FRANCS will still be used in your school after completion of the research project?	Yes, completely		1 (1, 3)	– Buy-in and seeing value in the process (B/F)
	Mostly			
	Unsure			
	Not completely			
	Not at all			

Note. B = barriers; F = facilitators; FRANCS = FRamework for maNagement of Concussion at Secondary Schools.

[a] See Appendix C for description of themes.

DISCUSSION

We previously used CBPAR to co-design a framework for implementing concussion support in secondary schools (Phase 1b, Salmon et al., 2025). In this paper we profiled students with concussion across 12 schools and determined implementation outcomes, rated by the school stakeholders. Across the two years, 84 concussions (82 students) were reported and managed using the framework. Girls accounted for 30% of the participants, reported significantly higher Concussion Symptom Severity Scores during their first assessment, and generally attended more follow-up sessions with the ARF than the boys.

We had planned to meet with students with suspected concussion within the first week following the injury. However, the first meeting with the ARF was a median 13 days following the injury, with a maximum time just over 17 weeks for one student, challenging the fidelity and penetration of implementation of the follow-up assessments. The timing of assessments was challenged by delayed self-report, logistical issues for matching the ARF's availability with the students' school timetable, and the only communication mode with students being via text or emails when they had been instructed to limit screen time following their concussion. Possible concussion-related forgetfulness may have contributed to non-attendance of some sessions. It is also possible the students did not understand the seriousness of concussion, and thus may have lacked motivation.

Fifty-eight cases of concussion (69%) had Concussion Symptom Severity Scores up to 25/75, suggesting on average they had no or "mild" symptoms. Most students were thus near-symptom resolution when meeting with the ARF for the first time. On the other hand, "moderate' (average 26 – 50/75, 28.6% of cases) and "severe" (above 50/75, 2.9% of cases) scores for some students are concerning. Adolescents with concussion are at increased odds of reporting poor mental health and, particularly males, having two or more concussions within 12 months have greater odds of reporting suicidal attempts compared to students reporting one concussive event (Kay et al., 2023). Post-traumatic amnesia, sleep quality, and depression are associated with recovery in adolescents (Wilmoth et al., 2022). Anti-social behaviour has also been described in about one-third of people with long-term post-concussion symptoms in a New Zealand community cohort (Theadom et al., 2024). Taking longer than one month to recover post-concussion also predicted exiting the workforce due to the injury within four years, nearly one fifth of people in another cohort study (Theadom et al., 2017). In turn, exiting the workforce following concussion can have a significant impact on the labour market (Fouquet et al., 2024).

It is critical to identify and implement care and support for this smaller, but significant (~ 30%), group of adolescents who are at risk of having an ongoing burden in terms of symptoms, psycho-social consequences, cognitive and learning ability, and, potentially inability to enter and maintain the workforce after experiencing a concussion. Teachers and school support staff could contribute towards improving post-concussion outcomes, not only in terms of short-term RTL and RTS, but also in the longer term to enhance employability of the student beyond their secondary school years. Informed teachers, sports coaches, and school personnel could identify such students at risk based on symptoms complaints, and possible changed behaviour, academic performance, or physical performance, for example during physical education classes or sports training. Besides implementing learning support, school personnel could also have an important role of prompting parents or guardians to organise and attend medical doctor appointments for diagnosis and clearance if their child had a suspected concussion.

Implementation

Despite the challenges of arranging timely meetings with students post-concussion and documenting recovery timepoints, FRANCS appeared to be "easy" to implement and adopt, based on the school staff implementation survey. Based on the open-ended questions of the implementation survey, school stakeholders appreciated the support of the ARFs, suggesting that external support may be needed to assist schools to implement and maintain FRANCS. Specifically, the ARFs met with school staff at the beginning of the year to modify the process for the specific schools' context and resources. The ARFs also provided education sessions and regular follow-up with students, which in future would need to be sustained by school staff.

More work is needed to improve stakeholder buy-in and seeing value in the process (thereby enhancing penetration), including from the school leadership team, administrators, teachers in daily contact with students, coaches, and parents (Proctor et al., 2011). Engagement with staff and parents was inconsistent across the schools, and there appeared to be a remaining lack of understanding of the potential seriousness of concussion despite education sessions, as has been reported internationally (Mylabathula et al., 2023). Provision of study information to students was dependent on support by each school's concussion officer, whose role appeared critical for the success of the implementation.

Varied and continued delivery methods of concussion education and resources are required to address the multiple stakeholders who can influence and support the adolescents' concussion recovery (Mallory et al., 2022). Repeated education sessions may be needed throughout the year, particularly due to high turnover rate of staff, and parents often engaging only when their child had a concussion. Didactic education sessions can be considered to be providing information "just in case", which may generate low interest or uptake and may explain low compliance reported for parents and students. To complement those education strategies, resources that are accessible for school staff, parents, and students are needed to provide information and guidance "just in time" (right time and right place, Chueh & Barnett, 1997; McGowan et al., 2008). "Just in time" training includes relevant information being accessible when a specific student has experienced a suspected concussion. While online concussion resources for New Zealand schools are available (Te Tāhuhu o te Mātauranga – Ministry of Education, 2019), our findings suggest awareness of these was low. Reminders of such resources and of the schools' processes may be needed at student assemblies, parent newsletters, and staff and coaching meetings throughout the school year. Recent changes in ACC guidelines for a uniform stand-down period following concussion across all sports are likely to decrease the challenge faced by school staff with implementing these (Accident Compensation Corporation, 2025).

The project was undertaken in the immediate post-COVID period (2022/2023), where high student absenteeism and increased staff sick leave and turnover created implementation challenges. Schools are complex systems with multiple stakeholders, where concussion education and support may not always be a priority. In February 2023, devastating floods in Auckland and Hawkes Bay further required schools to allocate staff and logistical resources to urgent needs. Schools face competing demands for adolescent wellbeing support, including mental health education, smoking and vaping prevention, sexuality and relationships education, and bullying prevention. In the USA, research indicates students who had tried cigarette smoking, used an electronic vapour product, or considered suicide experienced a higher prevalence of sports-related concussions compared to peers who had not (Sarmiento et al., 2023). Balancing the priority of concussion education and support within the complex and resource-constrained school environment remains challenging, especially with growing expectations to deliver extensive wellbeing education in an already crowded curriculum.

Methodological considerations

The development and implementation of FRANCS was based on co-design with school stakeholders, thus "by" schools "for" New Zealand schools (Salmon et al., 2025). We included 12 schools from three different geographical areas across socioeconomic levels, including one in a rural settlement. However, the study design did not allow us to determine the actual incidence of concussion in the schools; thus, the compliance or reporting could not be determined. The relative participation of Māori and Pasifika students was 9.6% and 7.4% respectively. ACC concussion statistics suggest that concussion claims by Māori contributed towards 17.6% and for Pasifika 7.2% of all claims for the age group up to 19 years. Despite including four schools with a Māori student ratio greater than 17%, Māori, in particular, were under-represented in the FRANCS project. Enhanced involvement by Māori stakeholders to improve access to and equity for concussion prevention and management is needed. Although we had planned to define healthcare access, and RTL and RTS timepoints for each student with concussion (Salmon et al., 2023), this proved to be difficult as more than half of the participants attended only one session with the ARF. The implementation survey did not allow depth of analysis, and results of qualitative interviews will complement the results in a future paper.

Implications

Parents' and coaches' attitudes towards concussion can influence students' timely self-reporting of their concussion (Warmath et al., 2022). Reporting a concussion promptly is crucial for initiating individual RTL and RTS plans. Continued education strategies across the school year ("just-in-case") and accessible resources ("just-in-time") are needed to improve concussion awareness and attitudes of students, teaching and support staff, coaches, and parents. Improving school staff ability to identify and support students with possible concussion-related behavioural issues and symptoms, as well as those with mental wellness challenges (Sarmiento et al., 2023), would be of benefit for the overall wellbeing of students. Future research is needed to explore the effectiveness of FRANCS to improve concussion outcomes in schools in the longer term. Specifically, continued CBPAR is needed to enhance involvement and access to support by Māori and Pasifika students and their whānau/aiga. Further strategies are needed to improve engagement within schools and to prepare for a national roll-out.

CONCLUSION

We implemented a FRANCS across 12 schools over two years, capturing data of 82 students with concussion. Most concussions were sports-related and 21 of 24 school stakeholders rated FRANCS as successfully implemented, and 22 (from 11 of the 12 schools) would use FRANCS beyond project completion. Support provided by the ARFs and FRANCS' processes were highly valued. Challenges included lack of time and inconsistent buy-in from some students, parents, staff, and coaches. FRANCS can be adapted to individual schools' contexts and buy-in, and good communication processes are needed from all members of the school community to sustain the processes.

KEY POINTS

1. We implemented a FRANCS in 12 schools across Aotearoa New Zealand.
2. Eighty-two students reported their concussion and were monitored by a concussion officer in each school and by an assistant research fellow.
3. The concussion officer passed information to relevant teachers to implement a return to learn process.
4. School stakeholders completed an implementation survey at the end of each of the two years, and most suggested that they would continue using the framework in future.

DISCLOSURES

This study was funded by a Lottery Health Grant. The authors declare no other conflict of interest.

PERMISSIONS

This study was approved by the University of Otago Human Ethics Committee (reference number D23/046).

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CONTRIBUTIONS OF AUTHORS

Conceptualisation and methodology, DS, MB, KM, SW, SK, and GS; formal analysis, GS, DS, and MB; interpretation, all; writing – original draft preparation, GS, MB, and RC; writing – review and editing, all; data curation and project administration, GS, CS, RC, KM, MB, and AZ.

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Appendix A

IMPLEMENTATION PLANNING CHECKLIST FOR SCHOOLS

Checklist	Name	Notes
1. Identifying key stakeholders		
Stakeholders involved in initial implementation of FRANCS (driving team) For example, school principal, director of sports, school nurse Available stakeholders to be involved in concussion management responsibilities in school. For example deans, nurses, health and safety committee, sport coordinator		
2. Other resources available		
For example, school clinic – how may this be utilised as part of FRANCS; or specific communication platforms; or networks/relationships; or people that can help support		
3. Key responsibilities	Assigned to [role; name(s)]	Notes/How will this be done?
– Designation of concussion officer(s) role within the school. *"Who oversees concussion management?"* (Responsibilities of concussion manager contained in the FRANCS guideline book) – Ensuring all relevant stakeholders understand their responsibilities – Establish a direct way of reporting concussion (e.g., specific email address concussion@…school.nz, which is linked to the concussion officer's email). *"How is concussion going to be reported?"* – Activate an automated email response linked to the reporting email address, providing the person reporting the concussion with immediate advice (template for this email provided by research team). *"How will concussion notification/advice be shared?"* – Identifying and reporting responsibilities communicated to all coaches/manger/parents. *"Does everyone know how to report concussion?"* – Organisation of appropriate medical treatment. *"How/when will students see doctor?"* – What other health provider is involved, such as a physiotherapist or a member of the concussion service? *"Who will communicate with that provider, if needed?"* – Develop a communication plan that includes all relevant stakeholders. *"How will all teachers, parents, coaches be informed of concussion/stand down?"* – Activating and documenting a tailored return to learn plan (accommodations, etc). *"Who manages academic accommodations?"* – Monitoring students' return to learn. *"Who checks in on student?" "How are students to be tracked and reported?"* – Making educational content provided as part of FRANCS accessible to all stakeholders within schools (i.e., concussion cards for coaches, educational resources for parents, students, etc.)		

Note. FRANCS = Framework for maNagement of Concussion at Secondary Schools.

Appendix B

SCHOOL DEMOGRAPHIC DATA

School ID	Phases 1b, 2 (2022)	Phases 3, 4 (2023)	Gender	Student *n*	Decile/ equity index [a]	Ethnicity [b]				Urban/rural [c]
						Māori	Pasifika	European/ Pākehā	Other	
1	✓		G	565	3/506	51.7	29.6	37.7	11.2	Large urban
2	✓	✓	G	314	4/394	10.8	0	92.4	7.1	Medium urban
3	✓	✓	B	845	7/457	20.2	7.9	73.1	14.9	Major urban
4	✓	✓	G	714	8/434	15.0	6.6	76.6	19.1	Major urban
5	✓	✓	B	514	10/386	10.9	1.6	89.5	11.5	Major urban
6		✓	B	526	9/396	12.4	1.7	85.9	9.9	Large urban
7		✓	G	1,567	10/NA	3.0	5.0	48.8	48.8	Major urban
8		✓	B/G	1,218	7/455	16.3	2.3	90.7	6.2	Medium urban
9		✓	B/G	678	8/429	14.2	7.2	71.5	22.7	Major urban
10		✓	B/G	149	6/483	28.2	5.4	90.6	4.7	Rural settlement
11		✓	G	371	6/480	12.4	12.7	83.3	6.5	Medium urban
12		✓	B	379	6/485	19.3	12.9	73.6	5.3	Medium urban

Note. B = boys; G = girls; NA = not applicable.

[a] Decile: Measures the extent to which students live in low socioeconomic communities. Decile 1 schools are the 10% of schools with the highest proportion of students from low socioeconomic communities; this measurement was last used in 2022. Equity index: Measures the extent to which a school draws its children from low socioeconomic communities and is used to determine a school's level of government equity funding (since 2023). A higher index indicates a higher proportion of students facing socioeconomic challenges (Willis, 2024). [b] Ethnicity: Students who are affiliated in more than one ethnic group are counted in each ethnic group. [c] Based on to data from Stats NZ (2023).

Appendix C

OPEN-ENDED SURVEY ANALYSIS: DESCRIPTION OF THEMES

Theme	Implementation factor	Summary of facilitators and barriers
Existing policies and governance	A, B	Facilitator Schools that are already following some similar processes. Barrier Policies or processes are difficult to ratify, implemented as a guideline instead. Difficulty with sports with different return to sports periods.
Buy-in and seeing value in the process	A, B, C	Facilitator School staff seeing value in improved management of students, structured. process, clear reporting system, important for health and wellbeing of students, improved follow-up and record keeping. Schools not having concussion processes prior to the project and see the need/importance of having a structured process in place. FRANCS provided authority to manage students appropriately (against push-back attitudes from parents/students). FRANCS education and resources were useful, simple way to improve knowledge. Easy when everyone is on board. Enhanced parent, coaches, student, and teacher concussion knowledge; staff taking concussion seriously. Buy-in from school staff who are passionate about welfare, see it as their duty of care.

Theme	Implementation factor	Summary of facilitators and barriers
		Barrier Some modifications required to optimise success of FRANCS, needed more input from key staff. Lack of buy-in at governance level, or lack of buy-in in individual sports. Unsure if FRANCS is valuable; value will only really be determined once study results are available, or more is known, or staff did not have enough involvement to comment.
Parent, student and staff compliance	B	Barrier Easy to implement but may be difficult for staff to maintain FRANCS. Parents not taking concussion seriously and wanting their children to return to sport, students desire to get back playing sport too soon. Students' compliance to process and pushing to return.
Clarity of roles and responsibilities	A, B	Barrier Lack of clarity, responsibilities not assigned around FRANCS process. Students unclear on what their responsibilities are as part of process.
Reporting, communication, and awareness of process	A, B	Facilitator Staff awareness of process. Strong lines of communication across staff and parents. Recording approach employed by school that facilitates communication to all relevant stakeholders. Barrier Students/coaches/parents not reporting or communicating about concussion, concussions sustained outside of school. If no centralised form for documenting concussions, and just using paper incident reports, or emails result in another step that must be completed – concussions are not always captured/recorded. Not keeping records up to date, or not closing cases if recovered. Difficulties with clear lines of communication/methods of communicating. Communication not always reaching relevant teachers/staff. Not all staff or sports team members familiarised with the processes, including recording students with concussion. Communication from doctors: Left to students to communicate plan back to the school.
Resources, people, and time	A, B	Facilitator Existing support systems: Having a school nurse/medic that can help facilitate process, supportive environment, existing good connection with students regarding their wellbeing. Close-knit/small school, knowing the parents, involved coaches. Barrier Human resources: Time challenges of staff, staff with multiple roles. Finding time to catch up with students and parents, informing staff of the processes.
FRANCS process, resources, and education	A, B	Facilitator Easy straightforward process, resources and templates. Concussion awareness and knowledge through education.
Research team support and follow-up	A, B	Facilitator (major) Support from project team following up with students and parents. Direction, support, and communication from project team given to school. Barrier Needed more guidance regarding the process.

Note. A = acceptability, appropriateness, and feasibility; B = adoption, fidelity, and penetration; C = sustainability.

Participants' Experiences of a New Menstrual-cycle Phase-based Anterior Cruciate Ligament Rehabilitation Programme: A Post-hoc Qualitative Study

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ABSTRACT

Anterior cruciate ligament (ACL) ruptures are a common problem within the sporting population. Reconstructive surgery and rehabilitation are commonly utilised to improve knee function. Women are disproportionately represented in the ACL rupture population and have poorer clinical outcomes. Research has shown that phasing exercise with the menstrual cycle improves clinical measures of muscle performance. A recently completed randomised controlled trial examined the efficacy of a menstrual cycle synchronised ACL rehabilitation programme. This study aimed to gain participant perspectives of this new menstrual cycle phase-based anterior cruciate ligament rehabilitation programme. Six women participated in research interviews via video conferencing in 2023. All had completed the intervention with satisfactory clinical outcomes. Three themes were constructed from the interviews using reflexive thematic analysis: Acceptability, connectedness, and strength. Overall, the programme was perceived as acceptable. Participants reported positive connections with their physiotherapists and their bodies throughout the programme. An increased sense of strength, both physical and mental, was also experienced. The phasing of the programme was also found to improve motivation. These factors are shown to improve patient engagement in long-term rehabilitation. Therefore, this study supports the premise that menstrual cycle-synced rehabilitation may enhance participant engagement in the rehabilitation process.

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Key Words: Anterior Cruciate Ligament; Female; Menstrual Cycle; Rehabilitation; Resistance Training

INTRODUCTION

Anterior cruciate ligament (ACL) ruptures are disabling traumatic knee events that frequently occur among physically active populations. This significant injury commonly arises in sports environments, caused by either a high force direction change or rapid deceleration, rupturing the ligament (Parsons et al., 2021). Physiotherapy and/or reconstructive surgery are usually required to restore knee function post-rupture (Beynnon et al., 2005; Fjellman-Wiklund et al., 2022). Boys and men account for a larger percentage of these injuries (Fjellman-Wiklund et al., 2022); however, when adjusted for sex differences in sporting participation, women are more likely to sustain ACL ruptures (Sutherland et al., 2019). A combination of individual and environmental influences contribute to women's ACL injury risk, which is two to six times higher than men's (Bruder et al., 2023). Additionally, women return to their preinjury level of sport at a significantly lower rate than men (52% versus 61%) (Ardern et al., 2014).

Current ACL reconstruction (ACLR) protocols prescribe progressive overload to increase knee strength prior to return to sport (RTS) (O'Loughlin et al., 2023). However, these protocols are predominantly based on research conducted on men, despite evidence that women have specific physiological and psychological needs during rehabilitation (Bruder et al., 2023; O'Loughlin et al., 2023). This lack of female-centric guidelines impacts the quality of care that female ACLR patients receive (O'Loughlin et al., 2022a). Standardised rehabilitation protocols have been repeatedly found to be demotivating and arduous, with patients, especially women, expressing that individualised approaches are more effective in reaching their goals (DiSanti et al., 2018; Dunphy et al., 2022; Scott et al., 2018; Welling et al., 2022).

Furthermore, ACLR patients' sense of autonomy over their situation is predictive of perceived barriers to engaging in rehabilitation (Burland et al., 2020; Welling et al., 2022). Men and women who undergo ACLR are aware of the importance of engaging with prescribed exercise postoperatively

(Kaur et al., 2019), but struggle to find the motivation to do so (Kaur et al., 2019; Mahood et al., 2020; Scott et al., 2018). Burland et al. (2020) and DiSanti et al. (2018) observe that a combination of psychological, physical, and environmental factors affect experiences of motivation and perceived disability during rehabilitation. Overall, the current androcentric medical and research biases may be correlated to inequities in ACLR outcomes.

One physiological factor that has been largely overlooked in ACLR rehabilitation is the menstrual cycle (O'Loughlin et al., 2023). The menstrual cycle has four phases, during which the two main female steroid hormones, oestrogen and progesterone, fluctuate at varying ratios over the duration of a month (Janse de Jonge et al., 2019). The two main phases of this cycle, follicular and luteal, are characterised by the peaks in oestrogen and progesterone levels respectively (Janse de Jonge et al., 2019). Existing research has shown the effectiveness of phasing strength and power-based exercise programmes in alignment with the menstrual cycle to promote strength gains and muscular hypertrophy (Sung et al., 2014). Oestrogen effects anabolic changes on skeletal muscle, while progesterone has been thought to have a catabolic effect (Sims & Heather, 2018). Repeated follicular phase-based strength training has been shown to provide improvements in lean muscle mass and strength, and affect strength gains and muscular hypertrophy for eumenorrheic females in some studies (Markofski & Braun, 2014; Wikström-Frisén, 2017), but not all (Sakamaki-Sunaga et al., 2016). These conflicting results may be due to the small sample sizes and incomplete hormonal profile verification (O'Loughlin et al., 2023; Elliot-Sale et al., 2021). A recent systematic review has supported the potential of cycle-based training for improving strength gains and muscular hypertrophy (Thompson et al., 2020) (Figure 1).

Despite the growing research in sex specific training, sex and gender considerations remain underexplored in ACLR rehabilitation research. Existing qualitative research has established the importance of customising ACLR rehabilitation prescription according to individual needs (DiSanti et al., 2018; Kaur et al., 2019). Lisee et al. (2020) identified gendered differences in patient experience during ACL rehabilitation, as they noted that women observed more fluctuations in mood, motivation, and strength than men; however, they did not consider a correlation between menstruation and these variations. Understanding how hormones affect rehabilitation experiences and outcomes may inform improved care for women.

Currently, only one study by O'Loughlin et al (2024) has researched the effect of menstrual cycle synchronised rehabilitation on ACLR outcomes. Participants had similar limb symmetry following menstrual cycle synchronised rehabilitation versus good quality usual care. Therefore, this study recommended ACLR patients and physiotherapists may consider undertaking such rehabilitation as a feasible option, particularly for women who prefer this individualised, menstrual cycle-synchronised training. Another aspect of the work leading to the randomised control trial (RCT) was to ask participants how they might engage in a menstrual synchronised programme (O'Loughlin et al., 2022a). Now that the results of the RCT have been published (O'Loughlin et al., 2024), the aim of this paper was to understand how participants in the RCT found the co-designed programme. This study aims to build on the research by O'Loughlin et al. (2024) to further understand participants' experiences of the programme.

METHODS

Ethics approval was granted by the Auckland University of Technology Ethics Committee (reference number 23/40). This study follows a qualitative descriptive design, within an interpretivist paradigm, allowing for contextual understanding of the research findings as applied to the participant group. This project is informed by a feminist lens, as addressing sex-based inequities in healthcare is central to the primary researcher's positionality (Grant & Giddings, 2002). This research utilises a relativist ontology (Fox & Ramazanoglu, 2008). It is designed to better understand patient experiences of a rehabilitation programme targeting health outcomes for women. Reflexive thematic analysis pioneered by Braun and Clarke (2006) is used to ensure this research was coded by females and therefore useful to the people it seeks to benefit. The study is reported in line with Consolidated Criteria for Reporting Qualitative Research (COREQ) guidelines (Tong et al., 2007).

Participant recruitment and eligibility

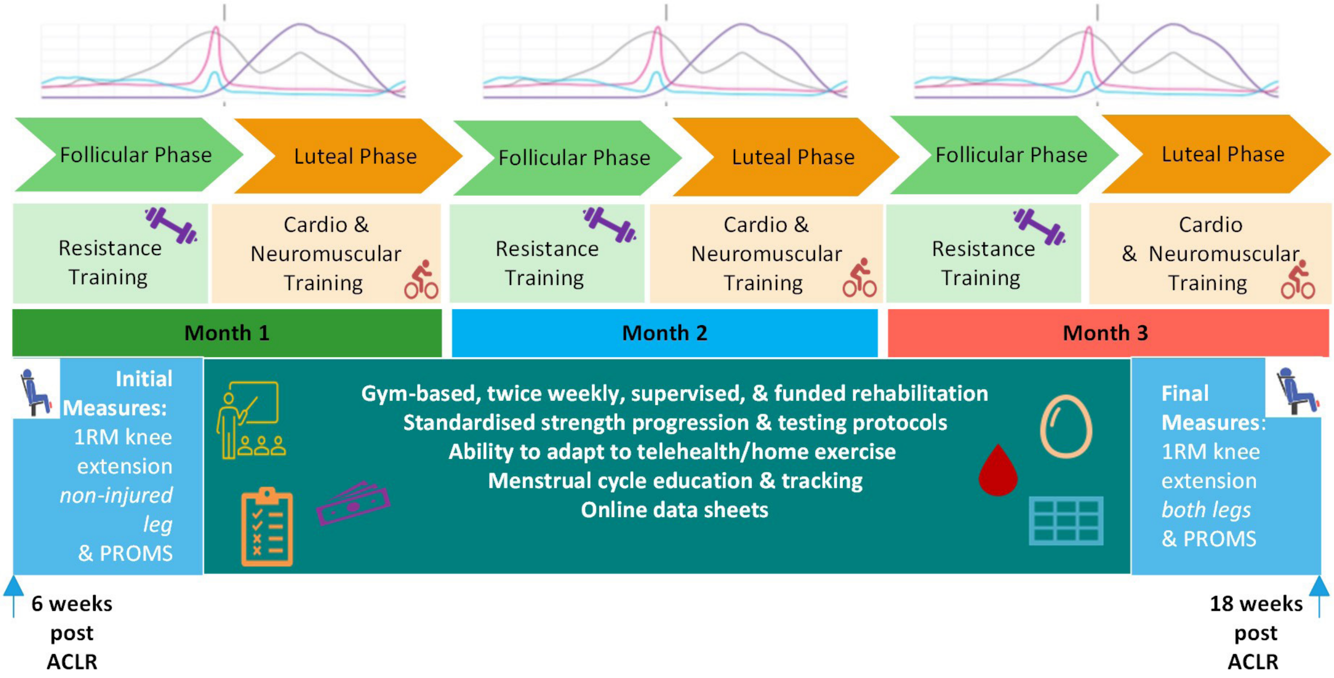
Using a purposive recruitment strategy, 19 intervention group participants who had completed the menstrual cycle synchronised rehabilitation previously (O'Loughlin et al., 2024) were emailed by the lead researcher (EOL) to ascertain their interest in further research participation. These participants underwent a 12-week fully funded, gym-based, post-operative ACLR rehabilitation programme synchronised with their menstrual cycle. As part of the programme, participants confirmed their menstrual cycle phases using calendar tracking, basal body temperature, and urinary ovulation testing. All participants included in the final analysis were regularly cycling and ovulating. They carried out resistance training twice weekly in the follicular phase of their menstrual cycle, and neuromuscular and cardiovascular exercise twice weekly in the luteal phase. Those who could converse in English were eligible. Seven potential participants who expressed interest were provided the primary researcher's (JH) contact details. When contacted, JH supplied information and consent forms. The primary researcher provided participants with the reasons for doing the research, including her interest in female-specific musculoskeletal research. Six participants agreed to participate in the research, yielding a response rate of 31.6%. The first two participants had two interviews each, as the primary researcher added questions to help refine the interview process following their initial interviews. Participants were not financially incentivised to participate in the study; however, a koha was offered in thanks for their participation at the conclusion of the research project.

Data collection

The primary researcher and interviewer (JH) was a female

Figure 1

Menstrual Cycle Synchronised Anterior Cruciate Rehabilitation



Note. PROMS = patient reported outcome measures; 1RM = one-repetition maximum.

Visual representation of the menstrual cycle phase-based quadriceps resistance training programme. Training commenced at six weeks post-surgery and continued until 18 weeks post-surgery. Participants attended twice weekly at a gym-based setting for supervised rehabilitation. These sessions were adapted if needed, i.e., telehealth. The researcher, physiotherapist, and participants entered all data into an online datasheet. Females received menstrual cycle education and inputted information into their datasheet to establish their menstrual cycle phase. Participants engaged in resistance training in the follicular phase sessions, and cardiovascular and neuromuscular exercises in the luteal phase sessions. Physiotherapists used standardised strength testing to measure outcomes and standardised progression protocols to prescribe strength exercises. Funding was available for females to attend sessions. Image used with permission (O'Loughlin et al., 2022a).

physiotherapy honours student in the final year of study. The other two researchers were a female early career physiotherapy researcher (EOL) and an experienced male physiotherapy professor (DR). EOL and DR were lead investigators in the previous RCT study. A set of pre-determined questions (Table 2) were collated in collaboration with DR and EOL to guide the interviews. The questions were based on previous literature (O'Loughlin et al., 2024) and aimed to explore both logistical and psychological experiences of women who underwent the menstrual cycle-synchronised programme. Follow-up questions were used to gather more data where appropriate (Carter & Lubinsky, 2015). Video interviews took place between March and August 2023. All interviews were audio recorded via Zoom recording (Zoom Video Communications, Inc., San Jose, CA, USA) and on the researcher's mobile phone, to ensure a technology failure would not cause a loss of data. All interviews lasted approximately 30 min. Interviews were conducted until the research team deemed that the information gathered was of adequate power, richness, and detail to answer the research question and so no further recruitment was carried out (Malterud et al., 2015). Audio recordings were transcribed verbatim using Otter AI (Otter. AI, Mountain View, CA, USA). Only the researcher and participants were present for the interviews. Transcripts were reviewed by JH to ensure accuracy, and any discrepancies were edited and corrected. Transcripts were not returned to participants, and no repeat interviews were carried out.

Data analysis

Throughout the research process, the primary researcher (JH) kept a research journal, utilising reflexivity and reflection to enhance the research process (Thorne, 2016). Thematic analysis was utilised as informed by Terry et al. (2017), to create themes from the data collected during the research interviews. Reflexive thematic analysis was selected as it aligns with the interpretive framework of this study and recognises the active role of the researcher in theme development, rather than viewing themes as passively emerging from the data. This approach is particularly appropriate in qualitative health research, such as in this study, where the researcher's subjectivity is viewed as a resource, not a threat to rigour (Braun & Clarke, 2021). Thematic analysis followed the six phases of thematic analysis as outlined by Terry et al. (2017) including familiarisation with the data, initial code generation, searching for and reviewing themes, defining and naming themes, and report production.

Table 1

List of Research Interview Questions

	Research interview questions
1	How did you injure your ACL?
2	What was the goal of your ACL rehabilitation and surgery?
3	What was your previous exercise experience?
4	What was your previous experience of injury rehabilitation (if any?)
5	Have you previously followed a prescribed exercise plan?
6	What kind of plan was it?
7	Where was it from (i.e., physiotherapist or other professional)?
8	Have you worked with a physiotherapist previously?
9	How do you think this programme was compared to previous injury rehabilitation programmes you have followed/ used?
10	What was your experience of the volume of physiotherapy (twice weekly sessions)?
11	Was it a good amount?
12	What did you think of the emphasis on strength training during the programme?
13	Was this something new to you?
14	Did you find it enjoyable?
15	What about it was enjoyable?
16	What do you think about the level of supervision provided during the programme?
17	Which aspects of the programme did you find the most difficult?
18	Which aspects did you find the most useful or enjoyable?
19	What do you feel you have gained from the programme?
20	Is there any aspect of the programme that you think could be changed to help you gain more from the programme?
21	How did you find tracking your cycle – including taking your temperature, peeing on the urinary stick, and noting your periods on the chart?
22	Was it difficult? What about it was difficult?
23	Did you enjoy it? Do you feel you learned anything from it?
24	How did you find entering your data on the spreadsheet?
25	Is this sort of phased training something you intend to use in future? Why/why not?
26	Would you consider using it again while injured? Why/why not?
27	Did you find it to be a positive experience overall and if so, why?

Note. ACL = anterior cruciate ligament.

The primary researcher (JH) led the initial stages, repeatedly reading the transcripts to support familiarisation. She also drafted preliminary codes and candidate themes inductively and iteratively and coded the data in Microsoft Word (Microsoft Corporation, Version 365, 2024, Redmond, WA: Microsoft Corporation). JH then discussed the codes and candidate themes in depth with the other two members of the research team (DR and EOL). These discussions, with all members of the research team, encouraged critical reflection, alternative interpretations of the data, and refinement of themes (Braun & Clarke, 2021). The team, overall, helped to ensure the themes were robust and grounded in the data (Braun & Clarke, 2023).

RESULTS

Six participants participated in qualitative interviews. All were women who had completed the menstrual cycle phase-based ACLR programme within 12 months of their interview. All six participants were physically fit and active prior to injuring their ACL. The participants were familiar with using gym facilities, and most had previously participated in team sports. Full details of participant demographics can be found in Table 2. All participants had previously seen a physiotherapist for a musculoskeletal injury. Participant (P) 1 had previously ruptured the ACL of her contralateral knee and undergone reconstructive surgery. This provided important context for her data, as she directly compared her experience of the menstrual cycle phase-based programme to her previous ACLR. Participant 2 (P2) had previously had patellofemoral stabilisation surgery. She noted difficulty rehabilitating her knee following the surgery and experienced considerable loss of muscle tone, which provided context for her comparisons of previous knee surgery rehabilitation. Both P1 and P6 initially attempted conservative treatment to rehabilitate their injured knee; however, due to unsatisfactory outcomes, they underwent reconstructive surgery. The other four

Table 2

Demographic Characteristics of Participants

Participant	Age (years)	Sex	Ethnicity	Resistance training status $^{a, b, c}$	ACL rupture date	ACL surgery date	Sport ^{d}	Rehabilitation goal ^{e}
1	41	F	NZ European	Trained	1 July 2021	7 May 2022	Soccer	Return to sport WKS
2	38	F	NZ European	Trained	8 April 2021	21 September 2021	Soccer	Return to normal daily activity WKS
3	35	F	NZ European	Trained	24 July 2022	28 September 2022	Netball	Return to normal daily activity WKS
4	42	F	Asian	Untrained	19 January 2022	20 April 2022	Skiing	Return to sport WKS
5	21	F	NZ European	Untrained	2 October 2022	19 May 2022	Skiing	Return to sport WKS
6	37	F	NZ European	Trained	1 July 2021	18 January 2023	Netball	Return to normal daily activity WKS

Note. ACL = Anterior cruciate ligament; F = female; NZ = New Zealand; WKS = without knee symptoms.

[a] *Resistance training status* refers to training frequency in the six months prior to injury. [b] Trained = resistance training ≥ 2 times per week. [c] Untrained = resistance training < 2 times per week. [d] *Sport* indicates the primary physical activity or sport the participant engaged in prior to injury. [e] *Rehabilitation goal* was self-reported by participants during the interview process.

All interviews were undertaken using Zoom video conferencing.

participants elected to have surgical treatment early in their ACL journey. Three main themes were identified from the data: Acceptability, connectedness, and strength.

Theme 1: Acceptability

All six participants found the menstrual cycle phase-based programme highly acceptable, including the session dosage, bi-phasic training, and rehabilitation outcomes. This was evidenced by five participants continuing to utilise menstrual cycle phase-based training past the end of the trial: "I've made my strength stuff within that first week … the same sort of concept and then I focus on … slower, easy runs … on the second" (P2, 38 years). Participants provided different reasons for continuing with this method of rehabilitation training: "I … liked it and I found my body coped really well … [if given the option in future] I would try the one with the … menstrual cycle" (P4, 42 years). Only one participant did not continue using menstrual cycle synchronised training on the conclusion of the trial, noting she found the administration of tracking her cycle too time consuming when she returned to work: "… it was a little bit tricky to keep [it up]" (P5, 21 years).

The session dosage was highly acceptable to the participants. Two physiotherapist-guided sessions per week were accommodated with minimal issues: "twice a week was definitely, definitely good" (P6, 37 years), and "…my main goal was to get back into … life as quick as I can, so I … made time for it" (P3, 35 years). Several participants noted that more sessions would have been difficult to attend: "…the volume of exercises … was quite like hard to fit in … once I went back to work, it was kind of … hard to find the time" (P3, 35 years). In contrast, at times, some participants worried about not training enough: "I was almost worried that it wasn't enough" (P2, 38 years).

Most of the participants liked the programme variation, as the bi-phased training allowed both progressions and prevented boredom. All participants liked knowing that their programme would be changing in advance. This awareness helped facilitate engagement when they were struggling to self-motivate:

> …because I could see that there was going to be a change … for two weeks and then different for two weeks of the month … I was more motivated … Knowing that I only had two weeks to do heavy weights … I really wanted to push myself in that two weeks. (P1, 41 years)

Overall, the participants were satisfied with both the programme and their rehabilitation outcomes. Several credited the structure of the menstrual cycle phase-based ACLR as benefiting their ACL journey: "…just really structured and you knew what you're doing, which is nice" (P5, 21 years). In comparison to previous injury rehabilitation, several participants believed this programme to be preferable: "I think I got better rehab. I think I recovered from my surgery quicker … I've … had the same surgery on the other knee about four years ago" (P1, 41 years). Measuring incremental improvements throughout their ACLR empowered participants to visualise their progress: "Having the … strength testing … at the beginning and the end … was really satisfying" (P1, 41 years). This reinforced perceived improvements in strength and increased programme satisfaction.

The acceptability of methods utilised to track the participants' menstrual cycles varied. Younger women noted more difficulty with entering their menstrual cycle data, and some found it "annoying" or expressed difficulty remembering to gather and record the data: "…when you commit to the programme you have to do it, and you just do it" (P4, 42 years). Those who had previously tracked their menstrual cycle to facilitate conception did not find the process as bothersome: "I've had three kids, so I was kind of fine with it" (P2, 38 years). Some participants found the data collection interesting: "It was quite cool to see … I really enjoyed the data collection side of it" (P5, 21 years). P5 noted that a specific application may improve patient adherence and compliance by improving ease of data collection and entry: "…maybe just an easier way to put in the data. Like, I know apps are super expensive to make, but … it was a bit of a hassle, putting it in on Google Sheets" (P5, 21 years). Several participants questioned the accuracy of ovulation tracking and whether it was directly useful, or essential for the research: "I didn't think it was … important to know the exact day of ovulation, especially when … often it would fall when I wasn't going to physio" (P1, 41 years).

Theme 2: Connectedness

The menstrual cycle phase-based ALCR programme positively influenced connections to clinicians, the participants' bodies, and other women. Participants felt physiotherapist support and encouragement augmented their self-motivation: "I enjoyed going to see the physio twice a week and her pushing me … I knew that … I was … gonna progress as fast as I could … being like, safely … monitored" (P3, 35 years). Although P2 expressed concerns about muscle atrophy from not training hard enough, her physiotherapist provided reassurance and education. The participants' respect for the clinical expertise and insight provided appeared to be invaluable in building rapport and progressing with their rehabilitation: "It was … nice to have proper feedback given in a session [regarding my form] … that supervision was really beneficial and helpful" (P6, 37 years).

Most participants experienced increased awareness of and connection to their bodies, resulting from the increased knowledge sustained throughout the RCT. The extent of this varied, with several participants describing increased awareness of the different stages of their menstrual cycle and how it affected them individually. The increased cognisance of their cycles appears to be associated with a sense of curiosity about the way their bodies were affected by menstrual cycle phase-based training: "…it felt like the right thing to be doing" (P1, 41 years). Most participants experienced an awareness of increased energy and strength during their follicular phase, contrasting with fatigue and demotivation during their luteal phase: "…the biggest thing I got from [this programme] … was the way that it felt … I definitely felt sorer and … niggly … in that second phase. It's really obvious" (P2, 38 years). Understanding the connection between hormonal changes and mood or energy levels appeared to facilitate increased self-understanding:

> I've enjoyed … listening a little bit more to my body, when like … you feel strong … you can push yourself and then … [during] those two later weeks of your cycle … if you don't … feel as, you know, motivated … [you can] dial back a little bit on the strength. (P3, 35 years)

Another important concept within the theme of connectedness was female bonding. Three participants mentioned conversations with peers about the programme and their experiences: "I talked to other friends too about that … I have been teaching them about it … they wanted to know" (P1, 41 years). One participant felt she was aware that empowering herself and others to have these discourses, fighting the "stigma" surrounding female bodies and hormones: "I mean, it's like … when I'm talking to my friends … they were all … super intrigued [about] … what's going on" (P5, 21 years).

Theme 3: Strength

The concept of strength developed in different ways throughout the interview discussions. This included both physical strength, regarding the knee's physical performance, and mental strength, including self-motivation and trust in their post-surgery knee. The programme phasing and repeated strength testing enabled participants to visualise improvements in physical strength: "I've known since three months that … I was strong" (P1, 41 years).

Satisfaction with their strength was important to most participants. Several expressed feelings of vindication seeing the weights increase on the gym machines as they progressed through their rehabilitation: "…it was hard at the time. But I think … seeing the progress … watching that weight go up … that sense of achievement. So that's what I quite liked about it" (P6, 37 years).

Several participants remarked that they progressed faster than expected, and expressed increased trust in their knee and awareness of strength improvements throughout the programme: "When you feel strong … you can push yourself" (P3, 35 years). Participants then understood that the programme positioned them well for their remaining ACL journey: "I think if I didn't do it, I probably wouldn't have come out with such a good outcome" (P2, 38 years). The two participants who had previously undergone knee surgery and post-surgical rehabilitation felt their rehabilitation outcomes were comparatively better: "I think I got better rehab. I think I recovered from my surgery quicker" (P1, 41 years). This increased trust in their injured limb was contextualised in the participants' RTS: "I need to have a strong muscle [to go] back to the ski field … it's going to protect my knee [against further injury]" (P4, 42 years). In contrast, P5 noted the focus on quadriceps strength resulted in a relative hamstring imbalance at the end of the programme, which concerned her and her treating physiotherapist: "once I finished the programme … my hamstring strength was … a shock" (P5, 21 years).

DISCUSSION

The three themes collected from the data in this study – acceptability, connectedness, and strength – were experienced and expressed in diverse ways by different participants. Overall, the programme was well received; however, this research observed differences in which aspects participants enjoyed, found interesting, and gained personal insights. This reflects the variation in patient engagement and experiences of rehabilitation programmes, even when following the same rehabilitation prescription (Dunphy et al., 2022).

Programme acceptability

The menstrual cycle phase-based programme that these ACLR participants followed throughout the first 12 weeks of their postoperative journey was acceptable to all participants interviewed in this study. Several participants expressed their satisfaction that the programme was tailored to their individual menstrual cycles. Patient buy-in is an essential component of adherence to lengthy exercise prescription (Wassinger et al., 2022). Motivation and engagement throughout the extensive process of ACLR is impacted by perceived results, and interest in the exercise prescribed (Pizzari et al., 2002). Previous ACLR programmes have followed a more traditional progressive overloading method of prescription, which participants often report as "arduous" and boring (Heijne et al., 2022; Piussi, Krupic et al., 2022; Piussi, Magnusson, et al., 2022). Furthermore, the repetitive nature of standard ACLR protocols was concluded to be demotivating and disengaging by Pizzari et al. (2002). Participants in this study described the bi-phasic structure of the programme as refreshing and motivating, particularly due to the mostly predictable two-weekly variation of rehabilitation, and alignment with their menstrual cycles. Consequently, the findings of this research suggest that the bi-phased nature of this menstrual cycle phase-based rehabilitation may be helpful for patient engagement and supports further research into female-centric rehabilitation frameworks (O'Loughlin et al., 2023. While participants largely found the programme acceptable, one participant discontinued cycle tracking post-trial, noting the administrative burden of monitoring her cycle as a barrier. Future iterations of menstrual cycle-synchronised rehabilitation may benefit from tracking tools such as mobile apps or wearable technology to enhance adherence.

These findings must be interpreted with caution due to the small sample size. This qualitative study provides good depth of understanding; however, we acknowledge the results may not apply across all patient populations. Yet, adherence data collected during the original RCT (O'Loughlin et al., 2024) supports these findings. In that trial, adherence rates were high across both groups; however, participants in the intervention group had slightly higher session attendance. This combination of qualitative and quantitative data provides preliminary support for the consideration that phasing rehabilitation with the menstrual cycle may support engagement. Nonetheless, larger samples are needed to confirm this relationship.

Several participants experienced improved perceived outcomes due to participation in the menstrual cycle phase-based rehabilitation, only two of whom had previously undergone knee surgery. Consequently, these assertions had little context for the participants to draw their conclusions. While P1 had previously undergone ACL reconstruction and rehabilitation, the four years between her surgeries may have affected the treatment received. Her age and life stage may have influenced both the physiotherapy care prescribed and her engagement in rehabilitation. Best-practice physiotherapy standards for ACLR continue to evolve in response to new research (Piedade et al., 2023), which may further influence differences in care participants receive for the same injury sustained years later. Furthermore, in general, most participants in this study were over 35 years of age, which may have influenced the acceptance of the programme. Older participants may have had different life responsibilities and levels of body awareness, especially regarding the menstrual cycle. For example, several participants had previous experience with menstrual cycle tracking for planning their families, which may have made the intervention more acceptable or familiar.

Connectedness to self and others

Another theme that was experienced in different ways was connectedness, including increased connection to the treating physiotherapist. Previous research has found therapeutic relationships are vital to patient engagement and satisfaction during ACLR (Burland et al., 2020; Lisee et al., 2020). Recent qualitative research by Haberfield et al. (2025) highlights that women recovering from ACL injury value clear rehabilitation structures, empathetic relationships with health professionals, and individualised approaches that align with their realities and needs. Many of these themes were outlined as experiences of the participants in this current study. Therefore, menstrual cycle-synchronised rehabilitation may address both physiological and psychosocial needs during rehabilitation.

Similarly, an interesting finding of this research is that several participants described increased connection to women in their lives, either through passing on and sharing of information or through increased empathy with those struggling with sports injuries. This sense of body awareness described by these participants aligns with previous studies that connect improved outcomes with increased body literacy (Kaur et al., 2019; Scott et al., 2018. In contrast, previous research has found that ACLR participants often feel isolated throughout the rehabilitative process, demonstrating the importance of feeling connected to peers (Hildingsson et al., 2018; Lisee et al., 2020; Piussi, Krupic et al., 2022; Scott et al., 2018). In this way, the current study provides insight into how this type of rehabilitation can address these gaps in ACL rehabilitation, specifically for women.

Furthermore, Piussi, Krupic et al. (2022) linked feelings of isolation to increased depressive symptoms, reduced physical performance, and slower recovery post ACL reconstruction. Only two participants (P2 and P4) did not disclose increased connections to their peers resulting from participation in the RCT. However, P2 was the only non-Pākehā participant, and cultural differences may account for different attitudes towards talking about menstruation and hormones outside medical contexts (O'Loughlin et al., 2022b). Considering variation in levels of comfort women experience discussing menstruation, and the importance of menstruation in this research, some participants may experience these benefits differently (O'Loughlin et al., 2022b).

Previously, three studies have established that ACLR patients often experience a sense of disconnect to their physical bodies (Kvist et al., 2023; Scott et al., 2018; Thing 2006). This is attributed to physical changes both post-injury and throughout ACLR. Piussi, Magnusson et al. (2022) found that ACLR patients identified as "copers" reported increased learning about self and body during their rehabilitation. The new rehabilitation protocol discussed in this paper has explored the influence of female hormones on ACLR (O'Loughlin et al., 2024) and provided an opportunity for participants to learn about and connect with their bodies. Participating in the menstrual cycle phase-based protocol appears to have empowered ACLR patients to gain new understandings about their bodies. Considering previous research has noted gendered trends in the psychological experience of rehabilitation (Lisee et al., 2020), further exploration of this phenomenon may provide additional insights.

Strength and satisfaction

The third theme emerging from this research was strength. The increased sense of strength the participants experienced following the menstrual cycle phase-based protocol is of particular interest. Previous ACLR research found patients were often dissatisfied with their physical performance at the end of their initial postoperative rehabilitation (Heijne et al., 2022; Kaur et al., 2019; Piussi et al., 2023). ACLR patients are aware of the need to engage in exercise-based rehabilitation to improve and maintain the health and function of their knee (Burland et al., 2018; Kaur et al., 2019). However, experiences of altered function and persistent knee symptoms demotivate and disengage patients from ACLR (Kaur et al., 2019; Pizzari et al., 2002; Truong et al., 2022). The increased awareness of their strength may have been partially due to the regular strength assessments utilised throughout the protocol. These findings are consistent with those of Pizzari et al. (2002) whereby patients utilise benchmarking to motivate and assess their recovery progression throughout rehabilitation.

Mental strength and perseverance were also exhibited by the participants in this study. Previously Piussi, Magnusson et al. (2022) and Scott et al. (2018) have drawn connections between the importance of perceived self-growth and patient–clinician relationships for fostering these attributes during rehabilitation. Existing qualitative literature largely explores patient experiences of fear and trauma associated with ACLR (Kaur et al., 2019; Kvist et al., 2023; Little et al., 2023; Mahood et al., 2020; Ross et al., 2017). However, the participants did not extensively discuss this during their interviews. A few participants briefly mentioned concern about re-injury, disclosing awareness of re-injury risk or taking care during RTS participation. Consequently, the participants' experiences and perceptions of the protocol could be partially attributed to their mental strength.

Strengths and limitations

These findings align with a recent study advocating for more individualised, gender-specific rehabilitation strategies following ACL injury. The recent systematic review by Bruder et al. (2023) calls for more sex- and gender-informed research and rehabilitation approaches. The present study contributes to this gap by offering initial evidence that tailoring rehabilitation to the menstrual cycle may be one strategy worth exploring further. The principal limitation of this research was time availability, which limited sample size and, as discussed previously, may have impacted the research findings. This research is also limited by the homogenous nature of the interview population. Participants were mostly of European descent; therefore, cultural influences on perceptions of this type of training may affect its viability with other populations. Furthermore, the age of included participants may limit applicability to other populations. Previous research found that younger women are less comfortable discussing their menstrual cycle with peers (O'Loughlin et al., 2022b). This is due to learned stigmas and social expectations around the taboo of menses (Wootton & Morison, 2020), and this stigma may cause some people to disengage from such discourse. Furthermore, all participants were able to discuss their hormones and ACLR at length with the interviewer. Previous researchers have determined that individuals with good health literacy are more inclined to participate in healthcare research, causing less health-literate populations to be underrepresented (Anderst et al., 2020). Therefore, this study may not have captured the women who have reduced health literacy. Additionally, it is possible some participants in the initial RCT who found the intervention less useful and had a less positive experience did not respond to the advert to participate in the study, introducing an element of selection bias.

Clinical implications

Previous research found that menstrual cycle-synchronised rehabilitation provides similar quantitative strength outcomes for sportswomen (O'Loughlin et al., 2024). This study demonstrates that the experience of biphasic training of menstrual cycle-synchronised rehabilitation appears to be favourable for participants following ACLR. Therefore, considering these qualitative results, patients and physiotherapists may consider undertaking such rehabilitation if that is their preference, as menstrual cycle phase-based training may result in favourable qualitative outcomes, such as high acceptability of their rehabilitation programme, strong perceptions of connection to self and others, and a strong perceived feeling of strength.

CONCLUSION

The menstrual cycle phase-based ACLR programme was established to be acceptable and favoured by those who participated in this research. In general, participants found their outcomes to be satisfactory and felt that the programme was beneficial to their post-ACLR improvements in strength and power. The participants indicated that minor modifications to the menstrual cycle tracking utilised alongside the rehabilitation exercise prescription may lead to better patient experiences and may facilitate optimal compliance in future populations. Participants expressed an increased connection to their physical bodies and female peers through their experience of menstrual cycle phase-based ACLR. The therapeutic relationships built with their treating physiotherapists facilitated greater understanding of themselves and were perceived to contribute to better clinical outcomes from the programme. Previous research found that menstrual cycle phase-based exercise provides similar quantitative results for sportswomen, while the qualitative results of this data set provide insight into how this programme may be experienced, and may support engagement for some women following ACLR. Therefore, overall, this research suggests that menstrual cycle-synced rehabilitation could enhance engagement and recovery, offering a promising new approach for women with ACL injury.

KEY POINTS

1. Previous research found that menstrual cycle phase-based exercise provides similar quantitative results for sportswomen; this study adds that participants also found the experience qualitatively favourable during ACL rehabilitation.
2. Minor modifications to the menstrual cycle tracking process – such as using a simpler app – may lead to better patient experiences and support engagement in future populations.
3. Participants reported increased connection to their bodies and physiotherapists through their experience of menstrual cycle phase-based ACLR, contributing to overall programme satisfaction.
4. Menstrual cycle-synchronised rehabilitation may offer a promising approach to engagement and recovery in the rehabilitation process.

DISCLOSURES

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Conflict of interest: No conflicts of interest exist that may be perceived to interfere with or bias this study.

PERMISSIONS

This study was approved by the Auckland University of Technology Ethics Committee (reference number 20/224). Permission has been granted by the *New Zealand Journal of Sports Medicine* to republish Figure 1 in the *New Zealand Journal of Physiotherapy*.

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CONTRIBUTIONS OF AUTHORS

Conceptualisation and methodology, JH, DR, and EOL; validation, formal analysis and data curation, JH, DR, and EOL; writing – original draft, JH; writing – review and editing, JH, DR, and EOL; supervision, DR and EOL; project administration, JH, DR, and EOL; funding acquisition, DR and EOL.

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Expectations and Understanding of Patients Attending Advanced Physiotherapy-led Orthopaedic Triage Clinics in Primary Care: A Scoping Review

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ABSTRACT

Physiotherapy-led orthopaedic triage has been shown to reduce waiting times for specialist assessments. These triage models are now being adopted in Aotearoa New Zealand. To ensure successful implementation, it is important to work in partnership with tangata whenua (the Indigenous people of Aotearoa New Zealand), respecting Te Tiriti o Waitangi (a founding document of Aotearoa New Zealand). This scoping review explored the expectations and understanding of patients attending physiotherapy-led orthopaedic triage services. It followed the Arksey and O'Malley (2005) framework and is reported in accordance with the PRISMA extension for scoping reviews. Eligibility criteria included English-language articles focusing on adult populations that explored patient understanding, expectations, perceptions, and ideas regarding physiotherapy-led orthopaedic triage. Online database searches were conducted via Medline (EBSCO, including CINAHL and SPORTdiscus), Cochrane Library, and SCOPUS. The findings are charted within Te Pae Māhutonga Māori health promotion framework. Patients expect to receive information about pathways, diagnoses, and timeframes earlier in their journey and want easy access to pathways and clinicians. Healthcare users desire patient-centred care, where they and their general practitioner (GP) or other important advocates/whānau (extended family unit) are involved in analysing options and making decisions. This review highlights gaps in the literature regarding the Aotearoa New Zealand and Māori health contexts that require further exploration. As this service delivery model develops in Aotearoa New Zealand, there is a need to ensure services are fit for purpose.

Keef, T., O'Brien, D., & Saywell, N. (2025). Expectations and understanding of patients attending advanced physiotherapy-led orthopaedic triage clinics in primary care: A scoping review. *New Zealand Journal of Physiotherapy, 53*(2), 80–97. https://doi.org/10.15619/nzjp.v53i2.464

Key Words: Orthopaedics, Physiotherapy-led, Te Pae Māhutonga, Triage

INTRODUCTION

Triage is the process of determining the best care pathway based on a patient's presentation. It aims to optimise care delivery and ensure the best use of resources (Hussenbux et al., 2015). Reviews such as the one by Morris et al. (2015) show that research into physiotherapy-led orthopaedic triage to manage wait times for specialist assessment for elective non-urgent orthopaedic conditions, like osteoarthritis, has existed for approximately 30 years. There is significant variation in the definition of physiotherapy-led orthopaedic triage, but the common themes of orthopaedic triage are the presence of a referral, the aims of triage, and a clinician qualified to conduct the triage (Morris et al., 2015).

The literature supports physiotherapy-led orthopaedic triage, with evidence showing good diagnostic agreement between the therapist and the orthopaedic consultant, appropriate triage recommendations, effective management outcomes, and reduced waiting times for orthopaedic surgical services (Trøstrup et al., 2020; Vedanayagam et al., 2021). Waiting times for specialist assessments continue to increase in the Aotearoa New Zealand public health system (Health New Zealand – Te Whatu Ora) (Abbott et al., 2022). Recently, Health New Zealand – Te Whatu Ora has implemented changes in orthopaedic pathways that incorporate physiotherapy-led triage. These changes emphasise access, equity, and collaboration between primary and secondary care (Te Whatu Ora – Health New Zealand, 2022).

Patient expectations, understanding, attitudes, beliefs, and perceptions are linked to and profoundly affect clinical and patient outcomes (Oster et al., 2024). Expectations are the cognitive appraisal of health situations and can be impacted by previous knowledge, experiences, information gathered, perceived consequences, perspectives, and emotions (Barron et al., 2007). Expectations are further compounded by a person's social and cultural influences and are entwined in the psychosocial makeup of the person (Barron et al., 2007). Understanding patients' expectations is the basis of person-centred care, enabling patient collaboration and decision-making in healthcare (Oster et al., 2024). Person-centred care has improved patient health outcomes and efficiencies in clinician investigations and interventions (Oster et al., 2024). El-Haddad et al. (2020) conducted a study investigating patient expectations of healthcare and discovered that expectations are conceptualised into three categories: (1) Health outcomes – patients expect realistic improvements in health through treatments; (2) Individual clinicians – expectations of clinicians include qualities such as professionalism and listening skills; and (3) Healthcare systems – expectations arise from the limitations of health care systems, rules, and constraints.

Aotearoa New Zealand's unique health system includes obligations to honour Te Tiriti O Waitangi (Aotearoa New Zealand's founding document) (Came et al., 2020). Te Tiriti o Waitangi provides a constitutional framework promising Māori (Indigenous people of Aotearoa New Zealand) self-governorship and equity, including health outcomes (Goodyear-Smith & Ashton, 2019). It defines the intent to develop and implement partnerships between Māori and the Crown. In keeping with the notions presented by Reidy et al. (2025), for the context of this paper we have defined equity as the fair and just distribution of health outcomes and access to care, achieved by addressing avoidable, unjust disparities through intentional shifts in power, resources, and system structures, particularly in relation to colonisation and social determinants.

Evidence demonstrates that despite Te Tiriti obligations Māori experience health inequities. For example, a cohort study by Singleton et al. (2013) found that Māori patients undergoing primary joint arthroplasty are younger, often have poorer general and mental health, and experience worse preoperative and postoperative function compared to non-Māori. It is also reported that Māori commonly face greater barriers to accessing primary care (McGruer et al., 2019). Inequalities in healthcare affect the outcomes for Māori, Pasifika, and those from lower socioeconomic backgrounds (Goodyear-Smith & Ashton, 2019).

Numerous Māori health and wellbeing frameworks have been developed to address inequity and improve Māori health (Wilson et al., 2021). These commonly share key concepts, principles, and values such as whanaungatanga (connectedness), whakawhanaungatanga (building relationships), whānau (extended family unit), and socio-political health contexts (Wilson et al., 2021). Several Māori health models, such as Te Whare Tapa Whā, Te Pae Māhutonga, and Te Wheke, are commonly incorporated into the Aotearoa New Zealand health system to inform health system design and delivery (McIntosh et al., 2021). Te Pae Māhutonga is explicitly designed for primary and public health use to guide healthcare promotion and delivery in alignment with Māori values; hence, it is well positioned to frame services that span primary and secondary care with a te ao Māori lens (Māori world view) (McIntosh et al., 2021).

Research question and purpose

The research question is: What are patients' expectations and understanding of physiotherapy-led orthopaedic triage? The primary purpose is to examine the research range, extent, and nature and explore how findings might impact practice. The secondary purpose is to contextualise the research in Aotearoa New Zealand's cultural context using Te Pae Māhutonga. This question has yet to be addressed in Aotearoa New Zealand, and the findings will help direct further research and provide practical recommendations for similar triage clinics across the country.

METHODOLOGY

Methodology considerations

This research adopts an interpretivist philosophical stance, aligning with a qualitative paradigm that embraces a naturalistic approach and views reality as subjective and open to interpretation (Grant & Giddings, 2002). Recognising the possibility of multiple subjective truths, this approach considers how populations and research interpretation may vary.

The primary investigator's (TK) positionality as a physiotherapy-led orthopaedic triage clinician and master's student influences the review by bringing a practical rather than theoretical perspective (Thorne et al., 2002). Being based in Aotearoa New Zealand shapes the analysis, emphasising the local health system and social context (Thorne et al., 2002). Reflexivity is integral to this qualitative paradigm, acknowledging the primary investigator's active involvement in the research area and the influence of his Māori whānau on potential biases and interpretations (Palaganas et al., 2017). The other researchers DOB and NS bring their experiences as academic physiotherapists to the analysis. Prior to their research careers, they both had more than a decade working in a range of clinical settings and observed first-hand the need to address the inequities that persist in health care delivery. Both have significant experience in qualitative research design and implementation in the context of musculoskeletal health care delivery. This reflexive approach ensures greater awareness of how personal and contextual factors shape the research process.

METHODS

A scoping review was selected as the most suitable method to address the research question, as it is specifically designed to explore the literature and answer broad research inquiries (Munn et al., 2018). This method seeks to map key concepts within a research area and examine the primary sources and types of evidence available. It is particularly useful for emerging fields where no prior reviews have been conducted (Verdejo et al., 2021). Additionally, scoping reviews facilitate the identification and analysis of gaps in the existing literature (Munn et al., 2018). While maintaining a systematic approach, they ensure rigour and trustworthiness in their process (Arksey & O'Malley, 2005; Munn et al., 2018). However, a notable limitation of scoping reviews is the absence of a detailed critique of study quality (Grant & Booth, 2009).

Protocol

This scoping review aligns with the Arksey and O'Malley (2005) framework and recent advancements to increase rigour and trustworthiness (Levac et al., 2010; Peters et al., 2021). This review is reported in concordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) (Tricco et al., 2018).

1. Identify research question

An iterative approach to the research question with reflective practice was used. The defining concepts of the research question are "physiotherapy-led orthopaedic triage" and "patients' expectations, understanding, and attitudes towards the service". Physiotherapy-led orthopaedic triage roles have varied terminology across the literature, including advanced practice physiotherapy, extended scope physiotherapy, and clinical specialist physiotherapy. All these terms are used interchangeably and identify the target clinician group (Naik et al., 2023; Trøstrup et al., 2020).

Importantly, this question explicitly asks about patients' expectations and perceptions before attending these clinics, rather than their satisfaction after attending them. This is due to the overarching theme that this approach is currently a novel concept in Aotearoa New Zealand and emphasises the importance of the patient in these concepts.

Further questions that helped define and frame the scoping review include:

- What designs, population, and clinic settings were included when exploring this research question?
- What information on expectation and understanding is available in the patient-satisfaction literature on this research question?
- How does this review align with Aotearoa New Zealand-based healthcare and Te Tiriti o Waitangi?

2. Identify relevant resources

Electronic library databases were used to conduct this search. The search strategy used an iterative approach with reflections on keywords, phrases, and frameworks to help refine the search as it proceeded. The databases chosen for the searches included EBSCO MEDLINE, CINAHL, and SPORTDiscus, Scopus, and Cochrane Library. The MeSH terms used in the search strategies were "Perceptions OR understanding OR expectations OR attitudes", AND "physi*", AND "orthopaedic triage". The full search strategies for each database are available in Appendix A.

Due to limited relevant search returns, broader terms were used, such as removing community-based restrictions and including experience-based studies with components of expectation or understanding. This expanded the review by including research that explores patients' expectations, perceptions, and understanding after they have attended these clinics. This allowed for the inclusion of much richer data. Search results were provisionally screened by title. The remaining full-text articles were downloaded and read to apply the inclusion and exclusion criteria. The reference lists of included studies were also scanned to ensure no research was missed.

3. Study selection (inclusion and exclusion criteria)

The student researcher conducted the initial search. Inclusion and exclusion criteria were developed to justify the research question and assess the feasibility of this review. Inclusion criteria were research with a description of the participants' understanding or expectations before seeing a physiotherapy-led orthopaedic triage service (or another interchangeable title) with advanced practice assessment for an orthopaedic specialist service. Other criteria were peer-reviewed research written in English, due to time constraints and the cost of translating materials. As this is a novel research area with limited studies, and we wanted to capture all studies relevant to the research question, no date limit was applied to the inclusion criteria. All participants needed to be adults. Quantitative, qualitative, and mixed-method study designs were included to consider all aspects of the available research.

Exclusion criteria were studies that focused on orthopaedic surgeon-led services and those that examined the experiences of outcomes related to triage services. Policy-based documents were also excluded. This decision represents a delimitation of the review and was made because examining policy was not feasible within the timeframe and might detract from the research question. All studies were saved in an electronic database software (EndNote 20, Clarivate).

4. Charting the data and reporting findings

Reporting of methodologies, study designs, participant information, and findings were extracted and presented. A framework is used to present the thematic results of the included studies. We positioned the findings using a Māori health framework to bring the Aotearoa New Zealand context and health equity to the forefront of summarising and reporting the findings. Te Pae Māhutonga, a model commonly used in Aotearoa New Zealand for health promotion, was considered the most appropriate choice (Durie, 1999; Ratima, 2010). Discussions with the research team and a Māori health leader (Dr Aitken, Ngāti Ruapani and Ngāi Tūhoe) helped confirm this model's appropriateness. This model is linked to the Ottawa Charter for Health Promotion, which enables people to improve and have control over their health (World Health Organization, 2009). Health promotion encourages the foundations of advocating for favourable health conditions, enabling equity, patient control, and the ability to make healthy choices. Coordination among all concerned, including communities, organisations, and authorities, is a major aspect of the Ottawa Charter for health promotion (World Health Organization, 2009).

Te Pae Māhutonga is a framework named and modelled on the Southern Cross constellation (Durie, 1999). It includes four key tasks for health promotion (Southern Cross) and two prerequisite or guiding points (guiding stars). This framework acts as a map or a guide to bring together the components of health promotion for Māori, which benefits all New Zealanders. It is important to note that the model's aspects overlap, allowing for an iterative approach to integrating findings within this model.

The four key tasks include:

Mauriora (Access to te ao Māori): To have a cultural identity, which is important for Māori and other Indigenous health populations. This describes how healthcare programmes have incorporated the Māori world and Māori worldviews (te ao Māori) while considering the cultural aspects of access and information provision.

Waiora (Environmental protection): This is linked to the external world and includes the spiritual element that connects environments and people. This includes appreciating environmental protection and considering a safe and comfortable environment. This could also be how the environment has supported whānau and support services.

Toiora (Healthy lifestyles): This is linked to the lifestyles and choices that lead to health outcomes. This includes taking in and understanding information to make health choices and building trust in healthcare through rapport, honesty, and positive behaviours. To strive for equity, this could also be incorporated into seeing the right health professional early in the journey.

Te Oranga (Participation in society): Includes consideration of socioeconomic circumstances. It is defined as the goods and services people can use, and their voice in deciding how they are used to enable thriving and meaningful life. This incorporates the confidence that patients can access services and feel a sense of ownership of them.

The guiding points are:

Ngā manukura (Leadership): This section focuses on the impact of community leaders, alliances, and relationships between health services and community leaders. It establishes the capacity to be flexible with the community and healthcare, coordination among services, the community, and leaders, and effective relationships and alliances. This could also be regarded as the removal of sectoral boundaries.

Te mana whakahaere (Autonomy): The community user has ownership and control over their health. Health workers should not undermine autonomy when making decisions regarding wellbeing and health. This can be reflected in person-centred care.

5. Consultation with stakeholders

Consultation with stakeholders was not conducted, which is a limitation of this review. This was due to timing and funding constraints.

RESULTS

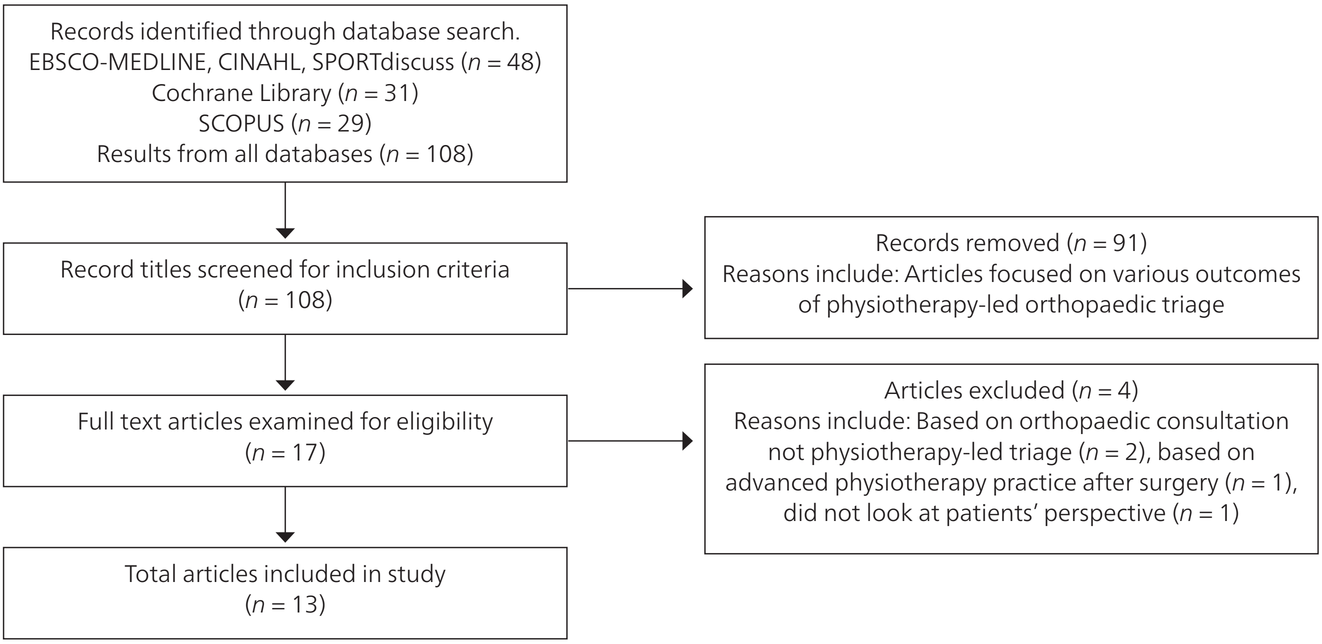
The primary researcher conducted the database search in March 2024. Figure 1 shows the study selection process for the sources of evidence. A total of 108 research articles were identified in the initial searches (including iterative changes). The article titles were screened against the inclusion and exclusion criteria, and 91 did not meet the inclusion criteria. Seventeen full-text articles were read, and 13 were included in this review.

Characteristics of included studies

The included studies were conducted across the United Kingdom (Jasim et al., 2023; Joseph et al., 2014; Reeve & May, 2009; Ryan et al., 2020), France (Kechichian et al., 2024), Canada (Bath & Janzen, 2011; Desjardins-Charbonneau et

Figure 1

PRISMA Diagram of the Selection Process for Sources of Evidence



al., 2016; Rempel et al., 2017), Sweden (Gustavsson et al., 2023; Samsson et al., 2016), Denmark (Bødskov et al., 2022), Australia (Mutsekwa et al., 2022), and Ireland (Fennelly et al., 2020). The dates of the included studies ranged from 2009 to 2024. Ten of the 13 studies were published within the last 10 years (Table 1). Two studies included participants who had not attended a physiotherapy-led orthopaedic assessment clinic or a similar facility (Desjardins-Charbonneau et al., 2016; Joseph et al., 2014). Two studies involved participants awaiting assessment in their respective clinics (Reeve & May, 2009; Rempel et al., 2017). The remaining eight studies (Bath and Janzen, 2011; Bødskov et al., 2022; Fennelly et al., 2020; Gustavsson et al., 2023; Kechichian et al., 2024; Mutsekwa et al., 2022; Ryan et al., 2020; Samsson et al., 2016) included aspects where they explored participants' expectations, perceptions, and understanding after attending a clinic. This focus was included because it provided rich information and addressed the question of patients' expectations and understanding of these clinics. Aspects that accounted for expectations of treatment outcomes or satisfaction were not included in the analysis. The study by Jasim et al. (2023) was an outlier, exploring patients' perspectives on the orthopaedic arthroplasty pathway. This pathway did not involve a physiotherapy-led orthopaedic triage clinician; instead, a GP acted as the triage clinician during the pathway. This study was included in the review as physiotherapy management and clinician triage were integral aspects of the pathway.

The study designs included quantitative, qualitative, and mixed-method studies. The qualitative studies utilised focus groups and one-on-one semi-structured interviews for data collection, which were then analysed thematically (Fennelly et al., 2020; Jasim et al., 2023; Joseph et al., 2014; Kechichian et al., 2024; Mutsekwa et al., 2022; Reeve & May, 2009; Ryan et al., 2020). The quantitative studies employed surveys for data collection and typically utilised either a randomised controlled trial or a cross-sectional study design (Bath & Janzen, 2011; Desjardins-Charbonneau et al., 2016; Gustavsson et al., 2023; Samsson et al., 2016). Two studies (Bødskov et al., 2022; Rempel et al., 2017) also employed a mixed-methods design, using quantitative survey data in combination with qualitative approaches, including free-text comments in the survey or one-on-one semi-structured interviews.

Two included studies (Bath & Janzen, 2011; Fennelly et al., 2020) had 70% and 80% of participants, respectively, identifying as living in rural areas. Another study focused on a university community (Desjardins-Charbonneau et al., 2016). No other included studies collected rural/urban demographics. Although only reported in eight of the included studies, a range of education levels was observed among participants (Table 1). However, no study integrated this point into its findings or discussions. There was limited reporting of the ethnicity or socioeconomic status of participants across the studies. Two studies noted that all their participants were white British or white European (Jasim et al., 2023; Reeve & May, 2009).

Charting of data to Te Pae Māhutonga framework

Mauriora – Access to te ao Māori

No identified studies incorporated Indigenous or cultural aspects into their designs or findings (Table 2). Specifically, there were no references to concepts such as whānau/family-centred care and support, or the need to provide a culturally safe environment.

Waiora – Environmental protection

Two articles (Fennelly et al., 2020; Reeve & May, 2009) discussed the patients' perspectives on the environment or the environment of the assessment clinic, and the results highlighted two main aspects. Some participants felt the hospital was the best environment for a clinic, as it is perceived to be where experts are located and that services are close to the experts, i.e., the radiology department for X-rays may be in the next room (Fennelly et al., 2020). Conversely, some participants reported that having the clinic closer to home made access more manageable, and the familiar surroundings made them feel more comfortable (Reeve & May, 2009).

Toiora – Healthy lifestyles

All studies discussed participants' perceptions and expectations regarding the importance of information, education, understanding, and trust (Table 2). Additionally, findings showed that most participants expected the therapist to aid in creating a management plan and understanding treatment options. Most commonly, participants wanted more information about pathways, clinics, and timeframes (Bødskov et al., 2022; Fennelly et al., 2020; Kechichian et al., 2024; Mutsekwa et al., 2022; Reeve & May, 2009; Samsson et al., 2016). Participants frequently wished to receive information earlier in their pathway journeys, along with details about the clinics' roles and pathways (Jasim et al., 2023; Kechichian et al., 2024). This process helped participants understand what to expect, fostering trust and a therapeutic alliance (Kechichian et al., 2024). Some participants felt that insufficient information about services, pathways, and clinicians impacted their expectations and, consequently, their attitudes (Jasim et al., 2023). One study describes that participants expected to see an orthopaedic surgeon but were, in fact, satisfied after seeing the advanced practice physiotherapist/triage physiotherapist (Bødskov et al., 2022). In contrast, Remple et al. (2017) found that 70% of study participants indicated that, if considered inappropriate for surgery by the physiotherapy-led triage clinician, they would still want to see the surgeon for confirmation and reassurance. Additionally, participants in the study who did not receive information about pathways were less willing to participate in a non-physician screening assessment (Remple et al., 2017). Mutsekwa et al. (2022) found that participants had less familiarity with novel pathways and physiotherapy-led orthopaedic triage roles. However, familiarity and trust in these services improved after attending these clinics.

Accessible knowledge is an expectation of participants attending physiotherapy-led orthopaedic triage clinics. This includes receiving a clear diagnosis and understanding it

Table 1
Characteristics of Included Studies

Author (date) Country of origin	Aims of the study	Sample size and demographics	Methods	Outcome measures/intervention type
Bath and Janzen (2011) Canada	Evaluate patient's and referring care provider's satisfaction associated with a spinal triage service delivered by physiotherapists in collaboration with orthopaedic surgeons.	*n* =108 patients who had completed an assessment with the physiotherapist; 61 provided comments. Grade 12 education or less = 44%. Rural settings = 70%.	Quantitative survey. Preassessment measures used within study. Part of survey asks about patient expectations.	Survey developed by researchers included two questions with a 5-point Likert scale response. Free space provided in for comments.
Bødskov et al. (2022) Denmark	Evaluate patient's levels of satisfaction with diagnostic examination in the shoulder clinic; determine whether a difference exists between levels of satisfaction among patients examined by APPs and orthopaedic surgeons; explore patient's experiences with being examined by APPs.	*n* = 133 patients recruited from shoulder clinic, who were appropriate to see the orthopaedic surgeon or APP. 9 of these participated in qualitative interviews. Secondary school education or less = 51%.	Quantitative survey and qualitative semi-structured individual interviews. One survey question asked about patient expectations**.**	VSQ-9 with five response options: Excellent, very good, good, fair, and poor. Qualitative interviews themed with deductive content analysis.
Desjardins-Charbonneau et al. (2016) Canada	Assess the perceptions of physiotherapists as primary care practitioners and APPs for the treatment of patients with musculoskeletal disorders.	*n* = 513. Convenience sample of university community – students and staff. All had college education or higher.	Quantitative survey.	Questionnaire comprised 37 questions regarding diagnostic ability, efficacy and safety, effects on access to care, and uses of health resources. Answers could be multiple choice or 4 or 5-point Likert scale responses.
Fennelly et al. (2020) Ireland	Explore patients' journeys, experiences, and preferences when using musculoskeletal APP triage services in Ireland.	*n* = 10 participants post-consultation with the APP. Secondary school education or less = 90%. Rural areas = 80%.	Qualitative semi- structured interviews. Explores patients' preconceptions of APP.	Thematic analysis.
Gustavsson et al. (2023) Sweden	Compare perceived quality of care after physiotherapist-led triage with standard practice in a secondary care setting for patients with primary hip or knee osteoarthritis.	Within a week of seeing the orthopaedic consultant (*n* = 199) or physiotherapy-led orthopaedic triage (*n* = 249). More than an elementary school education = < 15%.	Quantitative randomised control trial.	A short form of QPP questionnaire, to assess perceived quality of care. Answered with a 4-point Likert scale. One question asked if patients' expectations were met.

Author (date) Country of origin	Aims of the study	Sample size and demographics	Methods	Outcome measures/intervention type
Jasim et al. (2023) United Kingdom	Explore participants' views about planned improvements to the total joint arthroplasty pathway. Looks at the GP as the gatekeeper for orthopaedics. Not a physiotherapist as the triage clinician.	Focus groups: Group 1 ($n = 5$) and 2 ($n = 4$) patients with a replacement. Group 3 ($n = 5$) patients who had not had a replacement. All subjects identified as white British or white other.	Qualitative focus groups.	Thematic analysis. Has rich information about patients' expectations and understanding of orthopaedic services.
Joseph et al. (2014) United Kingdom	Determine the most advantageous features of triage services for patients with musculoskeletal conditions.	Two focus groups: Experts ($n= 7$) and patients ($n = 4$). Patients had experienced healthcare in the public and private sectors due to a musculoskeletal condition or injury. No relevant information on demographics.	Systematic review with qualitative focus groups.	Thematic analysis for qualitative aspect.
Kechichian et al. (2024) France	Explore the experiences and perceptions of patients attending first-contact physiotherapy-led care for low back pain in multidisciplinary team primary healthcare clinics.	$n = 10$ patients who consulted a FCP for low back pain in the model. Nil relevant demographic information.	Qualitative semi-structured interviews. Part of interview investigates patient perspectives.	Thematic analysis. Discusses patients' expectations as a theme.
Mutsekwa et al. (2022) Australia	Exploring patient's acceptability, experience, and perceptions of four allied health extended scope physiotherapy models of care in a tertiary health service.	$n = 29$, who had been referred to the clinics (either dietitian first gastroenterology clinic; physiotherapy pelvic floor primary contact clinic; orthopaedic primary contact clinic; physiotherapy vestibular and speech therapy ear nose, and throat primary contact clinic). Secondary school education or less = 54%.	Qualitative semi-structured interviews. Part of interview included exploring patients' expectations of the clinics.	Thematic analysis.
Reeve and May (2009) United Kingdom	Establish the dimensions of quality that were important to patients for an ESP spinal screening service, and to determine if there were any substantial differences compared with previous physiotherapy satisfaction literature.	$n = 12$, taken from a sample of patients on a waiting list who had been referred to the ESP screening service from their GP. All participants were white British.	Qualitative semi-structured interviews (prior to the ESP consultation).	Thematic framework analysis.

Author (date) Country of origin	Aims of the study	Sample size and demographics	Methods	Outcome measures/intervention type
Rempel et al. (2017) Canada	Survey patients with low back and low back-related leg pain who had been referred for a surgical assessment regarding their attitudes towards having a nonphysician healthcare provider assess their suitability for low back surgery.	*n* = 80 patients referred for elective surgical assessment at one of five spinal surgeon clinics. Most had tertiary education and above.	Quantitative cross-sectional survey. Also had quantitative comments in a questionnaire.	19-item questionnaire (developed for this study), about expectations regarding wait times for consultation and, willingness to pay, travel, and be screened by nonphysician healthcare providers. Questions answered with a 5-point Likert scale.
Ryan et al. (2020) United Kingdom	Address patients' experiences of being managed within a NHS sciatica pathway, involving spinal triage roles conducted by specialist physiotherapists.	*n* = 14 patients under the care of a specialist physiotherapist triage practitioner. Setting was physiotherapy outpatients where spinal triage role is conducted. Nil relevant demographic information.	Qualitative semi-structured interviews. Explored patients' perceived needs from care.	Thematic analysis.
Samsson et al. (2016) Sweden	Evaluate patients' perceived quality of care in a physiotherapist-led orthopaedic triage in primary care compared with standard practice.	Patients who were seen by physiotherapist-led triage (*n* = 83) or orthopaedic consultant (*n* = 80). Questionnaire administered 5 days following the consultation. Most had at least an upper secondary school education.	Quantitative randomised control trial.	QPP questionnaire, 4-point Likert scale. Questions included if expectations were met, and how important aspects of the clinic were to patients.

Note. APP = advanced practice physiotherapist; ESP = extended scope physiotherapist; FCP = first contact practitioner; GP = general practitioner; NHS = National Health Service; QPP = Quality from the Patient Perspective questionnaire; VSQ-9 = Visit Specific Satisfaction Instrument.

(Bath & Janzen, 2011; Bødskov et al., 2022; Joseph et al., 2014; Reeve & May, 2009; Ryan et al., 2020). Participants also express the need to have sinister causes screened and cleared, and reassurance regarding the assessment provided to them early in their journeys (Gustavsson et al., 2023; Kechichian et al., 2024; Mutsekwa et al., 2022). Participants deem it important to be offered options, with risks, benefits, and costs discussed, and to have this developed into an action plan (Bath & Janzen, 2011; Fennelly et al., 2020; Joseph et al., 2014; Reeve & May, 2009; Ryan et al., 2020).

Participant trust in the clinician and service is vital, and this was a finding in multiple studies. The participant's knowledge of the competence and background of the clinician was deemed important in three studies (Fennelly et al., 2020; Joseph et al., 2014; Samsson et al., 2016). Other studies found that trust was built through relationship and rapport building (Jasim et al., 2023) and by seeing the right health professional at the right time (Kechichian et al., 2024). Rapport and trust could significantly affect the participant's journey through triage pathways, with negative experiences or relationships impacting their progress (Jasim et al., 2023). Having trust meant they had confidence in the diagnosis and treatment options (Desjardins-Charbonneau et al., 2016). Previous experiences with physiotherapy in a private or hospital setting affected people's trust and expectations both positively and negatively (Fennelly et al., 2020; Reeve & May, 2009). This led to the patient wanting to be listened to, understood, and treated with empathy (Ryan et al., 2020; Samsson et al., 2016).

Te Oranga – Participation in society

Access, navigating pathways, the referral processes, and timeframes were major aspects of patient participation. This point was reflected throughout all studies. The first barrier many patients found was obtaining a referral (Jasim et al., 2023). It was often felt that general practitioners (GPs) and physiotherapy-led orthopaedic triage clinicians were gatekeepers to manage demand (Jasim et al., 2023). To navigate the pathway, one had to see the gatekeepers, fail their management, and convince them to refer on. These delays in the process then appeared to be exacerbated, with multiple waitlists at each stage of the journey (Joseph et al., 2014; Ryan et al., 2020). This issue led to barriers to making appointments and navigating health systems (Jasim et al., 2023). Difficulty scheduling and setting appointment times was challenging for patients to manage, resulting in a patient giving up on pursuing care (Kechichian et al., 2024). Value was placed on the ease and flexibility of booking appointments (Mutsekwa et al., 2022; Reeve & May, 2009). One study commented that patients felt the pathway was too rigid and that protocol-driven services were limiting (Ryan et al., 2020). Other society-based barriers included the costs of attending appointments, such as time off work, transport, parking (Bødskov et al., 2022; Fennelly et al., 2020; Mutsekwa et al., 2022; Ryan et al., 2020).

Timeframe expectations were also identified as an important societal factor in managing their health. This included the expectation of seeing a clinician within one month of referral (Rempel et al., 2017) or promptly (Bødskov et al., 2022; Desjardins-Charbonneau et al., 2016; Fennelly et al., 2020; Joseph et al., 2014; Kechichian et al., 2024; Mutsekwa et al., 2022; Rempel et al., 2017).

Ngā manukura – Leadership

The main feature of Ngā Manukura is the cooperation between stakeholders. This can be between the orthopaedic triage therapists, the surgeon, the GP, the community leaders, or with whānau and patients themselves. Patients felt this was of high importance as it fosters trust (Kechichian et al., 2024) and confidence (Bødskov et al., 2022; Mutsekwa et al., 2022; Rempel et al., 2017; Ryan et al., 2020). Services appearing compartmentalised and non-collaborative can prove difficult for patient navigation and progression along pathways (Ryan et al., 2020).

Te mana whakahaere – Autonomy

Participants value a pathway that has a patient-centred approach. This can involve individualised treatments (Bath & Janzen, 2011) and involving the participant in decision-making and empowering them to make healthy decisions (Bath & Janzen, 2011; Fennelly et al., 2020; Gustavsson et al., 2023; Reeve & May, 2009; Ryan et al., 2020; Samsson et al., 2016). Participants felt that, at times, being proactive and independent in their pathway was very burdensome and difficult, especially while living with pain (Ryan et al., 2020). Participants thus valued support and guidance to make decisions and proactively manage their pathways (Fennelly et al., 2020; Joseph et al., 2014; Ryan et al., 2020). Participants often supplemented the information the healthcare professional provided with information from talking to friends and family and internet searches (Ryan et al., 2020).

DISCUSSION

This review explored the expectations, understanding, beliefs, and perceptions of patients attending physiotherapy-led orthopaedic triage clinics. The initial question was directed to the community and primary care-based settings. However, with a limited number of studies investigating this area of research, the inclusion criteria for the setting needed to be expanded to include all physiotherapy-led orthopaedic triage models. This included clinics within orthopaedic surgeon clinics, clinics based in physiotherapy outpatient departments, and clinics based in primary care. This step permitted the inclusion of additional relevant literature and a more in-depth analysis of themes.

Using the Te Pae Māhutonga framework to organise the findings enabled alignment with the Aotearoa health context and supported reflection of Te Tiriti o Waitangi obligations. The data from the review did not fit perfectly into the model, which is to be expected and can be seen as a strength. It highlighted the gaps concerning Aotearoa New Zealand relevant knowledge. Further findings focused on the significance of information and connectedness with patients. Communication is a central theme, not just with patients but also with leaders in the patient health community. This includes GPs, whānau, community leaders, and other specialists.

Importance of information

A central theme in all the included studies is that patients want information. In the model Te Pae Māhutonga, this is *Toiora.* It means patients want information to make informed decisions and change behaviours. The information that patients request includes details about the orthopaedic management pathways, individual diagnoses, treatment options, and the risks associated with these options. Clinician recommendations within an expected and timely timeframe are also crucial for patients. The findings show that patients want this information early in their journey and preferably before assessment. Knowledge and education are significant aspects of treating musculoskeletal and orthopaedic conditions (Correia et al., 2022). They help patients understand their conditions and actively make management choices (Correia et al., 2022). Interestingly, a qualitative study by McGruer et al. (2019) found that few Māori women with osteoarthritis reported experiencing education about their condition, suggesting areas for improvement.

The findings regarding the importance of information have practical implications, including the need to deliver the information that patients would like to have, such as how orthopaedic pathways work, information on the qualifications and experiences of clinicians, and making this diagnostic information tailored to the patient. There was no preference as to how the information should be provided; however, it must be accessible and understandable to the patient and simple to implement (Metcalfe et al., 2022; Wang & Voss, 2022). It is important to avoid information overload, and we need to ensure education is delivered in a patient-focused and relevant way to empower the patient and whānau to make informed decisions (Wang & Voss, 2022).

Communication and leadership

The second central theme was *Ngā manukura*. This was displayed as leadership and communication with leaders such as whānau, GPs, or community leaders. Communication between the triage clinician, the GP, or other clinicians relative to the patient is vital to the individual's healthcare success. Whānau, extended family, and community are paramount in Māori society, and, thus, decisions (including health decisions) are made collectively (McGruer et al., 2019; Walker et al., 2006). In rangatiratanga (right to exercise authority,

Table 2

Charting of Findings in Te Pae Māhutonga Framework for Health Promotion

Author (date)	Tasks				Guiding points	
	Mauriora: Access to te ao Māori [a]	Waiora: Environmental protection [b]	Toiora: Healthy lifestyles [c]	Te Oranga: Participation in society [d]	Ngā manukura: Leadership [e]	Te mana whakahaere: Autonomy [f]
Bath and Janzen (2011)			Patients want a better understanding and accurate diagnosis. They want to be able to make sense of their symptoms. Keen to plan things that they can do/ solutions and strategies.			Patients want communication and empathy, and individualised information.
Bødskov et al. (2022)			Patients hope to have clarification on their condition and be pain-free. Few patients expect to be assessed by an orthopaedic surgeon but were satisfied with APP. Difficulty with insufficient information.	Parking and access were a problem, as were waiting times.	The lack of collaboration between GP services and clinics was seen as negative.	
Desjardins-Charbonneau et al. (2016)			Patients have trust and confidence in diagnosis and treatment. 58% were confident or extremely confident in APPs competence in triaging patients for surgical care. 63% confident that APPs make adequate decisions regarding their health.	72% of patients feel that APP use will reduce wait times.		
Fennelly et al. (2020)		Attractive for appointments to be at the hospital as this is where patients feel the experts are, and other services are co-located.	Patients want to be given information about clinics. Patients' knowledge of clinicians' competence and professionalism gives them ease, as well as knowing what the options are. Some see the APP as another step; this was more common in people who had seen a physiotherapist previously and were frustrated when they received the APP letter. But they were happily surprised once they had seen the clinician and had an assessment. (However, some patients were unsure that they had not seen the specialist/surgeon).	Timely access. The inconvenience of attending hospital appointments, the cost of travel, time off work, bus services, etc., were all barriers.		Patients want to be actively listened to, and to be offered guidance. Patients want to be involved in decisions.

Author (date)	Tasks				Guiding points	
	Mauriora: Access to te ao Māori [a]	Waiora: Environmental protection [b]	Toiora: Healthy lifestyles [c]	Te Oranga: Participation in society [d]	Ngā manukura: Leadership [e]	Te mana whakahaere: Autonomy [f]
Gustavsson et al. (2023)			Patents want their disorders confirmed.			Patients consider it important to be involved in the decision-making process related to their continual care.
Jasim et al. (2023)			Disconnected communication leaves patients feeling powerless with insufficient information to make such informed decisions. Patients want information earlier in their journey. Relationships with key professionals could significantly impact their experience and progress – negative interactions with surgeons halted their progress. GP recommended non-surgical management, which resulted in little or no improvements or too much pain to engage, with patients viewing this as a mechanism for managing service demand. Patients felt they need to demand and bully healthcare workers to help them progress along pathway.	Patients found pathways difficult to navigate. Obtaining a referral was a far greater challenge and concern.		
Joseph et al. (2014)			Patients want competency in clinicians. Patients are satisfied if clinicians decide to reroute treatment and provide their decision with an explanation. Patients want plans for treatments.	Access is a major barrier, and having to see a GP first before triage was described as a further barrier. Patients want more rapid access. GP can be a barrier. Patients find having to go to the GP to get a referral difficult.		Patients want support with the pathways. Patients want greater control in management.

Author (date)	Tasks				Guiding points	
	Mauriora: Access to te ao Māori[a]	Waiora: Environmental protection[b]	Toiora: Healthy lifestyles[c]	Te Oranga: Participation in society[d]	Ngā manukura: Leadership[e]	Te mana whakahaere: Autonomy[f]
Kechichian et al. (2024)			Patients would like reassurance. Education and explainations were important to them. Concern with the administration team's lack of information given to patients about the roles and what to expect. Competence in clinician. Seeing the right person at right time. "Physios are more specialised for these types of problems with joints".	Patients expect to be quickly managed. One patient was concerned that she was prescribed three physiotherapy sessions, and when she tried to get an appointment with a physiotherapist, she couldn't find one, so she gave up.	Cooperation between different departments and professions fosters trust.	Active listening and a patient-centred approach used by first-contact practitioners enabled patients to feel involved in their management.
Mutsekwa et al. (2022)			Patients have less familiarity with novel roles and pathways. This improved after attending the clinic. Patients want information that is understandable. Patients want diagnosis and exclusion of more sinister pathologies, which will be communicated in the first few sessions.	Timely access and shorter wait times to care. The long wait times were a source of anxiety. Patients value easy and efficient procedures with referral process and ease of arranging and attending appointments. Concerns about the costs of going to appointments and time off work.	Patients desired continuity and relationships with healthcare workers, with adequate follow-up. Better communication between GPs and health professional improves patient's confidence.	

Author (date)	Tasks				Guiding points	
	Mauriora: Access to te ao Māori [a]	Waiora: Environmental protection [b]	Toiora: Healthy lifestyles [c]	Te Oranga: Participation in society [d]	Ngā manukura: Leadership [e]	Te mana whakahaere: Autonomy [f]
Reeve and May (2009)		Some felt hospital was the best environment as this is where the experts are perceived to be and where further investigations (i.e. radiology) are close by. Some wanted location closer to home to make travel easier; familiar surroundings were more comfortable for patients.	Written information is considered helpful and can be referred to. Patients want more information about pathways and processes, and timeframes. Patients would like results framed in understandable terms. Patients want to come away with an action plan. Previous experiences, especially with physiotherapists, could affect patients' trust.	Patients want flexibility in appointment times, especially concerning work and transport.		Expect a competent diagnosis and together decide on management. Patients respect good communication, building rapport, and speaking to patients as equals.
Rempel et al. (2017)			45% of participants selected less than 3 on the Likert scale questionnaire for willingness to undergo nonphysician healthcare provider screening. 88% had some willingness. 70% of participants who, if ruled out for surgery as an option, would still want to see a surgeon for confirmation. 8.8% would not require confirmation from a specialist. 75% willing to pay or consider paying for nonphysician screening.	Expecting a timely screen within 1 month of referral.	Concerns from patients regarding concordance between surgeon and nonphysician assessment results.	

Author (date)	Tasks				Guiding points	
	Mauriora: Access to te ao Māori [a]	Waiora: Environmental protection [b]	Toiora: Healthy lifestyles [c]	Te Oranga: Participation in society [d]	Ngā manukura: Leadership [e]	Te mana whakahaere: Autonomy [f]
Ryan et al. (2020)			Risks, benefits, and alternatives were not transparent for patients, nor was the way the pathway worked. Patients want their needs and circumstances heard. Some felt that care being protocol-driven limited this. Patients felt they lacked the skills to access and evaluate information.	Accessing specialist opinion is difficult and protracted due to gatekeeping by GP and triage physiotherapist. Problematic having to first attend and then fail this appointment, as well as having new waiting lists at each stage in a pathway. High costs for patient access.	Services appear compartmentalised and non-collaborative, with the exception of a MDT meeting.	Noted to be difficult and burdensome for patients to be independent and proactive to meet their healthcare needs. Patients want control over their pathways. However, they did not know the pathway, so had no control. Feel the pathway is not person-centred. Patients were required to be independent and proactive with information and opinions of others and found this to be burdensome and difficult. They felt that pain negated their ability to make decisions and navigation of health pathways. Also difficult for patients to remain positive and motivated throughout this.
Samsson et al. (2016)			High importance for receiving information. Want a healthcare person who listens and is understanding. Reported high importance for competence.			High importance for the opportunity to participate in decision making.

Note. APP = advanced practice physiotherapist; GP = general practitioner; MDT = multidisciplinary team.

[a] Rests on secure cultural identity. Factor is important in health. To promote identity. How has health care incorporated te ao Māori? Or indigenous worldview? [b] Linked to the external world and spiritual element. Interaction of people and surroundings. How has the environment, location and health been considered? The safe, comfortable environment. [c] Messages delivered are clear to help improve the potential for Māori. People have the choice to improve their health. Education and communication: How information is delivered affecting change. Is this consistent and effective? [d] The services available and the voice in deciding how these are made available. Access: Why do people participate and have the confidence that they can access good health services. [e] Local leadership in the community. No single group has the skills or links to make large change. Bring whānau into health. Working together: How does communication between professions, services, leaders, and the community affect change? [f] Need a sense of patient ownership and control. Communities and whānau must have autonomy and self-determination in promoting their health. Health workers are working in patient-centred care and not leading the community/whānau in health changes. This includes patient participation in programmes. Person/whānau-centred care: Is understandable for patients. Indicators and measures are relevant to the community.

chieftainship, and ownership), self-determination and autonomy in shaping health are important for aligning health with Te Tiriti o Waitangi (McGruer et al., 2019; Walker et al., 2006). Thus, communication with the collective empowers patients to make decisions with their whānau and community in mind. Ailments in Māori (including osteoarthritis) affect whānau, the local community, and wider society. They affect their roles in these structures and can bring negative emotions and experiences (Dixon et al., 2021). To achieve improved communication and leadership, the findings of this review suggest that transparent communication chains and relationships between physiotherapy-led orthopaedic triage clinicians, GPs, and local communities should be created and nurtured. Acknowledging and welcoming whānau in clinics, creating collective dialogue, and person-centred care for the patient and whānau would remove barriers to patients making appointments and accessing services and pathways.

Gaps in the literature

All the study participants in this review appeared to have a white European background, presenting a Western preference of healthcare service delivery delivery. Moreover, there were no aspects of culture, or minority or indigenous peoples described in any of the studies, and none of the studies were conducted in Aotearoa New Zealand. This finding limits the applicability to Aotearoa New Zealand and determining whether Māori health needs are met in this health context, showing a need for future research. To be aligned with te Tiriti o Waitangi, culture and equity must be considered. Mauriora and waiora can be considered the acknowledgement and promotion of cultural identity and belonging, along with the interactions and relationships with and within the environment (Durie, 1999). This includes spiritual connections and access to spiritual lands and places such as marae and whānau (Durie, 1999). The lack of data for these two aspects helps to identify gaps that need to be investigated and acknowledged. Future research should explore the understanding and expectations that people hold about physiotherapy-led orthopaedic triage services in the context of Aotearoa New Zealand. Moreover, the use of Indigenous frameworks, such as Te Pae Māhutonga, to position the research would be valuable.

Strengths and limitations

To our knowledge, this is the first scoping review of patients' expectations and understanding of physiotherapy-led orthopaedic triage. A strength of this review is the framework used for conducting and reporting, which ensures rigour and trustworthiness. Using Te Pae Māhutonga as a framework helped identify gaps specific to the Aotearoa New Zealand cultural context, aiding identification of areas of future research specific to Aotearoa New Zealand.

The literature includes multiple clinician titles, terminology, and definitions, which may have influenced the search strategy and number of included studies. To address this, we checked reference lists of included articles, though significant overlap and interchangeable terminology persist (Naik et al., 2023; Trøstrup et al., 2020). Interestingly, no identified studies were conducted in the United States, possibly due to health system differences rather than terminology, as the search strategy accounted for variations like "physiotherapist" and "physical therapist". Studies included were from countries with similar health systems facing similar challenges.

The decision was made to focus on physiotherapy-led orthopaedic triage to assess feasibility and address the specific research question. Future studies could expand the scope to include innovative approaches in different disciplines, such as speech-language therapists working in ear, nose, and throat specialities.

The decision to include experience-based studies (post-assessment) regarding expectations and understanding made the extraction of information more difficult. While the addition of further rich information has enhanced the findings, it may also be seen as a limitation. This could be clarified by further studies examining understanding and expectations prior to physiotherapy-led orthopaedic assessment.

Clinical and practice-based recommendations

Practical and clinical recommendations emphasise patient education from the patient's first health access point to their discharge from service. This needs to include information about pathways, clinicians, diagnoses, treatment options, and timeframes. Effective active communication strategies with GPs, whānau, and communities are required. This could help break down barriers, especially regarding patient access, and create effective shared decision-making. This can also help to direct policy within these types of services.

CONCLUSION

The findings of this review on patients' expectations and understanding of physiotherapy-led orthopaedic triage are thematically reported within the Te Pae Māhutonga framework. Patients expect to receive information about pathways, diagnoses, and timeframes early in their journey. Patients want ease of access to pathways that limit barriers. Patients demand patient-centred care where they are involved in decisions and where good communication channels exist between primary and secondary care. This review reveals significant gaps in the literature, viewed through an Aotearoa New Zealand health context and equity lens. It emphasises the urgent need for Aotearoa New Zealand-specific health research to adapt physiotherapy-led orthopaedic triage services to our unique health system and to develop robust frameworks ensuring equitable health outcomes.

KEY POINTS

1. Patient-centred care and communication. The review emphasises the importance of providing clear, timely information about care pathways, diagnoses, and timeframes, ensuring patients feel informed and supported throughout their healthcare journey.
2. Culturally responsive practice. By applying the Te Pae Māhutonga Māori health promotion framework, the research highlights the need for culturally appropriate care that aligns with Te Tiriti o Waitangi, fostering equity and trust in service delivery.

3. Collaborative decision-making. The findings advocate for greater involvement of GPs, whānau, and other advocates in shared decision-making processes. This would enhance patient satisfaction and ensure services are tailored to individual and community needs.

DISCLOSURES

Nil.

PERMISSIONS

Nil.

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CONTRIBUTIONS OF AUTHORS

TK conceived the review and undertook searches, data extraction, charting, and analysis. He also contributed to developing the design, methods, manuscript production, and editing of the review. DOB contributed to developing the design, methods, analysis, manuscript production, and editing. NS contributed to developing the analysis, manuscript production, and editing.

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Appendix A

SEARCH STRATEGY

Medline via EBSCO (with CINAHL and SPORTDiscus) database search conducted on 30 March 2024

Search terms

1. Perceptions OR understanding OR expectations OR attitudes AND physi* AND orthopaedic triage
   = 4 results
2. Removal of physi*
   = 6 results
3. Final ortho* triage AND physi*
   = 48 results
   4 accepted to the next stage after reading titles

Cochrane library

Search terms

1. Ortho* triage
   = 31 results
   3 accepted to next stage after reading titles

SCOPUS

Search terms

1. Perceptions OR understanding OR attitudes OR expectations AND physi* AND orth* AND triage
   = 29 results

Comparative Effectiveness of Blood Flow Restriction Therapy versus Exercise Alone after Arthroscopic Rotator Cuff Repair: S-TRONGER Randomised Controlled Trial Protocol

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ABSTRACT

The purpose of this trial is to evaluate the effect of postoperative exercises with blood flow restriction therapy (BFRT) for 12 weeks in patients undergoing arthroscopic rotator cuff repair, compared to postoperative exercises alone. Fifty-eight adults aged from 40 to 65 years with a confirmed diagnosis of symptomatic degenerative rotator cuff tear, and treated with an arthroscopic rotator cuff repair, will be recruited to participate in a randomised controlled trial with 1:1 randomisation. Participants will be stratified by sex (female and male) and site (three hospitals) to twice weekly, supervised postoperative exercises with BFRT or postoperative exercises alone for 12 weeks. The primary outcomes will be the changes in shoulder muscle strength and muscle mass through abduction and external rotation maximal voluntary isometric contraction and supraspinatus cross-sectional area, respectively. Secondary outcomes include active range of motion, pain intensity, upper limb disability, and quality of life. Between-group differences will be tested with a linear mixed-effects model. Outcomes will be measured at baseline, 4 weeks, and 12 weeks. This is the first randomised controlled trial investigating the clinical effects of BFRT in patients with a rotator cuff repair. The novel application of BFRT may be a suitable strategy to attenuate shoulder muscle atrophy and strength deficits in the early stages of postoperative rehabilitation after rotator cuff repair. The results of this trial will support researchers and clinicians in optimising the BFRT postoperative exercises in patients with rotator cuff repair.

Ponce-Fuentes, F., Cuyul-Vásquez, I., Salazar-Méndez, J., Lluch, E., Calatayud, J., Casaña Granell, J., Cook, C., & Struyf, F. (2025). Comparative effectiveness of blood flow restriction therapy versus exercises alone after arthroscopic rotator cuff repair: S-TRONGER randomised controlled trial protocol. *New Zealand Journal of Physiotherapy, 53*(2), S1–S12. https://doi.org/10.15619/nzjp.v53i2.469

Key Words: Blood Flow Restriction Training, Clinical Trial, Exercise, Rotator Cuff Repair, Shoulder Pain

INTRODUCTION

Rotator cuff tears (RCTs) are one of the main causes of shoulder pain and disability, accounting for about 20% of all shoulder injuries (Lo & Burkhart, 2003), with an increasing prevalence among ageing populations (Wani et al., 2016). Traumatic RCTs typically occur in relatively younger persons (average age 54.7 years), predominantly males, often due to a fall on an outstretched arm (Mall et al., 2013). These tears are generally large, involve multiple tendons, and the supraspinatus is affected in 84% of cases (Mall et al., 2013). Non-traumatic degenerative RCTs are more commonly associated with lifestyle and metabolic factors. For instance, in females, non-traumatic RCTs have been linked to thyroid disease (Oliva et al., 2014), whereas smoking and hypercholesterolemia are considered risk factors in men (Oliva et al., 2014).

Both conservative and surgical interventions are used to treat participants with RCTs (Dickinson & Kuhn, 2023). Regarding surgery, arthroscopic rotator cuff repair is one of the most common interventions (Shibata, 2016). The main goal of rehabilitation after rotator cuff repair is to recover upper limb function. Current guidelines recommend dividing the rehabilitation process into three stages based on time-specific criteria: Stage I (passive range of motion), Stage II (assisted active range of motion), and Stage III (active exercise in closed and open chain) (Kjær et al., 2018). There is currently controversy about the optimal postoperative rehabilitation protocol following arthroscopic rotator cuff repair, particularly for the early postoperative phase (Chen et al., 2024; Houck et al., 2017). While early range of motion may provide superior benefits in terms of recovery of shoulder mobility after arthroscopic rotator cuff repair, aggressive rehabilitation could compromise repair integrity (Houck et al., 2017) and adversely affect shoulder function in the long term (Li et al., 2018). Postoperative protocols that include early range of motion are usually limited to passive mobilisations and pendulum exercises, with no consideration for the use of shoulder strengthening interventions (Chang et al., 2015). Indeed, open-chain active range of motion exercises for the shoulder are not recommended until advanced tendon healing, which is typically no earlier than six weeks after surgery (Kjær et al., 2018). Since atrophy of the rotator cuff does not improve after rotator cuff repair and correlates with poor functional outcome (Gladstone et al., 2007), new therapeutic modalities that can attenuate muscle atrophy and increase rotator cuff strength without compromising tendon healing need to be considered.

To increase skeletal muscle mass and strength, the American College of Sports Medicine (ACSM) recommends performing resistance exercise training at high intensity (> 80% of one-repetition maximum) (American College of Sports Medicine, 2009). However, these recommendations may be counterproductive for the early postoperative rehabilitation of an arthroscopic rotator cuff repair, as the tendon is in an early healing phase and shoulder movements are barely tolerated (Sgroi & Cilenti, 2018). In this context, alternative forms of traditional resistance exercise training such as blood flow restriction therapy (BFRT) are emerging to attenuate atrophy and allow muscle strength gains in the early postoperative rehabilitation (Ponce-Fuentes, Cuyul-Vásquez, Carranza, et al., 2024).

BFRT is an intervention that combines an external pressure system or cuff applied to a limb, which partially restricts arterial blood flow and fully restricts venous blood flow, with low load resistance training (Patterson et al., 2019). The main advantage of BFRT is its ability to induce adaptations in skeletal muscle mass and strength with low-intensity resistance exercises through various metabolic, hormonal, and neuromuscular pathways (Wang et al., 2023). To date, there is limited formal study on the efficacy of BFRT both in healthy people and in patients with rotator cuff disorders. Lambert et al. (2023) demonstrated that the combination of low-load resistance exercises targeting the rotator cuff muscles with BFRT produced a significant increase in upper limb lean mass, shoulder strength, and muscular endurance in comparison to low-load resistance exercises alone in healthy adults (Lambert et al., 2021; Lambert et al., 2023). Furthermore, an 8% increase in biceps muscle thickness and a 12% increase in shoulder internal rotation strength have been reported after shoulder-targeted exercises plus BFRT, compared to shoulder-targeted exercises alone in patients with rotator cuff tendinopathy (Kara et al., 2023). Although these data suggest a potential role for BFRT in healthy people and patients with rotator cuff disorders, it is not yet known whether these results are generalisable to patients undergoing arthroscopic surgery for RCT. Specifically, it remains unknown whether patients with an arthroscopic rotator cuff repair would benefit from the combination of active shoulder rehabilitation exercises with BFRT in the early postoperative stages.

We will conduct an assessor-blinded multicentre randomised controlled trial comparing the effects of postoperative exercises with BFRT versus postoperative exercises alone on shoulder muscle strength and mass in patients undergoing arthroscopic rotator cuff repair. Physical function, shoulder pain, upper limb disability, and quality of life self-reported outcomes will also be compared between both intervention groups. It is hypothesised that exercises with BFRT will result in significantly greater improvements in shoulder strength and muscle mass compared to exercises alone after 12 weeks of postoperative rehabilitation programme for patients receiving an arthroscopic rotator cuff repair.

METHODS

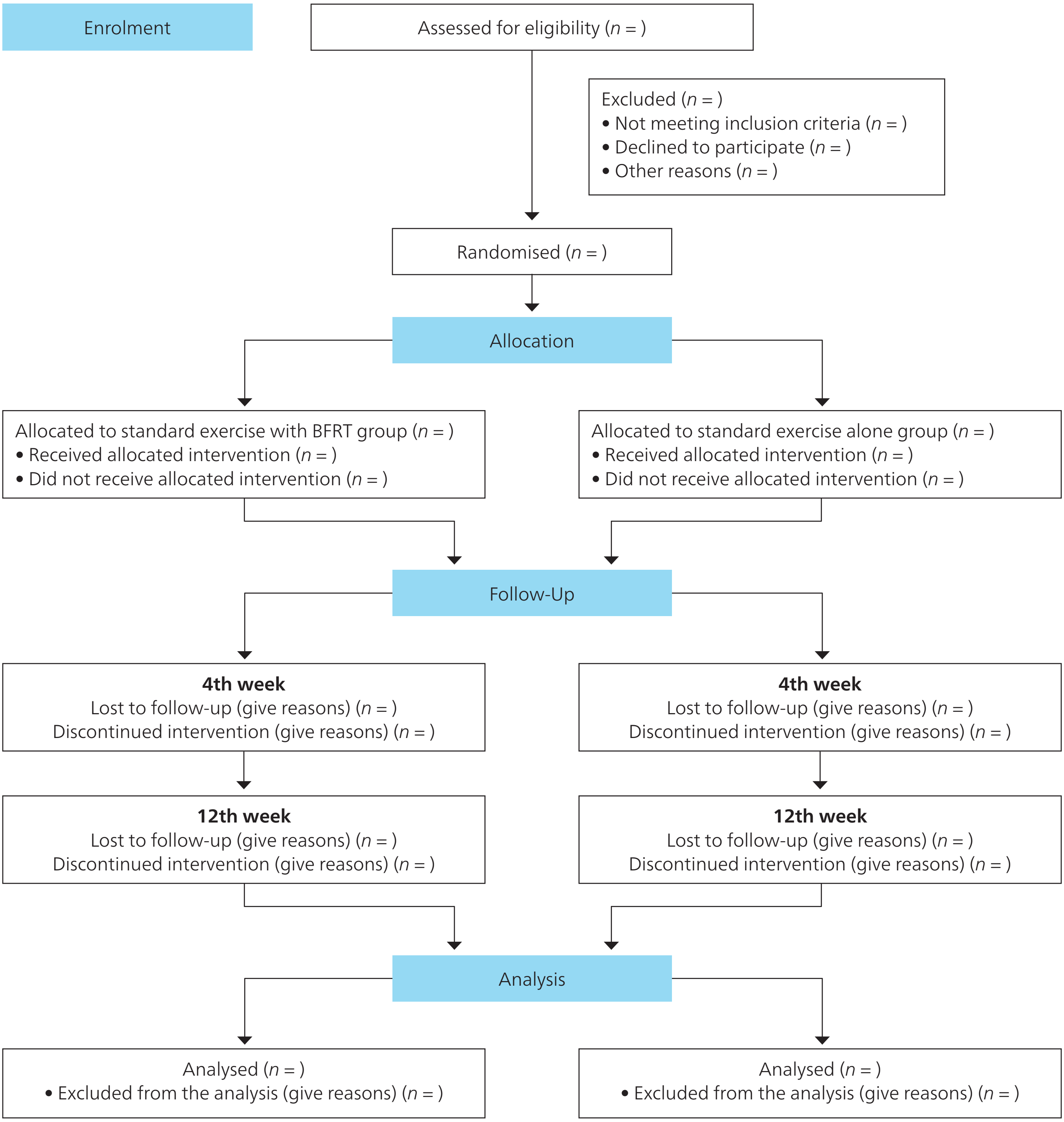
This trial protocol has been reviewed and approved by the ethics committee of the Araucanía Sur Health Service, Ministry of Health, Chile (protocol 396). Our study protocol follows the Standard Protocol for Randomised Interventional Trials (SPIRIT) (Chan et al., 2013), the Consolidated Standards of Reporting Trials (CONSORT) (Eldridge et al., 2016), the Template for Intervention Description and Replication (TIDieR) (Hoffmann et al., 2014), and the Consensus on Exercise Reporting Template (CERT) (Slade et al., 2016) guidelines. This Shoulder Therapy and Rehabilitation OccludiNG ExeRcise protocol trial (S-TRONGER trial) was prospectively registered on ClinicalTrials.gov (NCT06788327) in January 2025 and recruitment started in March 2025. It is expected that recruitment will be finalised in March 2027. Figure 1 presents the CONSORT diagram for this protocol.

Study design

This study will be a two-arm, assessor-blinded randomised controlled trial. Fifty-eight participants will be randomised into two intervention groups using a 1:1 allocation ratio. The experimental group will receive postoperative exercises with BFRT, and the control group will receive postoperative

Figure 1

Proposed CONSORT Diagram of Enrolment, Allocation, Follow-up, and Analysis for Each Arm of the Study



exercises alone. Randomisation will occur after baseline assessment (T_0) using computer-generated random blocks, stratified by sex and hospital. A member of the research team, who is not involved in the assessments or treatments, will oversee the allocation process. Both groups will undergo 12 weeks of intervention, with assessments performed at baseline (T_0), week 4 (T_1), and the end of the intervention week 12 (T_2). The study schedule is presented in Table 1.

Participants

Participants aged 40 to 65 years with a confirmed diagnosis

Table 1

Study Schedule

Schedule details	Study period			
	Enrolment	Allocation	Post-allocation	
Time point	T_{-1}	T_0	T_1 (week 4)	T_2 (week 12)
Enrolment	X			
Eligibility screen	X			
Informed consent	X			
Allocation		X		
Interventions				
Exercises with BFRT (intervention)		▪————	————	————▪
Exercises alone (control)		▪————	————	————▪
Assessments				
Demographic data		X		
Physical function variables				
Muscle strength		X	X	X
Muscle mass		X	X	X
Active range of motion		X	X	X
Self-reported variables				
Pain intensity (VAS)		X	X	X
Disability (SPADI)		X	X	X
Quality of life (WORC)		X	X	X
Adverse events			X	X
Statistical analysis				X

Note. BFRT = blood flow restriction therapy; VAS = visual analogue scale; SPADI = shoulder pain disability index; T_{-1} = 3 days prior to baseline assessment; T_0 = baseline assessment; WORC = Western Ontario Rotator Cuff Index.

of symptomatic degenerative full-thickness RCT involving at least the supraspinatus tendon (full thickness and width), verified by magnetic resonance imaging and treated with an arthroscopic rotator cuff repair will be included. They should be able to read and understand Spanish. Participants will be excluded if they present one of the following: A massive irreparable RCT, concomitant fracture, labral or nerve injury, suspicion of developing/diagnosis of a frozen shoulder, revision surgery after rotator cuff repair, previous corticosteroid injection (< 1 year), recent surgery (< 1 year) in the contralateral shoulder, a history of deep venous thrombosis/pulmonary embolism, peripheral vascular disease, thrombophilia or clotting disorders, severe or uncontrolled hypertension, or any comorbid condition that impedes participants from completing the intervention. Participants will be asked not to start any other intervention, including an exercise programme, while participating in the study.

Recruitment

This multicentre study will take place at Padre las Casas Hospital, Nueva Imperial Intercultural Hospital, and Villarrica Hospital, all located in the Araucanía region, Chile. Participants will be recruited primarily from the physiotherapy units of each hospital and will be assessed for eligibility between March 2025 and March 2027. A researcher will invite patients to participate in the study and will determine during the first assessment session which patients meet the eligibility criteria and inform them about the objectives and the study details. A six-step model will be used to ensure accurate recruitment of eligible patients following previous recommendations (Realpe et al., 2016): (1) explanation of the condition, (2) reassurance about receiving treatment, (3) information about why the study is necessary, (4) explanation of the purpose of the study, (5) a balanced view of integrating BFRT into traditional physiotherapy after rotator cuff surgery, and (6) explanation of study interventions and follow-up measurements. This process will be supported by a recruitment script, written by the research team and used in the first assessment session by the researcher. Patients who meet the selection criteria will be invited to sign informed consent prior to their participation in the study.

Randomisation, allocation concealment, and blinding

Participants will be randomised using a centralised computer-generated random number generator (www.random.org) into one of the two intervention groups (1:1). To ensure participants have equal chances of receiving exercises with BFRT or exercises alone, randomisation will be stratified by sex and hospital using a variable block size. Group allocation will be concealed by a research member using sequentially numbered opaque envelopes. These envelopes will be opened by the participant, in the presence of the recruitment team, but not in the presence of the outcome assessor. The statistician and the outcome assessor will be blinded to the group allocation, data collection, and analysis of the participants. Unblinding will only be permitted in response to regulatory requirements or at the end of the study. Participants will not be blinded to the allocated treatment due to the impossibility of concealing the interventions, as they are dissimilar in nature. The physiotherapists performing the interventions will not be blinded to the allocated treatment, as they need to know which intervention will be applied in each case.

Interventions

Both groups (postoperative exercises with BFRT and exercises alone) will receive an individualised 12-week physiotherapy programme that includes 24 one-on-one supervised physiotherapy sessions (2 sessions per week). In addition, each participant will perform two non-supervised exercise sessions per week, at home, on alternate days, from the physiotherapy sessions. After surgery, the affected shoulders of all participants will be immobilised in a sling with a bolster for 2 weeks, followed by 3 weeks of immobilisation in a sling without a bolster.

Two weeks post-surgery, both intervention groups will start an evidence-based physiotherapy programme developed for patients who receive an arthroscopic rotator cuff repair (Kjær et al., 2018; Kjær et al., 2021). This programme will be structured into three postoperative stages: Stage I (weeks 2 to 4), Stage II (weeks 5 to 8) and Stage III (weeks 8 to 12). Stage I will be primarily focused on shoulder-assisted passive range of motion and active-assisted range of motion exercises. Stages II and III will include shoulder and periscapular strengthening exercises in both closed and open chains with gradual loading of the rotator cuff tendons. Each supervised physiotherapy session will last approximately 45 min and include eight, six and six shoulder exercises in Stages I, II and III, respectively, for both intervention groups. All week-by-week predetermined exercise progressions in each stage will be selected and implemented following the recommendations of Kjær et al. (2018, 2021). In both treatment groups, during each supervised session, participants will be asked to perform all exercises with pain levels below five on the verbal Numeric Pain Rating Scale (NPRS). Physiotherapists responsible for implementing the exercise intervention will receive instructions on how to implement the postoperative physiotherapy programme, including the allowed pain intensity, and frequency of the shoulder exercises. In addition, each participant will perform two non-supervised exercise sessions at home per week, on alternate days from the physiotherapy sessions. All details of the home exercise programme are presented in Appendix A.

Exercises alone

Participants in the control group will start with flexion, abduction, and external rotation passive mobilisations, active supine bench press and active-assisted shoulder flexion for a total of eight exercises in Stage I. Then, the participants will perform six active and active-assisted exercises per session focused on flexion, abduction, external, and internal rotation of the shoulder in Stage II. Finally, six active and active-resisted shoulder exercises per session will be performed in Stage III. The description of the supervised physiotherapy protocol is described in Appendix B.

Exercises with BFRT

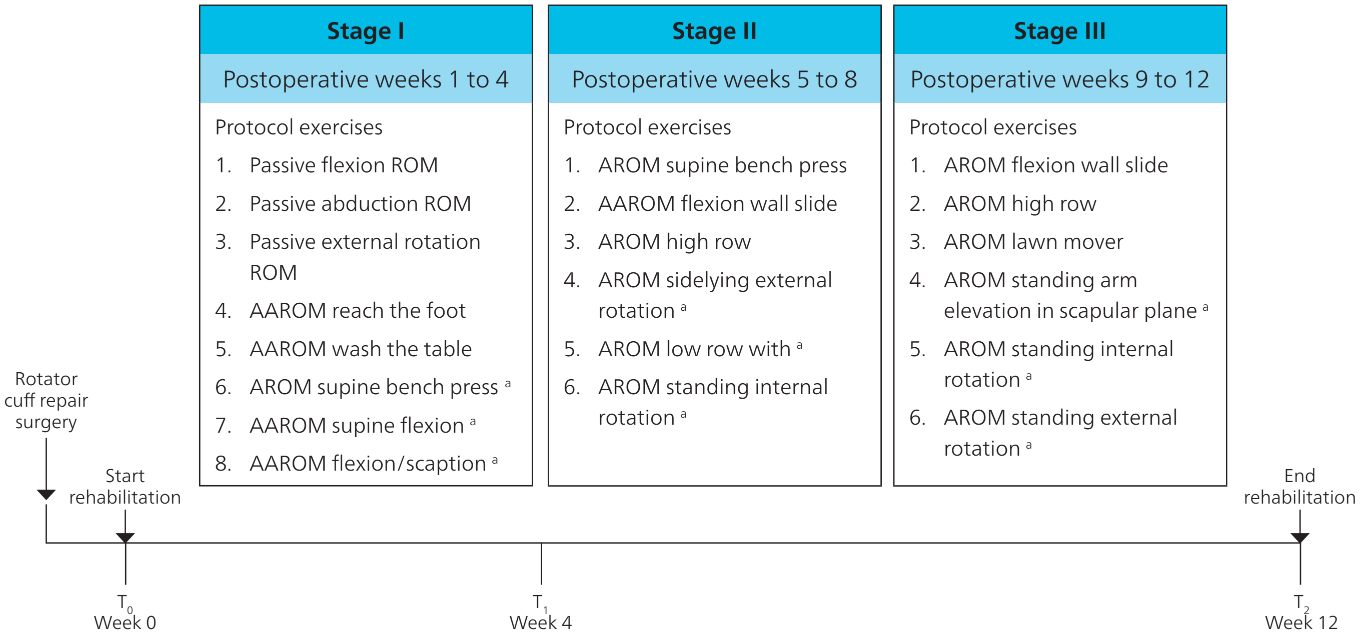
Participants in the experimental group will perform the same exercises as the control group, with the addition of BFRT in three exercises per stage. BFRT will be implemented according to current evidence-based guidelines (Patterson et al., 2019) and following the recommendations of previous studies using BFRT in patients with arthroscopic rotator cuff repair (Ponce-Fuentes, Cuyul-Vásquez, Carranza, et al., 2024). In each supervised session, BFRT will be added to three exercises focused on shoulder-assisted passive range of motion and active-assisted range of motion in Stage I, and to three shoulder and periscapular progressive strengthening exercises in closed and open chain with gradual loading of the rotator cuff tendons in Stages II and III (Appendix B). An auto-regulated portable BFRT SmartCuffs® 3.0 Pro system with a 17-inch long and 5-inch-wide cuff (Smart Tools Plus, Strongsville, Ohio, United States), placed on the most proximal part of the arm, will be used. Each BFRT session will begin with a maximal occlusion test to personalise the occlusion pressure to the participant. The limb occlusion pressure will be set at 50% of the maximum occlusion pressure in Stage I and 60% in stages II and III (Bowman et al., 2020; Ponce-Fuentes, Cuyul-Vásquez, Carranza, et al., 2024). The participant will perform 75 repetitions of each BFRT exercise, divided into four sets (30, 15, 15, and 15 repetitions). During each session, the intensity of exercise will be individually tailored using both the pain monitoring model approach (pain should be kept below five on the NPRS) and Borg's CR10 perceived exertion scale (1 = "very weak" to 10 = "extremely strong"). The load intensity during the BFRT exercises will be set near to 3 out of 10 on Borg's CR10 scale ("weak"), which corresponds to 30% of 1RM effort (Buckley & Borg, 2011). The physiotherapist performing the intervention will adjust the loads during each exercise to achieve the target range of perceived exertion (3/10). After each exercise, the cuff will be deflated, and the patient will rest for 2 min. An overview of the study rehabilitation interventions is shown in Figure 2.

Outcome measures

The descriptive characteristics of the participant and their medical history will be assessed, followed by muscle morphology, muscle strength, and mobility. Standardised 2 min rest periods will be used between strength assessments of each muscle group and between mobility assessments. The self-report questionnaires will be presented on paper at the end of the assessment sessions.

Figure 2

Representation of Treatment Schedule and Timepoint Assessments



Stage I	Stage II	Stage III
Postoperative weeks 1 to 4	Postoperative weeks 5 to 8	Postoperative weeks 9 to 12
Protocol exercises	Protocol exercises	Protocol exercises
1. Passive flexion ROM	1. AROM supine bench press	1. AROM flexion wall slide
2. Passive abduction ROM	2. AAROM flexion wall slide	2. AROM high row
3. Passive external rotation ROM	3. AROM high row	3. AROM lawn mover
4. AAROM reach the foot	4. AROM sidelying external rotation [a]	4. AROM standing arm elevation in scapular plane [a]
5. AAROM wash the table	5. AROM low row with [a]	5. AROM standing internal rotation [a]
6. AROM supine bench press [a]	6. AROM standing internal rotation [a]	6. AROM standing external rotation [a]
7. AAROM supine flexion [a]		
8. AAROM flexion/scaption [a]		

Note. ROM = range of motion; AAROM = active-assisted range of motion; AROM = active range of motion; T_0 = baseline assessment; T_1 = 4-week assessment; T_2 = 12-week assessment.

[a] Exercises with BRFT in experimental group.

Primary and secondary outcomes will be evaluated in a single session at baseline (T_0), week 4 (T_1), and week 12 (T_2). The time allocated for each assessment will be 60 min for T_0 and 45 min for T_1 and T_2. A progress tracking chart will be used as an individualised motivational strategy for each participant.

Primary outcomes

The primary outcomes used in this study will be the between-group changes in shoulder muscle strength and muscle mass.

1. Shoulder strength

Shoulder muscle strength will be measured through maximal voluntary isometric contraction (MVIC) in shoulder abduction and external rotation at 20° of abduction using an ActivForce 2 digital handheld dynamometer (Activbody, San Diego CA, USA) (Karagiannopoulos et al., 2022). Three trials will be performed for each direction at maximal effort. Each isometric contraction will last 3 s. Measurements will be taken bilaterally, and the average of the three maximal trials will be used for data analysis. The MVIC tests demonstrate excellent reliability, with intraclass correlation coefficients (ICCs) ≥ 0.93 for shoulder muscle strength (Meldrum et al., 2003). The minimal detectable change ($MDC_{\%}$) for shoulder abduction strength is 14.8% (Karabay et al., 2020) and 15.8% for external rotation (Holt et al., 2016).

2. Shoulder muscle mass

The cross-sectional area (CSA) of supraspinatus will be measured bilaterally using ultrasound imaging with a high-resolution, multifrequency (8-13 MHz) linear transducer (LOGIQ F8, GE Healthcare, Wauwatosa, WI, USA) based on the recommendations of a previous study (Safford et al., 2024). The participant will be seated with the trunk in a neutral position, the elbow flexed to 90°, and the shoulder in neutral position. The transducer will be placed on the superior aspect of the shoulder, and the CSA of the supraspinatus muscle will be identified from the posterior edge of the acromion to the medial edge of the spine of the scapula (Safford et al., 2024). The average of the three ultrasound measurements will be used for data analysis.

All the ultrasound measurements will be performed by the outcome assessor, who will be trained by an experienced certified sonographer, with 10 years of experience in musculoskeletal ultrasound assessment. ImageJ version 1.45s (NIH, Bethesda, MD), a computerised image analysis programme, will be used for supraspinatus CSA measurement. Intra- and inter-rater reliability of ultrasound measurements will be calculated before initiating the study, and additional training will be provided if the values of the ICC are below 0.90, which is consistent with results in the literature (Harris-Love et al., 2016). Ultrasound assessment of supraspinatus CSA is a reliable method for evaluating the shoulder muscle mass (ICC = 0.97) (Shah et al., 2017). The MDC for supraspinatus CSA is 0.8 cm^2 (Shah et al., 2017).

Secondary outcomes

The secondary outcome measures will be (i) shoulder flexion, abduction, and external rotation active range of motion measured with a 2° sensitivity goniometer (Enraf-Nonius, Netherlands) (Norkin & White, 2016), (ii) pain intensity at rest and worse movement, evaluated with the Visual Analogue Scale (VAS) (Michener et al., 2011), (iii) upper limb disability evaluated with the Shoulder Pain Disability Index (SPADI) (Roach et al., 1991), and (iv) quality of life measured with the Western Ontario Rotator Cuff Index (WORC) (Kirkley et al., 2003).

Descriptive characteristics and other outcomes

The baseline characteristics of the sample including age, sex, height, weight, educational level, ethnicity, marital status, job type, frequency of physical activity, comorbidities, smoking, use of medication, rotator cuff tendons affected, tear size, time since diagnosis, and time since surgery will be recorded.

Other outcomes measured during each physiotherapy session will also be recorded including pain intensity (NPRS; at the beginning and end of the session), perceived exertion (Borg's CR10; at the end of the session) and global rating of change (GROC; at end of the session). Each participant will complete an exercise diary to record home exercise sessions and assess adherence to the home rehabilitation programme.

Adverse events or side effects

Participants will be informed about the potential side effects resulting from each intervention, including instructions on how they should proceed if they occur. In particular, participants in the exercises with the BFRT group will be informed that they may experience mild side effects, such as numbness, a cold sensation, or minor bruising at the application area that often resolve in less than 24 hr (Hughes & Patterson, 2020). Furthermore, participants in the exercises with BFRT group will be informed that this intervention may cause serious adverse events, although the probability is very low (deep vein thrombosis: 0.06%, pulmonary embolism: 0.008%, and rhabdomyolysis: 0.008%) (Nakajima et al., 2006). In each supervised session, the participant will be asked to report any side effects or adverse events.

Data management

The protocols for informed consent, screening scripts, intervention handbook, and data forms will be available in a paper folder for study staff. Study data will be collected and managed by blinded study personnel using electronic data collection methods or double data entry via the SSASur website, a secure web-based data capture application with real-time data entry validation, audit trails, and transaction logs.

Data analysis

Sample size

The required sample size will be calculated using G*Power software (version 3.1). A repeated measures analysis of variance (ANOVA) model will be used, including the interaction between groups. The sample size calculation will be based on a previous study that reported a partial eta squared effect size of $\eta p^2 = 0.17$ for between-group differences in muscle strength after rehabilitation with BFRT (Karanasios et al., 2022). To achieve 80% power at an alpha level of 0.05, a total of 50 participants (25 per group) will be recruited.

Data analysis

An intention-to-treat analysis will be performed, which includes all randomly assigned participants. Descriptive statistics will be used to identify the demographic and clinical characteristics of the participants. The normality and sphericity of the data will be verified with the Kolmogórov-Smirnov and Mauchly tests, respectively. To verify randomisation, baseline characteristics will be compared between groups using t tests, Chi square tests, Wilcoxon rank-sum tests, or Fisher exact tests, as appropriate. Characteristics that are different between groups ($p < 0.10$) and considered potential confounders will be included in the models described below. The differences analysis will be tested with linear mixed-effects models. Treatment (BFRT and control), time (baseline, week 4, and week 12), treatment by time interaction, and baseline covariate will be fixed effects, and participant will be the random effect in the linear mixed-effects models for shoulder muscle strength, supraspinatus CSA, active range of motion, pain intensity, disability, and quality of life variables. Furthermore, the effect sizes within and between groups will be calculated using the partial eta squared. Effect sizes of 0.01 will be considered small, 0.06 medium, and 0.14 large (Cohen, 2013). The level of significance will be established at $p \leq .05$. All statistical analyses will be performed using SPSS version 25.0 software (SPSS Inc, Chicago, IL).

Training, fidelity, and monitoring

The physiotherapists responsible for implementing the interventions will be trained by a physiotherapist with more than 15 years of clinical experience in musculoskeletal rehabilitation, certified in BFRT and with prior published BFRT studies in upper limb pathology (Ponce-Fuentes, Cuyul-Vásquez, Carranza, et al., 2024; Ponce-Fuentes, Cuyul-Vásquez, & Ó Conaire, 2024). This training period will begin one month before the start of the study and include instruction on the theory and application of BFRT, as well as practice trials of the BFRT protocol with healthy persons to ensure consistency among physiotherapists. The training sessions will consist of two days of training (6 hr per day) in a workshop format, which will include theoretical foundations, question-and-answer sessions and role-playing exercises to demonstrate how to support participants. The training sessions will be complemented by a comprehensive manual providing clear instructions to clinicians on all aspects of the interventions. In addition, a standardised treatment diary checklist will be available for each participant session to promote adherence to the treatment protocol and assess treatment fidelity. Finally, a practical test will be conducted to verify adherence to treatment protocols. The fidelity of the intervention will be assessed at one of the first five visits for each participant in both intervention groups by a team member not responsible for delivering the interventions. If intervention fidelity is less than 90% at any check, a recheck will be performed within the next five visits. If the procedural reliability remains below 90%, additional individual training sessions will be completed.

The outcome assessors responsible for evaluating all outcome variables will be trained on how to implement the participants' eligibility criteria, appropriate assessment of outcome measures, and how to correctly record data. Outcome assessors will undergo fidelity testing every 6 months. Data files will be reviewed on an ongoing basis to confirm that results are completed per protocol. If procedural reliability is below 90%, additional training sessions will be conducted.

A data monitoring committee composed of two researchers will review continuously the progress of the study, access interim results, and make the final decision to terminate the trial. Also, the data monitoring committee will review the presence of any adverse events every four months. If the number of participants reporting an intervention-related adverse event reaches five (unfavourable and unintended sign, symptom, or disease, generally manageable and reversible, e.g., nausea, headache, mild rash) or if one serious intervention-related event occurs (severe event related to life-threatening situation, death, situation that requires hospitalisation, or causes persistent/significant disability), the study will be suspended until the committee monitor evaluates the study-relatedness for each incident and determines whether continuing is appropriate. In addition, the informed consent and de-identified data of all participants will be stored in a secure database with daily backup. Hard copies of the data will be kept in an approved, secure storage facility. Any protocol amendment will be communicated to the Scientific Ethics Committee of the Chilean Ministry of Health, which will annually audit the correct functioning of the research.

Dissemination plan

The study findings will be reported to participants, stakeholder groups, at conferences, and in peer-reviewed publications.

DISCUSSION

Despite the growing use of BFRT for treating different musculoskeletal disorders, few studies have assessed its use in the rehabilitation of people with shoulder pain (Ceballos et al., 2022; Kara et al., 2023; McGinniss et al., 2022; Miller et al., 2022; Ponce-Fuentes, Cuyul-Vásquez, Carranza, et al., 2024). To our knowledge, only one case report has evaluated the effects of BFRT in a patient with an arthroscopic rotator cuff repair (Ponce-Fuentes, Cuyul-Vásquez, Carranza, et al., 2024). In this study, a 54-year-old man with an arthroscopically treated full-thickness rotator cuff tear completed a 12-week postoperative rehabilitation programme that included low-load resistance exercises with BFRT. The patient demonstrated clinically significant improvements in long head biceps brachii muscle thickness, shoulder abduction and external rotation strength, shoulder range of motion, movement-evoked pain, and physical function. However, due to design limitations, the authors recommended conducting a randomised clinical trial comparing the effectiveness of adding BFRT to postoperative physiotherapy exercises versus postoperative physiotherapy alone following an arthroscopic rotator cuff repair.

Other studies have assessed the effect of BFRT for people with rotator cuff disorders, but not specifically in a population undergoing rotator cuff surgery. For instance, a significant increase in biceps muscle thickness and shoulder internal rotation strength has been reported in patients with rotator cuff-related shoulder pain receiving BFRT (Kara et al., 2023). However, the study included participants treated conservatively for shoulder pain secondary to rotator cuff tendinopathy (without a rotator cuff tear), in which considerations related to tendon healing and irritability levels are not comparable to those patients undergoing a post-operative rehabilitation programme after rotator cuff repair. A case series study found a clinically significant improvement in shoulder strength and physical function after six to 12 weeks of BFRT in patients who underwent shoulder stabilisation surgery (McGinniss et al., 2022). However, this study presents critical differences with our trial protocol due to (i) exclusion of patients with rotator cuff repair, with BFRT performed only in patients with glenoid labrum or glenohumeral ligament injuries that had been surgically repaired, and (ii) inclusion of a young population (military cadets), which differs from our study, which will include adults up to 65 years old. Lastly, two case reports showed clinically significant improvements in shoulder isometric strength, range of motion, and patient-reported function in patients with shoulder subacromial impingement after BFRT in patients with subacromial pain (Ceballos et al., 2022; Miller et al., 2022).

The results of this trial could have a significant impact due to the lack of current evidence on the effectiveness of low-load postoperative resistance exercises with the addition of BFRT for patients with surgically repaired rotator cuffs, who need tailored exercise approaches to ensure both safety and feasibility. In fact, in the initial stage of postoperative rehabilitation for rotator cuff repair, early tendon healing, and low tolerance to shoulder movement could cause more pain and irritability of the local tissue should high-intensity resistance training or low load to volitional failure be used. This would lead to difficulties in improving muscle mass and strength in the early stages of postoperative rehabilitation (Sgroi & Cilenti, 2018). In this context, the novel application of BFRT may be a suitable strategy to attenuate shoulder muscle atrophy and strength deficits in the early stages of postoperative rehabilitation for patients undergoing an arthroscopic rotator cuff repair.

We recognise that there are several limitations to this study. For example, physiotherapists will not be blinded to treatment groups due to evident differences in the interventions applied. We have attempted to minimise potential bias by using standardised scripts to explain the BFRT intervention, and all assessments will be performed by researchers who will be blinded to the participant's allocated intervention. Finally, another limitation is the absence of a sham-BFRT control group, which allows for the assessment of the influence of non-specific factors, including natural history or contextual factors associated with the effect of BFRT.

DISCLOSURES

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PERMISSIONS

This study was approved by the ethics committee of the Araucanía Sur Health Service, Ministry of Health, Chile (protocol 396).

CONTRIBUTIONS OF AUTHORS

Design conceptualisation and methodology, FP-F, JC, JCG, and FS; validation, JC, JCG, CC, and FS; formal analysis, FP-F; data curation, not applicable; writing—original draft preparation, FP-F, IC-V, and JS-M; writing—review and editing, JC, JCG, CC, and FS; funding acquisition, no funding.

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Appendix A

HOME EXERCISE PROTOCOL AFTER ROTATOR CUFF REPAIR

Exercise number	Exercise name	Dose	Materials
		Stage I (postoperative weeks 2 to 4)	
1	AAROM reach the foot (flexion)	60 reps (30, 30), VAS < 5, twice per week on the days without physiotherapy session	Chair
2	AAROM wash the table (flexion on table)	60 reps (30, 30), VAS < 5, twice per week on the days without physiotherapy session	Table
3	AAROM supine flexion	60 reps (30, 30), VAS < 5, twice per week on the days without physiotherapy session	Not necessary
4	AROM supine bench press	60 reps (30, 30), VAS < 5, twice per week on the days without physiotherapy session	Broomstick
		Stage II (postoperative weeks 5 to 8)	
1	AROM sidelying external rotation	60 reps (30, 30), VAS < 5, twice per week on the days without physiotherapy session	Not necessary
2	Isometric hold for shoulder flexion	60 reps (30, 30), 5 s hold each rep, VAS < 5, twice per week on the days without physiotherapy session	Not necessary
3	AAROM abduction	60 reps (20, 20, 20), VAS < 5, twice per week on the days without physiotherapy session	Broomstick
4	AAROM flexion wall slide	60 reps (20, 20, 20), VAS < 5, twice per week on the days without physiotherapy session	Not necessary
		Stage III (postoperative weeks 9 to 12)	
1	AROM supine external rotation (hand to neck)	60 reps (20, 20, 20), VAS < 5, twice per week on the days without physiotherapy session	Not necessary
2	AROM supine internal rotation (hand to lower back)	60 reps (20, 20, 20), VAS < 5, twice per week on the days without physiotherapy session	Not necessary

Note. AAROM = active-assisted range of motion; AROM = active range of motion; reps = repetitions; VAS = visual analogue scale.

Appendix B

SUPERVISED PROTOCOL OF THE EXERCISES WITH AND WITHOUT BFRT AFTER ROTATOR CUFF REPAIR

Exercise number	Exercise name	Dose	Materials
		Stage I (postoperative weeks 2 to 4)	
1	Passive ROM: Flexion	2 min, VAS < 5	Not necessary
2	Passive ROM: Abduction	2 min, VAS < 5	Not necessary
3	Passive ROM: External rotation	2 min, VAS < 5	Not necessary
4	AROM supine bench press with BFR addition	75 reps (30,15, 15, 15), 2 s concentric: 2 s eccentric, LOP 50%, RPE 3/10, 30 s rest, 2 min inter exercise rest with reperfusion, VAS < 5	Broomstick
5	AAROM supine flexion with BFR addition	75 reps (30,15, 15, 15), 2 s concentric: 2 s eccentric, LOP 50%, RPE 3/10, 30 s rest, 2 min inter exercise rest with reperfusion, VAS < 5	Not necessary
6	AAROM flexion/scaption with BFR addition	75 reps (30,15, 15, 15), 2 s concentric: 2 s eccentric, LOP 50%, RPE 3/10, 30 s rest, 2 min inter exercise rest with reperfusion, VAS < 5	Jump rope
7	AAROM reach the foot (flexion)	60 reps (15, 15, 15, 15), VAS < 5	Chair
8	AAROM wash the table	60 reps (15, 15, 15, 15), VAS < 5	Table
		Stage II (postoperative weeks 5 to 8)	
1	AROM sidelying external rotation with BFR addition	75 reps (30,15, 15, 15), 2 s concentric: 2 s eccentric, LOP 50%, RPE 3/10, 30 sec rest, 2 min inter exercise rest with reperfusion, VAS < 5	Not necessary
2	AROM low row (extension) with BFR addition	75 reps (30,15, 15, 15), 2 s concentric: 2 s eccentric, LOP 50%, RPE 3/10, 30 sec rest, 2 min inter exercise rest with reperfusion, VAS < 5	TheraBand
3	AROM standing internal rotation with BFR addition	75 reps (30,15, 15, 15), 2 s concentric: 2 s eccentric, LOP 50%, RPE 3/10, 30 sec rest, 2 min inter exercise rest with reperfusion, VAS < 5	TheraBand
4	AAROM abduction	60 reps (15, 15, 15, 15), VAS < 5	Broomstick
5	AAROM flexion wall slide	60 reps (15, 15, 15, 15), VAS < 5	Not necessary
6	AROM high row	60 reps (15, 15, 15, 15), VAS < 5	TheraBand
		Stage III (postoperative weeks 9 to 12)	
1	AAROM flexion wall slide	60 reps (15, 15, 15, 15), VAS < 5	Not necessary
2	AROM high row	60 reps (15, 15, 15, 15), VAS < 5	TheraBand
3	AROM lawn mover	60 reps (15, 15, 15, 15), VAS < 5	Dumbbell
4	AROM standing arm elevation in scapular plane with BFR addition	75 reps (30,15, 15, 15), 2 s concentric: 2 s eccentric, LOP 50%, RPE 3/10, 30 sec rest, 2 min inter exercise rest with reperfusion, VAS < 5	Dumbbell
5	AROM standing internal rotation with BFR addition	75 reps (30,15, 15, 15), 2 s concentric: 2 s eccentric, LOP 50%, RPE 3/10, 30 s rest, 2 min inter exercise rest with reperfusion, VAS < 5	TheraBand
6	AROM standing external rotation with BFR addition	75 reps (30,15, 15, 15), 2 s concentric: 2 s eccentric, LOP 50%, RPE 3/10, 30 s rest, 2 min inter exercise rest with reperfusion, VAS < 5	TheraBand

Note. AAROM = active-assisted range of motion; AROM = active range of motion; BFR = blood flow restriction; LOP = limb occlusion pressure; reps = repetitions; ROM = range of motion; RPE = rate of perceived exertion; VAS = visual analogue scale.