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- Urinary incontinence assessment and management post-stroke
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Level 6
342 Lambton Quay
Wellington 6011
PO Box 27386
Marion Square
Wellington 6141
New Zealand

Phone: +64 4 801 6500
pnz@physiotherapy.org.nz
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Level 6, 342 Lambton Quay, Wellington 6011
Phone: +64 4 801 6500 | www.pnz.org.nz/journal

PHYSIOTHERAPY NEW ZEALAND
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Moving Forward with Innovation in 2023!

After approximately three years in the making, we are excited to announce the transition of the *New Zealand Journal of Physiotherapy* (*NZJP*) to Open Journal Systems (OJS) (PKP software) – which will be available either as you are reading this or very shortly after! OJS is a publishing platform enabling us to electronically manage many aspects of our current workflow including submission, peer review, and publication of papers. This platform was originally launched in 2002 in Canada (Willinsky, 2005) and has undoubtedly undergone many iterations since this time to become what it is today. Getting to the point of using the OJS software is a testament to the dedication of a team of people – we are very grateful for the input and expertise of staff from the University of Otago Library Research Support Unit and Information and Technology Services team, and to our physiotherapy colleagues who have generously trialled OJS (as an author or reviewer) over the past months to help us refine this system and respond to any glitches and inefficiencies. We are also thankful for the continuous support from Physiotherapy New Zealand (PNZ), which means we can publish our triennial issues of the *NZJP* to a high standard (including copy editing and design). PNZ has also supported us in disseminating our work through post-publication activities such as lodging metadata with Crossref, including impact statements in Physio Matters (to provide a synopsis of *NZJP* content), and notifications and communication through social media channels. While many aspects of the *NZJP* will remain the same with the shift to OJS, some will have a different look and feel. We invite you to visit us through the link on the PNZ website or directly at https://nzjp.org.nz/nzjp/index.

The *NZJP* is fortunate to receive support from a range of authors and reviewers, from physiotherapists working as clinicians, researchers, and lecturers, and indeed contributions from related professions as well. Through their work, we hope the content of the *NZJP* reflects what physiotherapists in Aotearoa New Zealand like to read in terms of research and professional issues. We aim to ensure the *NZJP* is a relevant and welcoming place to publish research that is of significance not only nationally but internationally. To this end, one of our foci in the upcoming year is whanaungatanga/relationship building, to establish and develop meaningful partnerships with other PNZ groups, including our Māori and Pacifica colleagues. In keeping with our vision, which is based on embedding and upholding Te Tiriti o Waitangi through our kaupapa to promote and disseminate the research of Aotearoa New Zealand, we would like to expand the publication of work that uses a kaupapa Māori approach or critically analyses issues pertinent to Indigenous and Pacific physiotherapy. We acknowledge there are different ways of knowing, and thus openly encourage a broad range of methodologies, including research that is foundational, clinical, implementational, or transformational. Due to our interest in professional and research matters that are specific to Aotearoa New Zealand, as an editorial committee we are committed to capacity building and so are willing to offer extra support to new authors and reviewers by providing guidance and mentorship when needed.

We are conscious the *NZJP* is relatively small on the international stage, but we are proud of our publication and strongly committed to developing its reputation and excellence. New measures were introduced to capture metrics with the listing of the *NZJP* on Scopus in 2018. Bearing in mind it usually takes approximately 18 months to accumulate sufficient data to generate metrics, data indicate the *NZJP* has risen from a 2019 ranking of 188/196 (4th percentile, CiteScore 0.1) in the Physical Therapy, Sports Therapy, and Rehabilitation category, to 157/218 (28th percentile, CiteScore 0.9) in 2021 (Scopus Preview, n.d.). To place this in context, the most highly ranked journal in this category is the *British Journal of Sports Medicine*, followed by a range of other journals (please refer to Table 1 for some examples of metrics). Based on these data, we still have some ground to cover, but we are committed to continuing our momentum up the Scopus ladder!

The *NZJP* is the journal of our profession in Aotearoa New Zealand, and we welcome your submissions. Benefits of publishing with the *NZJP* include a supportive and mentoring philosophy, open access, no publication charges, and listing on Scopus, as well as the opportunity to share relevant

Table 1

Selected Metrics from Scopus Preview in the Physical Therapy, Sports Therapy, and Rehabilitation Category

Journal	Percentile	CiteScore	Ranking (/218)
British Journal of Sports Medicine	99	21.3	1
Journal of Physiotherapy	96	7.8	9
Physiotherapy	86	5.0	31
Hong Kong Physiotherapy Journal	52	2.1	103
South African Journal of Physiotherapy	34	1.1	144
New Zealand Journal of Physiotherapy	**28**	**0.9**	**157**
Physiotherapy Practice and Research	25	0.7	164
International Journal of Sports Physical Therapy	7	0.1	203

findings to Aotearoa New Zealand and internationally. With the introduction of OJS, our publication timeframes will also be shorter, as we will be able to offer advanced online first publications. As always, we welcome any feedback, so please do get in touch with us at any time.

Stephanie Woodley, Richard Ellis, Rachelle Martin, Sarah Mooney, Suzie Mudge, Jo Nunnerley, Meredith Perry, Nusratnaaz Shaikh

Honorary Editorial Committee, *New Zealand Journal of Physiotherapy*

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‘Making Sense’ of Urinary Incontinence: A Qualitative Study Investigating Women’s Pelvic Floor Muscle Training Adherence

E. Jean C. Hay-Smith *PhD*
Professor of Rehabilitation, Department of Medicine, University of Otago, Wellington, New Zealand

Mark Pearson *PhD*
Reader in Implementation Science, Wolfson Palliative Care Research Centre, Hull York Medical School, University of Hull, United Kingdom

Sarah G. Dean *PhD*
Professor in Psychology Applied to Rehabilitation and Health, University of Exeter Medical School, United Kingdom

ABSTRACT

Urinary incontinence is common and disabling. Pelvic floor muscle training is recommended as first-line therapy for uncomplicated urinary incontinence. The effects of such behavioural therapies depend in part on adherence. We explored women’s experiences of incontinence treatment and training adherence in a longitudinal qualitative design. Six women (40–80 years) with stress, urgency or mixed urinary incontinence symptoms were interviewed twice; once at the start of treatment and again after discharge about 3 months later. Interviews were transcribed and analysed using principles of Interpretative Phenomenological Analysis. Experiences were represented by four themes: *Past experiences and meanings of leakage*; *the supervised treatment period*; *going on and looking ahead*; and *the relationship with and experience of others*. Variable adherence was explained by how women ‘made sense of it all’. Women with the least difficulty in making sense of their incontinence and in overcoming training inertia had the best self-reported outcomes. Conversely, variable adherence, poorer self-reported outcomes, and ambivalence about engaging in treatment were characteristic of women who struggled to make sense of their apparently intermittent or unpredictable condition. Helping women make sense of incontinence and overcome inertia and ambivalence could improve adherence, but this may be a prolonged process.

Hay-Smith, E. J. C., Pearson, M., & Dean, S. G. (2023). ‘Making sense’ of urinary incontinence: A qualitative study investigating women’s pelvic floor muscle training adherence. *New Zealand Journal of Physiotherapy, 51*(1), 6–13. https://doi.org/10.15619/NZJP/51.1.02

Key Words: Adherence, Interpretative Phenomenological Analysis, Pelvic Floor Muscle Training, Qualitative Research, Urinary Incontinence

INTRODUCTION

Urinary incontinence (UI) is common. While reported prevalence varies considerably by study and country, most studies have estimates in the range of 25% to 45% of women experiencing any incontinence in the last year (Milsom et al., 2013). Urinary incontinence is associated with poor quality of life (Pizzol et al., 2021), depression and anxiety (Cheng et al., 2020), and a range of other physical and psychological harms including stigma (Murphy et al., 2022). International guidelines recommend it is initially managed conservatively (Abrams et al., 2018), which includes lifestyle adaptation (e.g., diet and fluids), physical therapies (e.g., pelvic floor muscle training [PFMT]), and voiding-related strategies (e.g., urgency suppression, timed toileting). There is moderate to high quality evidence of benefit (symptomatic cure/improvement, fewer leakage episodes) for PFMT (Dumoulin et al., 2018).

Generally, adherence to rehabilitation exercise programmes over the longer term is problematic; some people may not adhere sufficiently to gain initial benefit but many will fail to adhere over the longer term to maintain ongoing therapeutic benefit (Sluijs et al., 2020). The same pattern is observed for PFMT. For instance, Borello-France et al. (2010) found 81% of women with urgency predominant UI were completing a therapeutic PFMT dose during the supervised intervention, yet one year later adherence levels were at about one-third. While the benefits of PFMT can be retained longer term, this requires that exercise dose continues at or above the threshold required to maintain therapeutic benefit or a decline in effect is observed (Dumoulin et al., 2015). In order to conduct a fair test of PFMT effectiveness over the longer-term we first need to identify what contributes to ongoing PFMT adherence. A possible contributor to low levels of adherence is a mismatch between patients’ understanding of their condition and its rehabilitation (Dean et al., 2005).

Urinary incontinence is experienced as ‘normal’ by many women – they associate it with being mothers and getting older. However, a sense that this is a loss of bodily control and that it is not socially acceptable to leak leads people to question whether it is normal or a legitimate medical illness (Toye & Barker, 2020). This, and many other issues (such as stigma, difficulties broaching the topic, finding the right health professional, and language barriers), create barriers to help-seeking (Toye & Barker, 2020). There are also multiple cognitive, physical, and affective barriers to PFMT adherence (Hay-Smith et al., 2015). Women’s experiences of PFMT suggest their capability is reduced by poor knowledge and skills, conscious motivation is

limited by the cognitive demands of PFMT (e.g., remembering), and multiple competing external demands decrease opportunity to exercise (e.g., work and family commitments) (Hay-Smith et al., 2015). However, none of the studies summarised in either of the qualitative evidence syntheses (Hay-Smith et al., 2015; Toye & Barker, 2020) cited above specifically explored women's experiences of PFMT adherence during treatment or over time. It is unclear how women experience the interaction between their symptoms and treatment, or how this impacts adherence.

Our study involved six women and their continence specialists. We interviewed participants separately and present findings from the women; another paper will report findings from the professionals. We aimed to explore in-depth women's experiences of conservative management of UI with a focus on their PFMT adherence.

METHODS

We used a qualitative approach, Interpretative Phenomenological Analysis (IPA) (Smith et al., 2009), to understand the lived experience of the participants.

Researchers were sent contact details of eligible women, identified by continence specialists (physiotherapists or continence nurses) in two New Zealand cities. The women were aged between 40 and 80 years old; referred for conservative management of symptoms of stress, urgency, or mixed UI; and offered PFMT with or without other interventions. Women were provided written and verbal explanations of the research, the opportunity to ask questions, and written consent to audio-taped semi-structured interviews at the start of treatment (time one: T1) and again after discharge (time two: T2). Interviews were arranged at a convenient, private location (at work, clinic, or woman's home). No woman wished to have a support person present.

Separate schedules were prepared for initial and follow-up interviews and drew on researchers' expertise in exercise adherence (SGD) and conservative management of UI (EJCHS). Questions were piloted prior to data collection. Women were asked to tell us about their bladder problem, the information and advice they had been offered and how they had managed to use that, the treatment they were undertaking, what helped them or made it more difficult to undertake the treatment, any concerns they had about treatment, and their thoughts about why this treatment was necessary. Each woman was interviewed twice by the same experienced female qualitative researcher, who was not known to them before the study. Researchers debriefed after the initial interview, but minimal question changes were required. The follow-up interview schedule also included bespoke prompts for each woman, based on their first interview content. On average interviews lasted one hour. All data were transcribed verbatim.

Step-by-step analysis (Smith et al., 2009), commenced with proof reading of transcribed data and coding of the first four interviews. IPA is an inductive or data-driven process performed on a case-by-case basis where themes are iteratively refined and compared across cases. As coding and theme development continued there were several layers of verification. First, participants were given the opportunity to comment upon their transcripts (none did). Second, two researchers commented on codes, emerging themes, and the extent to which raw data represented the themes. Third, three researchers refined the interpretation, checking that no further themes were present, and finally confirmed which transcript examples were to illustrate the themes. Pseudonyms are used to ensure anonymity.

RESULTS

Participants

The six women (see Table 1 for descriptive summary) received individualised treatment including recommendations about frequency strategies, urgency suppression techniques, defecation positioning, caffeine reduction, fluid management, and other lifestyle advice. All women were offered PFMT, and exercises were personalised for intensity, frequency, contraction duration, progression, etc.

Themes

Our findings confirmed much of what is known from the salient literature such as the potential stigma of UI, the normalisation of symptoms, the meaning of incontinence as a loss of control, and reasons for delayed help-seeking (Toye & Barker, 2020). We give a brief explanation of the four themes below. The remainder of the results focuses on our phenomenon of interest – PFMT adherence. Adherence was influenced by the ways women made sense of the whole (i.e. the four themes) (Figure 1).

The first theme *Past experience and meanings of leakage* depicted the process of re-visiting, amending, or reinforcing prior beliefs about incontinence and its treatment. During *The supervised treatment period* (theme 2) women initiated and tried to maintain a PFMT programme. New information offered by the continence nurse or physiotherapist was tested and sifted by women according to prior beliefs, and their observations of symptom change (or not) during treatment. Clinician confirmation of a correct pelvic floor muscle contraction provided confidence in the basic skill required for PFMT, yet this initial buoyancy quickly diminished as women faced the challenge of developing a regular exercise habit. After supervised treatment ceased the acceptability of longer-term exercise was assessed in *Going on and looking ahead* (theme 3). Women considered the potential burden of maintenance exercises, the treatment benefit to date, their fear of worsening symptoms or life restrictions in future, and other life priorities. *The relationship with, and experience of, others* (theme 4) was a pervasive influence on women's thoughts and actions. Trust and belief in the clinician supported the women's attempts to exercise. Conversely, if credible others (e.g., female friends) expressed a lack of belief in PFMT this weakened the women's conviction to adhere.

We observed, and describe below, three patterns of making sense of the whole (that is, past experiences, the supervised treatment, doing PFMT in future, and the influence of others). All themes were represented in each of the three patterns. The extent to which women could make coherent sense of the whole appeared to influence adherence.

Table 1

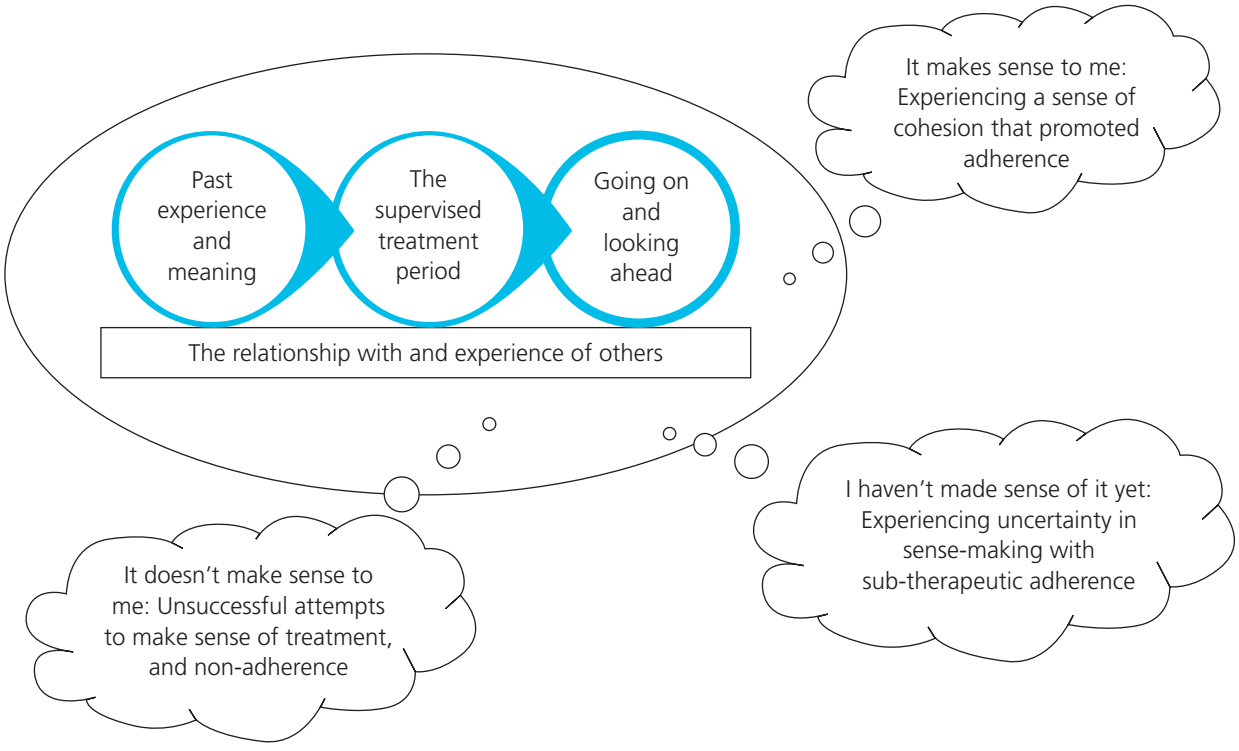
Summary of Participant Characteristics

Participant pseudonym	Referred by	Treated by	Symptoms	Duration of symptoms (causal or associated events[a])
Catherine	Neurologist	Nurse continence advisor	Overactive bladder syndrome with urgency urinary incontinence	Many years (part of her neurological condition)
Janice	GP	Physiotherapist	Stress urinary incontinence; rectal fullness and incomplete emptying.	18 years (following childbirth)
Deborah	GP	Physiotherapist	Stress urinary incontinence	5 years (following childbirth)
Bernice	GP (after medical specialist referral)	Physiotherapist	Stress urinary incontinence	5 years (following hysterectomy)
Heather	GP (after medical specialist referral)	Nurse continence advisor	Overactive bladder syndrome with urgency urinary incontinence and nocturia	Many years (had previous vaginal repair)
Ruby	GP (after medical specialist referral)	Nurse continence advisor	Overactive bladder syndrome with urgency urinary incontinence and nocturia	Many years (had previous colposuspension and tension free vaginal tape)

Note: [a] As attributed by the women.

Figure 1

Diagrammatic Representation of Themes



The phenomenon of adherence

It makes sense to me: Experiencing a sense of cohesion that promoted adherence

Bernice and Catherine gave the two most lucid, integrated accounts of treatment experience; they also reported the best outcomes. Initially, Bernice was bothered by leakage when walking downhill; by treatment end this no longer happened. Catherine planned her work around toilet localities to manage her urgency. After treatment she had less frequency and urgency, and longer voiding intervals. At T2 Catherine thought "it's gone very well" and Bernice was "probably a bit of a success story really".

Both women attributed symptom improvement to their adoption of the recommended treatment. Both perceived an almost immediate treatment response but also times when they had a crisis of confidence. Catherine vividly described her successful self-talk about not getting up to void in the night after her first appointment but then for "the first few weeks [I] went backwards rather than forwards" (T2); however, support from a nursing friend encouraged her to continue with treatment.

Bernice and Catherine overcame negative feelings about PFMT, which arose from persisting guilt for failure to exercise in the past. Both had been introduced to PFMT as young mothers but neither had done any, explaining that "I didn't do them because I was just exhausted … I should have been doing them since then really" (Bernice, T1).

Clinician support and reassurance provided an environment that facilitated engagement with treatment for both women. For example, Bernice repeated at both interviews how, when she told her GP that she was using a panty-liner, the GP's response was to share that she too experienced some leakage; for Bernice this "felt better … having that first contact with a reassuring person" (T1). Both women took responsibility for PFMT as it was felt "this is for me to do, nobody else can do this. They [continence therapists] can help with information but the actual incentive has to be mine" (Catherine, T1).

At T2 Catherine and Bernice did regular PFMT. Catherine "anchored" (T2) the exercises to bus rides and toileting while Bernice completed her PFMT in bed morning and night. Both made similarly positive statements of PFMT intention longer-term. "I think I will just keep on doing the exercises, hopefully throughout life. It seems to me to be the thing [to do]" (Catherine, T2).

These two women were the least ambivalent about, and expressed greater consonance with, the treatment and observed symptom response. We interpreted the experiences of Bernice and Catherine as achieving sense-making that fostered adoption of PFMT and intentions of longer-term adherence.

I haven't made sense of it yet: Experiencing uncertainty in sense-making with sub-therapeutic adherence

Ruby, Heather, and Deborah all described at T1 the boost in confidence and hope for a good outcome generated by their initial contact with the continence therapist. By T2 none were convinced their symptoms were better and each was uncertain about the worth of continuing PFMT. All three wished to have open access to the continence therapist if their symptoms got worse or changed: clinician contact was helpful but once it had ended there was insufficient carry-over to support longer-term PFMT.

The biggest difficulty these three women faced was relating changes in the symptoms to the treatment rather than to the apparently cyclical or unpredictable nature of their leakage or symptom severity. For example, Deborah's leakage was worst when running, and markedly worse in the pre-menstrual week. Her periods were erratic so clinical tests (e.g., pad test) did not demonstrate her problem because test timing never matched the timing of her symptoms. Deborah tried "pulling things in and tucking things up" while running, and could feel the muscles "tightening", but still leaked. Prior to the second interview Deborah was on holiday, less "stressed", running less and cycling more (which did not provoke leakage); she reasoned this was why she had "more control" and less leakage rather than due to doing PFMT. Deborah ended treatment, frustrated at her inability to demonstrate her symptom severity and believing clinicians were unconvinced of the extent of her problems, without experiencing direct benefits of a stronger pelvic floor while running, and with an alternative plausible explanation (not related to her adhering to PFMT) for her reduced leakage at T2.

Heather and Ruby ended treatment with similar uncertainty about treatment efficacy. Both had nocturia as their most bothersome symptom and both initially observed an apparent link between PFMT and fewer night-time voids. Heather recounted:

> The other night when I woke at two in the morning I needed to go. I thought I'm not getting up bladder. I did some exercises and went back to sleep. It worked until half past five in the morning and I felt so proud of myself. (T1)

At T2 both were disappointed because sometimes it seemed the exercises and urgency suppression techniques worked and other times they did not. Heather offered an explanation about why treatment did not make sense: "[bladder behaviour is] very varied … I need it to be much more simple – I do my exercise and things get better – but in fact lots of variables (are) in this" (T2).

For these women PFMT adherence at T2 was, at best, intermittent. For example, Heather and Ruby described cycles of remembering and forgetting, and exercised intermittently. At T2 Heather's PFMT was "random, as the case requires". Ruby said, "I'd probably go two or three days and then remember after a sudden leak and then do it constantly".

Ruby and Heather were particularly influenced by past experiences of continence surgery that was initially helpful but not effective long-term. The lack of permanent cure from surgery, which both women considered should have the most certain and enduring effect, influenced their views about PFMT; both were hopeful, yet neither was sure that exercises could help if surgery had not.

Interviews with these three women were characterised by shifting perceptions between PFMT benefit and lack of benefit. We interpreted their experiences as demonstrating unresolved

uncertainties about how PFMT made sense for improving UI symptoms, resulting in sub-therapeutic PFMT adherence at T2 and the possibility that adherence would decrease further without ongoing clinician contact.

It doesn't make sense to me: Unsuccessful attempts to make sense of treatment, and non-adherence

Janice had the most difficulty making sense of her experience in a way that would promote PFMT adherence. Janice had an inconsistent leakage pattern with running and high-impact activities, although it was a sudden increase in leakage frequency and volume with a cold and cough that precipitated her treatment referral. At T2 Janice no longer had leakage with "ordinary" running yet she doubted this was due to PFMT. Because of the long delay between referral and first appointment it was hard to connect symptom improvement with PFMT, as she no longer had a cough, which was her "acid test". Thus, in looking ahead Janice said:

> There's no reason for me to think that I can't do the exercises if I continue getting better but in my head there's this kind of barrier that says … I'm not entirely convinced that it [the leakage] will get better, that it will go away. (T2)

From T1 Janice found it difficult to reconcile her beliefs with the treatment recommendations. Janice's continence therapist suggested she did not run or lift weights while she started PFMT, yet Janice liked both these activities: they helped maintain her weight which was also "a problem" (T1). Janice compromised and did "the exercises she tells me, going to the toilet the way she tells me, and I won't do any weights standing up" (T1). By time T2, Janice was not doing any PFMT per se although she did do the lower/deep abdominal muscle exercises suggested by the continence therapist because she:

> Could actually incorporate into your day without any great [difficulty] 'cause I do a lot of exercise and they're always talking about tightening your core so it's actually just a continuation of what I was doing outside of seeing [the continence therapist]. (T2)

Another disparity between her experience and perception of PFMT arose from Janice's work as a health professional in chronic conditions management. She was profoundly influenced by her observations; she believed that "it's just too hard" (T1) for some patients to adhere to self-management strategies. Janice considered that UI was a chronic condition that:

> Can be controlled but you have to control it and in order to control it you will have to do A, B, C and that's true of every chronic disease because the onus is off the professional and on to the patient. (T1)

As a patient herself Janice found PFMT adherence too hard, saying:

> I went back for the second visit and got more exercises to do. I think then it hit me actually that there was going to be no kind of cure … I probably got a bit disillusioned 'cause I realised that this was just something I'd have to do for the rest of my life … they're not going to ever end. (T2)

Both interviews with Janice were riven with ambivalence. She regularly exercised for weight control yet could not see the sense in continuing PFMT to control leakage. She promoted self-management of chronic conditions to her patients yet felt continuing PFMT as her own UI self-management strategy was overwhelming. We interpreted Janice's experience as representing an unsuccessful attempt to make sense of treatment, resulting in PFMT non-adherence.

Two common difficulties

One consistent problem in making sense about PFMT was the difficulty of attributing a causal effect of PFMT on leakage reduction. Initial excitement at perceived symptom improvement was followed by lost confidence if symptoms fluctuated or quickly reached an apparent plateau. Changes in contraction performance were encouraging if noticed, yet it was hard to keep exercising for long enough (e.g., 12 weeks or more) to see if symptoms improved enough to make a difference. Making the link between PFMT and symptoms was made more difficult because stopping the exercises did not have an immediate opposite effect. This lag between behaviour and consequence was captured well by Deborah, who said "if I did the exercises regularly it probably could help at the other end and until I do those exercises regularly, I can't prove that it's not working".

The second problem was exercise inertia, which all women experienced in varying degrees. By inertia we mean the tendency to default to inaction (not doing PFMT) and non-adherence. Inertia is observed as a (passive) resistance to changing behaviour. Inertia was expressed as reluctance to exercise, due to competing priorities; being time poor, and the difficulty of fitting exercise in; apathy about PFMT including misunderstanding about the exercises; doubts about exercise efficacy based on past experience or conversations with others, and insufficient benefits to continue longer-term; and passivity characterised by unchanged exercise behaviour unless reminded or held accountable by an external other such as the continence therapist. Interaction of the four components of making sense could compound or diminish inertia. Those women who made more sense of treatment and its relationship with symptom response seemed more successful in overcoming PFMT inertia.

DISCUSSION

Main findings

Our findings suggest that women's past experiences, evaluations of supervised treatment, the credibility of influential others (including the continence therapist), and attitudes to doing life-long PFMT all contributed to whether women made sense of PFMT. The relative contribution of each component varied case by case, and the interaction between the elements could compound or diminish the experience of exercise inertia and ambivalence. All this had consequences for the uptake of, and long-term adherence to, PFMT.

Strengths and limitations

The in-depth analysis of this qualitative data has produced a richer understanding of a complex, sensitive issue. Our use of an analytic process, in which analysis of both interviews from each woman was conducted in parallel, is unique in the field and provided additional insight into women's sense-making processes over time; the longitudinal approach highlights the fluctuations in women's thoughts and feelings about the effects and worth of treatment and how this influenced adherence.

Moreover, interviewing women who represented a range of common presentations to continence therapists for conservative management meant we heard how and why treatment adherence is so complex; treatment needed to make sense to women based on past and current experiences of UI (including prior treatments), current symptoms, and symptom response to treatment, otherwise PFMT adherence diminished. This study has therefore opened up new areas of understanding about PFMT adherence that can be more comprehensively explored in future research.

There is a risk of selection bias (due to the opportunistic nature of recruitment) and of non-response bias (as we do not know the characteristics of women who declined to participate or their reasons), and with the small sample it is only possible to move cautiously towards any generalisation of our findings.

Interpretation

Inertia and ambivalence

In the physical sciences, inertia is a resistance to motion or changing state and is overcome by an external force sufficient to change the speed or direction of matter. Ambivalence is somewhat different, and usually means having mixed or contradictory ideas or feelings about something. When interpreting the way the women made sense of treatment for UI and PFMT adherence it seemed women had to overcome inertia to begin the exercises, and once 'in motion' this was not self-sustaining if existing or new uncertainties were not successfully addressed. The more ambivalent the woman was or became about how to successfully manage her UI and the role of PFMT in management, the more PFMT adherence reduced accordingly.

The women's narratives contained examples of how the continence therapist acted as an 'external force' for change by providing useful information, teaching necessary skill (i.e., correct pelvic floor muscle contraction), and encouraging behaviour change (e.g., accountability). For Bernice and Catherine initial contact with the continence therapist seemed sufficient to amplify exercise intention to overcome any obstacles to PFMT, and once started they appeared to maintain their exercise momentum. Even though both women talked about day-to-day difficulties of exercising (developing an exercise routine, finding time, and so on) they were least ambivalent about PFMT as they noticed symptom improvement attributable to PFMT and had a growing sense of exercise self-efficacy. In contrast, while contact with the therapist enabled Ruby, Heather, Deborah, and Janice to start PFMT this was not enough to surmount past experiences, detrimental influences of others, the mismatch between doing the exercises, and whether or how symptoms changed. All four spoke about treatment with varying degrees of ambivalence; their longer-term views of PFMT were characterised by reluctance, apathy, and passivity.

Surprisingly, we found only one other qualitative study about exercise for general health/fitness that named inertia as an influence on exercise adherence (Lees et al., 2005). Lees et al. (2005) reported this was the most identified barrier for exercisers and the second most frequent barrier for non-exercisers. While our study was contextually different (being about PFMT rather than physical activity) the finding of exercise inertia was common to both studies. Also congruent with Lees et al., we found that inertia was experienced with regard to PFMT in general and to specific exercise episodes (i.e., doing PFMT at all, and doing PFMT now in response to a trigger or cue). In our study, past experiences and meanings were potentially de-motivating for initiating PFMT, as was looking ahead to a lifetime of doing PFMT, because both past and future were ridden with doubts about the cost/benefit ratio of PFMT. In addition, on a day-to-day basis, the women in our study prioritised PFMT (or not) when confronted with many reasons not to exercise (such as competing priorities, time pressures, and so on). Thus, interventions to encourage exercise adherence probably need to include behavioural strategies that: (a) address what women think about UI and PFMT (past, present, and future), because thinking influences feelings and negative feelings influence automatic motivation; and (b) support the choice to exercise in response to triggers and cues.

Ambivalence about therapeutic exercise (as distinct from physical activity), arising from patient perceived uncertainties and contradictions, reduces ongoing engagement with sustained exercise (Davenport et al., 2019). In a systematic review, with meta-ethnographic qualitative evidence synthesis, Davenport et al. (2019) concluded "Patients held many contradictory positions and uncertainties which often resulted in ambivalences about engaging in and practising exercise. Under these circumstances, patients either failed to engage in prescribed practice or stopped prematurely" (p. 1972). Like Davenport et al. we found the clinician had a key role in supporting engagement and ongoing contact was desirable for encouraging women to practise PFMT. There was tension between women's personal responsibility for taking up the exercise but needing the impetus from an external source such as a clinician. Women's perception of benefit helped sustain practice, and it was much harder to sustain exercise if change was not observed fast enough or if high expectations for benefit were not met. Therefore, continence therapists need to develop a good working alliance as the basis for their multiple roles – educator, trainer, persuader, and enabler – to facilitate adherence (Hay-Smith et al., 2015).

Techniques for supporting exercise behaviour and adherence

Frawley et al. (2017) explain why PFMT is both a physical and a behavioural therapy. Inclusion of psychologically informed cognitive and behavioural elements may support the adoption and maintenance of sufficient PFMT for intervention effectiveness. As PFMT adherence decreases with time (Borello-France et al., 2010; Dumoulin et al., 2015) behaviour change support may be particularly important in the transition from short-term to sustained exercise. For example, while Bernice and Catherine were generally adherent and exercised daily, all six women described past or present instances of partial, cyclical, or discontinued exercise adherence at T2. These data highlight the need for specific attention to relapse management as an integral part of supervised PFMT to equip women to be life-long exercisers.

Two strategies that might be particularly useful to address relapse management are '*problem solving*' and '*action planning*'. These are two of 93 evidence-based behaviour change techniques (BCTs) named and described by Michie and colleagues (Michie et al., 2013), in their taxonomy. Problem

solving requires analysing what has or might happen and then generating and choosing actions that overcome barriers or increase the facilitators. For instance, working with women on options if they stop exercise and must overcome the inertia of starting again without the external 'force' from the continence therapist. Action planning is a detailed plan for doing PFMT. While a continence therapist would typically negotiate a plan for where and when to exercise and how often, action planning also includes awareness of the emotional and cognitive environment for exercise. Thus, conversations about noticing feelings of ambivalence and ways to address those may be important in supporting a return to exercise after a break. These are two examples among many documented in the BCT taxonomy (Michie et al., 2013).

CONCLUSION

The variety of women's experiences and the interaction between life circumstances and motivations emphasised the individual nature of women's PFMT adherence. Adherence may be facilitated if the clinician is able to elicit what sense the woman is making of treatment when PFMT is introduced and monitored. Components of making sense may include the women's prior experiences of PFMT, her expectations about UI and its treatment, and what she feels about the information she has from others about PFMT and UI. Continence therapists are potentially powerful agents of change and their attention to what women are thinking and feeling and how that influences what they do is an important part of supporting PFMT adherence longer-term. Our research findings provide the opportunity to develop interventions that are based on how women make sense of PFMT and that incorporate BCTs specifically to address the capabilities and motivations of women seeking treatment for UI. Inclusion of such techniques in the content and delivery of PFMT interventions has potential to enhance their effect both short and longer term.

KEY POINTS

1. Like most forms of therapeutic exercise, long-term adherence to PFMT is often poor.
2. Adherence might decrease if a woman is not able to make sense of her past and current experiences of urinary incontinence and its treatment.
3. Addressing exercise inertia, and ambivalent thoughts and feelings about PFMT, may help support adherence.
4. Conscious integration of evidence-based behaviour change techniques in PFMT programmes could encourage adherence.

DISCLOSURES

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PERMISSIONS

The study was approved by the Multi Region Ethics Committee of New Zealand (reference number MEC/05/04/046). All study participants provided written informed consent.

CONTRIBUTIONS OF AUTHORS

SD initiated the research, secured the grant and ethics approvals, and led data collection supported by JHS. JHS analysed the data and all authors were involved in theme development. MP drafted the paper, and all authors edited it. JHS was responsible for the final version and responding to peer review comment.

ADDRESS FOR CORRESPONDENCE

Jean Hay-Smith, Rehabilitation Teaching and Research Unit, Department of Medicine, University of Otago Wellington, PO Box 7343, Wellington South 6242, New Zealand.

Email: jean.hay-smith@otago.ac.nz

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Urinary Incontinence Assessment and Management After Stroke: An Exploratory Qualitative Study of Physiotherapists' Perceptions of Their Practice in Aotearoa New Zealand

Tessa Downes *BPhty (Hons)*
School of Physiotherapy, University of Otago, Dunedin, New Zealand

Rachelle A. Martin *PhD*
Department of Medicine, Rehabilitation Teaching and Research Unit, University of Otago, Wellington; Burwood Academy Trust | Hā-i-mano, Christchurch, New Zealand

E. Jean C. Hay-Smith *PhD*
Department of Medicine, Rehabilitation Teaching and Research Unit, University of Otago, Wellington, New Zealand

Daniela Aldabe *PhD*
School of Physiotherapy, University of Otago, Dunedin, New Zealand

ABSTRACT

Urinary incontinence post-stroke is associated with poor rehabilitation outcomes. Current stroke guidelines recommend that physiotherapists are involved in addressing urinary incontinence problems post-stroke to improve rehabilitation outcomes; however, physiotherapists' perceptions of their role are not known. This study explored how New Zealand physiotherapists perceive their current role in urinary incontinence assessment and management post-stroke, along with exploring what limits or facilitates this role. Using an exploratory qualitative methodology, eight physiotherapists from across New Zealand were interviewed. Data were analysed using a qualitative descriptive approach presented in four main themes: (a) physiotherapists' view of their scope of practice, (b) resources and training of physiotherapists, (c) lack of collaboration between professions, and (d) physiotherapists' view of urinary incontinence assessment and management experienced by patients. The physiotherapists' practice focuses primarily on functional mobility, balance, and upper limb function to achieve patient goals. Therefore, the physiotherapists perceived their stroke assessment and management had positive, indirect benefits for those who found it difficult to toilet independently post-stroke. The physiotherapists considered that a lack of time and formal training, and uncertainty about their role in urinary incontinence rehabilitation, limited their involvement in the urinary incontinence rehabilitation area. The physiotherapists viewed nurses as the lead profession for continence. However, they believed better collaborative practice within the healthcare team would improve the delivery of continence services.

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Key Words: Barriers, Facilitators, Stroke, Urinary Incontinence, Physiotherapy, New Zealand

INTRODUCTION

In Aotearoa New Zealand (NZ), stroke is the leading cause of adult disability (Ministry of Health, 2018). Direct stroke-related costs for the NZ health sector are an estimated $960 million annually (Anderson et al., 2005), with this expected to rise due to a predicted 40% increase in people experiencing stroke in the coming decade (Ranta, 2018). Stroke survival rates worldwide have also increased over recent years, with a drop of 36.2% between 1990 and 2016 (Johnson et al., 2019). Therefore, an increasing number of people within the community live with post-stroke related disabilities.

One common impairment post-stroke is urinary incontinence. Urinary incontinence often presents as a new problem post-stroke or, if pre-existing, can worsen significantly (Brittain et al., 2000). The prevalence of urinary incontinence reported in the literature varies greatly due to the use of different outcome measures to assess the presence of urinary incontinence. Currently, 9–15% of patients have persisting urinary incontinence symptoms one-year post-stroke (Patel et al., 2001; Rotar et al., 2011). The most common type of incontinence post-stroke is urgency urinary incontinence, occurring in 37% to 90% of stroke patients (Gelber et al., 1993; Gupta et al., 2009; Kim et al., 2010; Mehdi et al., 2013). Other types of incontinence include overflow, stress, and functional (Mehdi et al., 2013). Functional urinary incontinence can be due to cognitive, language, or functional mobility impairments leading to the inability to reach and use the toilet correctly (Brooks, 2004).

Urinary incontinence increases rates of falling (Divani et al., 2009), reduces quality of life (Dhamoon et al., 2010; Patel et al., 2007) and increases risk of depression (Limampai et al., 2017). Depression post-stroke is associated with poorer functional outcomes, increased isolation rates, and higher mortality (Bartoli et al., 2013; Brittain & Shaw, 2007; Desrosiers et al., 2008;

Willey et al., 2010). Adverse social, psychological, and financial effects occur for family caregivers of incontinent stroke survivors (Arkan et al., 2018).

Individualised assessment and management of urinary incontinence in stroke survivors contributes to improvements in bladder function and toileting, and decreased urinary tract infections (Thomas et al., 2014; Vaughn, 2009). In fact, stroke survivors receiving individually tailored urinary incontinence interventions have a significant reduction in the burden of urinary incontinence, with more than half of the participants regaining continence (Herr-Wilbert et al., 2010). Due to the positive outcomes demonstrated from structured and individualised urinary incontinence assessment and management, some stroke guidelines make recommendations in this regard. For example, best practice within the NZ stroke services (National Stroke Network, 2017) is informed by the section on urinary incontinence in the 2017 Australian Clinical Guidelines for Stroke Management, which include a structured urinary continence assessment and management plan (Stroke Foundation, 2021).

Urinary incontinence management guidelines are not routinely and consistently followed. In Australia, more than half of stroke services did not implement a formal management plan, and when in place, these plans were not usually patient-centred (Jordan et al., 2011; Kohler et al., 2018). Nurses from Sweden, China, and the UK reported that urinary incontinence assessment was rapid, with no identification of urinary incontinence type, and management plans were not individualised (Booth et al., 2009). Reasons for lack of guideline adherence included limited evidence supporting continence recovery, a containment focus, and a lack of staff knowledge and support (Booth et al., 2009).

Urinary incontinence assessment and management has primarily been viewed as a nursing role (Arkan et al., 2018; Vaughn, 2009). However, considering the clinical features of urinary incontinence and its impact on activity and participation, a whole-team approach is recommended, including physiotherapy (Dumoulin et al., 2005; Jordan et al., 2011; Vaughn, 2009). Physiotherapy practice should involve identifying the type of urinary incontinence and developing management plans, including education, pelvic floor muscle training, and behavioural interventions (Rudd et al., 2017). Studies investigating current physiotherapy practice for urinary incontinence post-stroke are scarce. One Canadian study reported that fewer than 15% of physiotherapists use best practice assessments such as urinary incontinence identification, and only 3% conduct best practice interventions post-stroke (Dumoulin et al., 2007). Reasons for these low percentages were not formally identified.

With such a limited evidence base to understand what impedes or supports physiotherapy best practice in urinary incontinence assessment and management post-stroke, the primary aim of this study was to explore how New Zealand physiotherapists perceive their current role in urinary incontinence assessment and management post-stroke. The secondary aim was to identify what limits and facilitates their role. Understanding urinary incontinence services present within the NZ healthcare system from a physiotherapy perspective could lead to initiatives to reduce stroke-related disabilities due to urinary incontinence in NZ.

METHODS

To explore the perceptions of physiotherapists, we undertook a qualitative exploratory study using one-to-one interviews and an inductive content analysis of transcribed data.

Methodology

In the absence of any previous similar exploration with physiotherapists or within NZ, a qualitative descriptive approach (Neergaard et al., 2009) enabled us to gather detailed data about a range of experiences and practices. The University of Otago Human Ethics Committee granted ethical approval for this research. Consolidated criteria for reporting qualitative research (COREQ) guidelines guided study reporting.

Participant selection and recruitment

Eligible physiotherapists needed to hold an annual practice certificate from the Physiotherapy Board of New Zealand and work with stroke survivors within NZ. Recruitment occurred via social media groups such as the Physiotherapy New Zealand Neurological Special Interest Group (NSIG) and professional contacts of the research team. An invitation to participate was sent via email to physiotherapists expressing an interest, or participants who viewed the study poster contacted the primary researcher (TD) directly. Those interested were sent a Qualtrics survey link with a unique numeric identifier. The survey screened for eligibility and included some demographic questions. The consent form was also attached.

Eleven physiotherapists registered interest. The focus of this study was to gather information about physiotherapists' perceptions of contemporary clinical practice of urinary incontinence management of stroke survivors. Hence, two physiotherapists were ineligible as they were not currently working with stroke patients. One physiotherapist did not respond to the questionnaire. Thus, a convenience sample of eight physiotherapists was recruited. One participant was known to the primary researcher (TD) before commencing the study.

Data collection

Online, single, one-to-one Zoom interviews were used. The interviewer (TD) followed a guide (Table 1) of open-ended questions to facilitate in-depth discussion (DiCicco-Bloom & Crabtree, 2006). More specific questions were used, if needed, to clarify or gain greater depth of information. In addition, field notes were taken that helped to prompt follow-up questions, captured the researcher's impression of the main points arising from discussion, and any ideas for further reflection (e.g., potential for changing the phrasing of a question, or new ideas raised).

The interview schedule was piloted by TD with JHS in the role of participant and DA as an observer. The three researchers then discussed the flow and content of questions, research interviewing skills, and assumptions and motivations being brought to the study.

The Zoom application transcribed the interview audio files, which TD then checked and edited for accuracy and de-

identification. Interviews ranged from 27 to 59 min long. The research team considered that participants' data provided sufficient information to address the research questions (Charmaz, 2006).

Analysis

We used an Inductive Content Analysis approach (Vears & Gillam, 2022). Data were managed in Word documents, with the researcher's notations made in the margins. The analysis process was done 'by hand' (i.e., data extracts were transferred into one document per coding category, and underlining,

Table 1

Interview Guide

Checklist	Prompts
Big picture	
Can you tell me the usual practices in your workplace for urinary incontinence assessment and management?	
Who is involved?	Responsibilities, e.g., toileting, transfers, managing when someone is incontinent, questions
In what ways is everyone involved? – assessment vs management roles, etc.	
Is there a dedicated team (or person) for this?	
Is this part of your team, or does it need a referral to another team/ service?	Multi-disciplinary team meetings? Informal discussions? Notes?
Does the information collected get passed on to other team members?	e.g., stroke guidelines, stroke pathway in their DHB, etc.
What guidelines or protocols support these practices?	
Are there any cultural considerations you note when urinary incontinence assessment or management is undertaken?	
Assessment	
What is your role in the assessment of post-stroke urinary incontinence?	What parts of your usual assessment may contribute to understanding why urinary incontinence is present?
During your subjective assessment, do you ask about urinary issues with your patients with stroke?	
If yes, what are the questions you ask?	What do you look out for around toileting?
If not, why?	Frequency of urgency, voids (day vs. night), incontinent episodes, issues walking or balancing or transferring
If a patient appears to have urinary incontinence, is there anything you add to your usual assessment?	
Do you share your findings with a team?	
Do you believe physiotherapists who treat stroke survivors should conduct urinary incontinence assessments? Why or why not?	e.g., specific questions, specific tools, assessment of pelvic floor, outcome measures, e.g., the Barthel Index
Management	
Could you tell me about your role in treating and managing post-stroke urinary incontinence?	How does training mobility, balance, transfers contribute? How often is this done, by you, in a "real-life" setting such as the bathroom when the patient wants to void?
Do you include anything particular for stroke patients with urinary incontinence guidelines/protocols you use?	
If a patient is being discharged from hospital with urinary incontinence, what is your role in supporting (self) management at home?	e.g., pelvic floor muscle training or bladder training
Do you have discussions with family/whānau or others who will care for a stroke survivor at home about managing the incontinence?	e.g., home visit to check environment, looking at toileting in real-life setting within hospital
Do you believe physiotherapy has a role in the management of urinary incontinence?	
Are there any cultural considerations you use specifically when involved with patients' toileting/continence?	
Barriers/facilitators	
What do you think is going well in assessing and managing urinary incontinence after stroke?	Example of facilitators: clear guidelines for assessment and management of urinary incontinence by the service; interprofessional practice where physios collaborate with urinary incontinence assessment and management
Specifically for physiotherapy?	
What do you think needs to change?	
Specifically for physiotherapy?	
What would enable that change to happen? What is needed?	Example of barriers: time restriction; physiotherapy discharge plan is focused on gait, transfers, upper limb function; lack of knowledge/training in this area, lack of protocols

highlighting, and margin notes were used to capture main ideas). The sequence of analysis was a) organisation of data into categories relating to the research question (i.e. the interview questions providing an initial coding framework); b) inductive examination of ideas within and across each category to develop codes capturing the main ideas; and c) reducing overlap and redundancy of data to locate key themes (Vears & Gillam, 2022). Independent parallel coding was conducted by DA, RM, and TD for four interviews and any inconsistencies between the researchers were settled by mutual discussion. TD coded and analysed the remaining interviews, with DA checking all coding once completed. Finally, the research team held a consensus meeting to define and name the final themes.

The researchers, all women, brought physiotherapy knowledge to the analysis process – the primary researcher (TD) was a fourth-year physiotherapy Honours student, and the others (DA, RM, JHS) are academics with physiotherapy and doctorate degrees and qualitative research experience, including incontinence research with stroke survivors.

The credibility of the findings was assured in several ways. Reliability and rigour of the coding were achieved through three researchers undertaking parallel coding for the first four interviews, from which main themes were discussed and identified. Independently, and in discussion with the other researchers, TD reflected on her positioning in the research (e.g., prior knowledge of the topic, and how her experience might influence the collection and analysis of data).

RESULTS

Participants

Eight physiotherapists (seven female, one male) from across NZ participated in the study (Table 2). Three were from the North Island and five from the South Island, and they represented urban and rural settings. The participants worked in various stroke rehabilitation settings. Many participants had worked across the stroke care pathway and reflected on previous experiences in different settings. The amount of experience working with stroke patients varied considerably between participants (2–27 years). Five participants identified as NZ European (Pākehā), one as North American, and two as British.

Themes

The four main thematic categories, with contributing subthemes, are shown in Figure 1.

Physiotherapists' view on their scope of practice

When the eight participants discussed their role in assessing and managing post-stroke urinary incontinence, they did so by considering their influence in addressing functional urinary incontinence. This included improving functional mobility, upper limb function, and transfers on and off the toilet. Regaining continence, however, was rarely the focus of interventions. For one participant, the goal of getting to the toilet was "mutually beneficial for our purposes as well as incontinence" (P7).

Participants believed their scope of practice centred on empowering stroke survivors to achieve their goals. However, urinary incontinence was rarely mentioned by patients, so was often not considered as a goal by participants: "When you say to them what are your goals, what are you wanting to get out of the session, the patient themselves often doesn't highlight incontinence" (P6).

Participants' involvement in urinary incontinence intervention post-stroke changed according to their work environment. In a hospital setting, it seemed that urinary incontinence assessment or management, in general, was not a priority: "The goal is: what do we need to be able to do to help this person leave the hospital as quickly and safely as possible?" (P1). Once the patient was within a community setting, urinary incontinence intervention was focused on self-management at home and reintegration into the community: "Having a plan for when they're going out and about knowing where the toilets are and having a strategy to manage that … it's just talking through a self-management plan collaboratively" (P2).

Resources for stroke physiotherapists

Participants felt their scope of practice was influenced by the available resources, such as time and the amount of formal and informal training they had.

Participants often focused on the limited time with patients, which was a barrier to providing continence assessment and care. As a result, urinary incontinence management was restricted and not perceived as a priority: "It's not a symptom

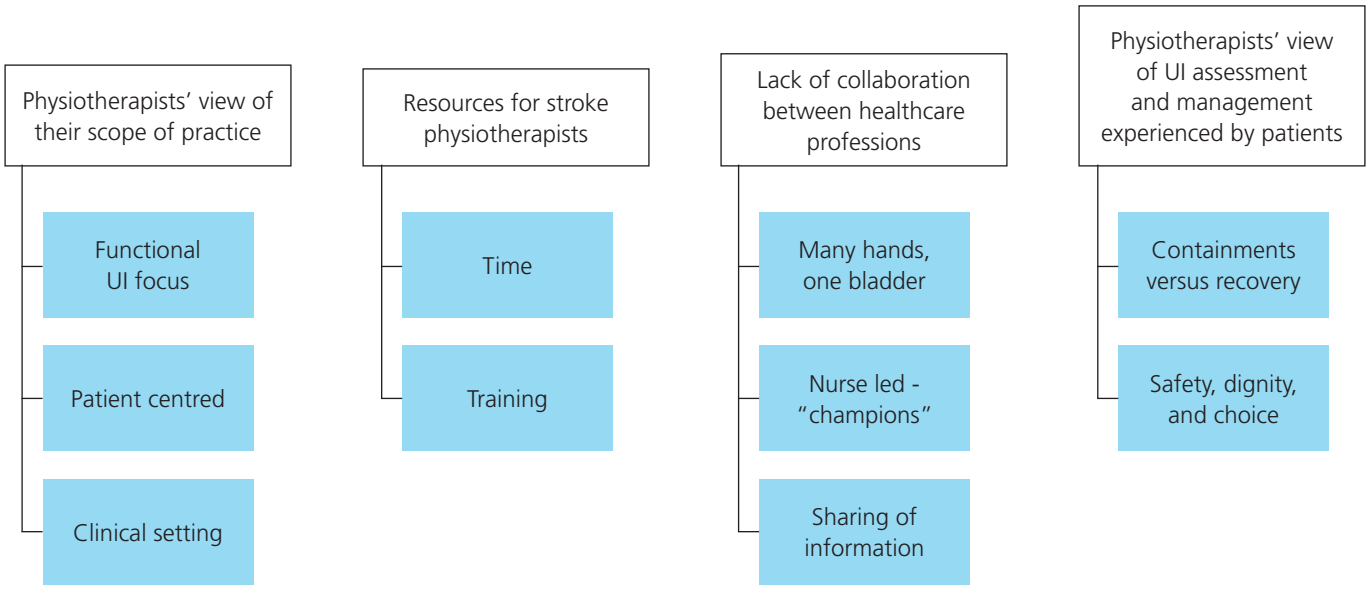
Table 2

Participant Demographics

Participant number	Experience with stroke survivors (years)	Type of service
1	5	Community – private
2	14	Community – home based
3	15	Community – private
4	10	Community – home based
5	20	Community – home based
6	27	Tertiary – rehabilitation
7	2	Tertiary – acute
8	5	Tertiary – rehabilitation

Figure 1

Overview of Themes and Subthemes Developed From Interviews



Note. UI = urinary incontinence.

that I have a lot of time for unless somebody specifically asked for physiotherapy for that" (P4). The potential discomfort surrounding the issue also means patients may take more time to disclose information and goals relating to urinary incontinence: "It's more private issues that some people feel less comfortable disclosing … you might ask the question on the initial assessment [then] it might not come up till later when somebody feels comfortable to disclose" (P2).

Many participants believed urinary incontinence assessment or management was out of their scope due to a lack of formal training. None of the participants indicated doing any formal training for urinary incontinence assessment or management outside of their undergraduate degree, and even then, "you don't really get taught it at Uni" (P1). This lack of training meant participants "don't feel confident with it" (P3). It seemed continence-specific knowledge came from reading literature, talking to and watching colleagues, or personal experience (e.g., knowledge of pelvic floor muscle exercises gained after childbirth). One participant stated that the continence questions included within her initial assessment weren't following a form or guide but rather, "I've been in this job for like six years, and that's just the kind of things that have come up regularly to know what to ask" (P4).

Lack of collaboration between healthcare professions

Participants indicated that the components of stroke rehabilitation are split between the professions aligning with professional strengths, with most participants believing that nurses championed urinary incontinence assessment and management. One participant highlighted that different professions tackled different aspects of incontinence within a community rehabilitation context. This may mean multiple visits and regularly communicating with different professions in a community setting.

> If it's a case of the person not having the capacity to walk safely and quickly to get to the toilet, then that becomes us. If it's an issue of them getting on and off the toilet, [then] it's more OT [occupational therapy]. If it's an issue of having no bladder control, then the nurses and the continence team would get involved… (P4)

Some indicated that they thought physiotherapists should have a more active role in managing continence. However, the knowledge surrounding patients' continence was rarely discussed as a team, particularly within the hospital setting.

> So continence and toileting themselves [were] a bit variable around problem-solving and how to manage it, it wasn't very transparent … Not saying that the nurses weren't doing it, but they definitely weren't bringing it to the table to talk about. (P5)

Physiotherapists' view of urinary incontinence assessment and management experienced by patients

Participants also reflected on the experiences of patients regarding continence assessment and management. Interestingly, these reflections were about the patient experience as a whole rather than physiotherapy specifically. Participants' core concerns were that urinary incontinence management often focused on containment rather than on recovery, and the impact this had on patient choice and dignity. Professionals who opt to contain continence with strategies such as catheterisation, uridomes, continence pads, etc., was seen as a

missed opportunity by participants to solve the root cause of the incontinence.

> If we were to put it into context as a physio, we would be saying, let's just focus on getting them transferring into a wheelchair, because you know, in a wheelchair they've got mobility, without actually seeing whether we can stop and teach them how to walk again. I kind of feel like that's what we're doing with our patients [regarding continence]. (P6)

A few participants questioned how much choice patients were offered. It seemed that patient choice could be forgotten in the use of containment products and discouragement to mobilise independently for toileting: "They put pads on people who actually don't need them, and then it doesn't encourage them to self-manage and to make that decision for themselves" (P8).

> I think it's a common issue in both hospitals and in residential care that there's a tendency to be risk-averse to ensure people are safe and make sure people are not falling, which is really important. But I think sometimes it's too far that people don't have the chance to take a risk … but actually, I feel like it's a human right to choose to take that chance and some people would prefer to have dignity of going to the toilet when they want and occasionally having a fall. (P2)

Participants recognised there were reasons that influenced healthcare team behaviour, such as resources, staffing, time, and concerns for patient safety.

DISCUSSION

To our knowledge, this is the first study in NZ exploring the practice and perspectives of physiotherapists on urinary incontinence assessment and management post-stroke. This was done to gain an understanding of the current role of physiotherapists within urinary incontinence assessment and management and to identify what might limit and facilitate the role. Four main themes were developed from the data: (a) physiotherapists' view of their scope of practice, (b) resources for stroke physiotherapists, (c) lack of collaboration between healthcare professions, and (d) physiotherapists' view of urinary incontinence assessment and management experienced by patients. In addition, subthemes were identified for each main theme.

Physiotherapists' view of their scope of practice

Participant data suggest that continence interventions provided by physiotherapists for stroke patients are related mainly to, but not directly focused on, functional urinary incontinence. The primary urinary incontinence-related assessments that participants felt confident conducting were related to functional mobility and toilet transfers to aid in self-management. According to the participants, the interventions they provided were mostly focused on improving functional mobility, balance, and upper limb function. These skillsets align with the Australian Guidelines' description of the primary role of physiotherapists in stroke rehabilitation (Stroke Foundation, 2021) and will allow patients with functional urinary incontinence to toilet more easily. However, participants did not feel competent in other skills relating to urgency and stress incontinence following stroke, such as pelvic floor assessment, bladder training, pelvic floor muscle training, and neuromodulation.

Participants perceived their practice as patient-centred, empowering patients to achieve their goals. Patient-centred practice is the cornerstone of rehabilitation, according to the Patient and Whānau Centred Care model (Darlow & Williams, 2018). One of the actions of this model is that physiotherapists support and encourage patients and whānau to develop the skills and knowledge they need to be actively involved in their healthcare (Darlow & Williams, 2018). However, some participants mentioned that they were unlikely to ask about or explore issues around continence with their patients. Such a lack of discussion could be problematic, as previous research suggests that continence is a "quiet" issue – meaning patients and healthcare workers are unlikely to raise the subject unless prompted (Horrocks et al., 2004). Therefore, setting patient-centred goals inclusive of continence could be possible if patients received all relevant information about the issues that physiotherapists can play a role in, including urinary incontinence.

The participants' view of their scope around urinary incontinence varied considerably between the clinical settings in which they worked, particularly between hospital care and community care. Participants' experiences indicated that they felt it was too early to explore options while patients were in acute hospital settings; however, discussions may start in the inpatient rehabilitation unit. Findings also suggest that participants see a more significant role around education and self-management once a person transfers to living in the community. Furthermore, in the private community setting, participants tend to refer people to physiotherapy specialists if continence is highlighted as an issue. High rates (32–79%) of urinary incontinence prevalence at admission (Brittain et al., 1998) and some resolution occurring with time (Brocklehurst et al., 1985) may contribute to the "wait-and-see" approach reported in acute care. A 2008 review, however, stated that thorough assessment and management of urinary incontinence might have the greatest impact in the acute phase (Thomas et al., 2008). If physiotherapists do not consider urinary incontinence a key factor from the beginning of a patient's rehabilitation, this may influence the flow-on rehabilitation focus.

Resources for stroke physiotherapists

A lack of time to appropriately conduct assessments and explore management options for urinary incontinence was regularly raised by participants throughout the interviews. Often participants viewed time as limiting what they should prioritise, especially given the focus on neuroplasticity in post-acute rehabilitation services. Urinary incontinence was not a priority rehabilitation focus for participants; instead, they focused more on functional mobility, balance, and upper limb function. As a result, improvements in functional urinary incontinence were incidental rather than explicitly focused on.

Time may also be considered a barrier because participants believed urinary incontinence was a subject that takes time to be disclosed by the patients. Findings suggested that patients and health professionals needed rapport and a deeper relationship before patients were willing to discuss continence openly. However, past research has shown that patients are often not informed about urinary incontinence being related to their

stroke and believe healthcare professionals view incontinence as an irrelevant issue (Arkan et al., 2018; White et al., 2014). In addition, embarrassment and shame can be associated with incontinence for patients (Clark & Rugg, 2005), and healthcare professionals have reported discomfort and difficulty initiating discussion around "difficult" topics such as sexuality and urinary incontinence (Mellor et al., 2013). Therefore, patients may not think to discuss continence due to a perception of irrelevance or discomfort, and physiotherapists may not explore continence due to a perception of patient- or self-discomfort. Consequently, both patient and healthcare professionals' perspectives may be barriers to addressing continence assessment and management.

Participants felt they lacked formal training and indicated this was one reason why physiotherapists do not undertake a formal assessment of urinary incontinence. Participants also reported they lacked confidence prescribing specific interventions such as pelvic floor muscle training. Evidence-based best practice recommends that physiotherapists be trained before undertaking comprehensive assessment and management of urinary incontinence (Bø, 2015; Martin et al., 2006). Due to the recommendation that physiotherapists should be involved in urinary incontinence intervention post-stroke (Dumoulin et al., 2005; Dumoulin et al., 2007), formal training should be available to physiotherapists working with stroke patients. However, undergraduate training in urinary incontinence management in NZ is limited. This aligns with previous research conducted in Canada, where physiotherapists were taught an average of 5.36 hr on urinary incontinence at undergraduate level (Dumoulin et al., 2007).

Interestingly, many participants were keen to upskill within the area of urinary incontinence by undertaking formal training. However, they identified barriers such as accessibility, time, and finances that prevented them from upskilling. Five out of eight participants indicated that they followed the Australian Guidelines for Stroke Rehabilitation. Still, none mentioned utilising the structured urinary continence assessment and management plan and its associated modules within the guidelines (Stroke Foundation, 2021). However, the incontinence information is not present within the physiotherapy discipline-specific summary, which is an additional barrier for physiotherapists. Participants with knowledge of urinary incontinence assessment and management indicated that their knowledge came from informal sources, such as observing and talking to colleagues, and online resources, potentially explaining discrepancies in participant involvement. Physiotherapists seemingly gained confidence in their role within post-stroke urinary incontinence from increased exposure to urinary incontinence assessment and management, developing confidence to ask questions and an awareness of available resources.

Lack of collaboration between healthcare professions

Effective collaboration between and within healthcare professions is vital for patient safety within the complex healthcare system (Babiker et al., 2014). Collaboration improves care coordination, reduces the time and cost of hospitalisation, and enhances satisfaction from the patient in their care (Babiker et al., 2014). The key features of effective collaborative practice include open and clear communication, shared decision-making, effective leadership and organisation, and a respectful team culture (Nijhuis et al., 2007). Data from this study suggest that urinary incontinence rehabilitation components were often siloed into professional roles, with participants expressing little knowledge about what other healthcare team members were assessing or managing. While some participants knew about management approaches being offered to patients, discussion within the team was lacking. Without full knowledge of what the other team members are doing, and discussions being limited, it could be difficult for physiotherapists to raise questions around incontinence or know where their role lies.

Most participants' believed continence was a nurse-led issue, and nurses were considered the "champion" voice for managing patients presenting with urinary incontinence. This view aligns with previous literature (Booth et al., 2009; Brittain et al., 2000; Thomas et al., 2019). However, nurses were not always involved in team meetings, and participants believed it depended on the confidence and experience of each nurse as to the focus and depth of continence assessment and management discussions within the team. Participants were keen to know more about nurse practice and where they could contribute more to the team and the collaborative management of the patient.

Implementing urinary incontinence guidelines may be one way to improve collaboration between professions. They have been shown to increase discussion, promote awareness of urinary incontinence impacts, structure cues and processes, and provide role clarity (Vaughn, 2009). They also led to better patient outcomes, such as improved bladder function and toileting, and decreased urinary tract infections at discharge (Brooks, 2004; Vaughn, 2009).

Physiotherapists' view of urinary incontinence assessment and management experienced by patients

When reflecting on the urinary incontinence assessment and management that patients receive, participants were vocal about their concerns about the non-individualised management of urinary incontinence. They also felt that assessment and management frequently did not seek to solve the underlying continence problem. Instead, they focused on continence containment strategies, including catheterisation, uridomes, continence pads, and net knickers. One of the participants likened the containment practice to putting people in wheelchairs to achieve mobility rather than seeing if walking function could be improved. Participants believed that a containment focus might be an automatic response of the team without anyone stopping to query the individual patient's status. Alternatively, perhaps, the ease of providing containment products to "deal" with the issue, compared to the resource required for developing an individual assessment and management plan. This was seen as a missed opportunity to solve the root cause of the incontinence.

One participant also questioned the practice of controlling people's choices to mobilise to the toilet independently. Prioritising a "zero falls policy" within facilities often means patients do not have the right to choose to go to the toilet without assistance. This assistance can often take a long time, leading to patients soiling themselves and causing humiliation.

This brings into question Right 3 of the Code of Patients' Rights in NZ, the right to dignity and independence (Health and Disability Commissioner, 1996). With depression being twice as high in patients with urinary incontinence post-stroke compared to those without urinary incontinence (Limampai et al., 2017), it is essential to consider the impact that incontinence has on a patient's psychological state.

Strengths and limitations of the study

Participants had worked within stroke rehabilitation services for a range of years (2–27 years). They worked throughout NZ and within different clinical settings. However, participants were predominantly female. Nevertheless, this mirrors the physiotherapy profession as a whole in 2018 (76%) (Reid & Dixon, 2018). The gender ratio within the stroke rehabilitation setting is unknown; however, it is likely biased towards females. No participants identified as Māori, and with no current literature surrounding Māori physiotherapists' views on urinary incontinence assessment and management, it is unknown how their perceptions of practice may differ. To better achieve equity and partnership for Māori within NZ, it is crucial to gain a Māori perspective on delivering health services (Waitangi Tribunal, 2019).

Participants knew the study was exploring physiotherapy practices within urinary incontinence rehabilitation before indicating whether they wanted to participate, indicating a source of self-selection bias. Therefore, the study results may over-represent physiotherapists with knowledge and experience of urinary incontinence rehabilitation and believe it fits their scope of practice. Conversely, stroke physiotherapists with minimal knowledge and experience around urinary incontinence may have believed their input would not benefit the study.

CONCLUSION

Study findings suggest that physiotherapists' involvement in urinary incontinence assessment and management post-stroke in NZ varies across clinical settings, particularly between hospital and community roles. Participant narratives indicated that physiotherapy is not the leading profession for urinary incontinence as their skillset is based around gross motor skills and functional mobility. However, participants perceived their assessment and management had positive, indirect benefits for those who found it difficult to toilet independently post-stroke. Participants indicated that they want a more significant role in urinary incontinence management. Further education and training for specialised urinary incontinence assessment and management would be needed for physiotherapists to feel confident to include this within their scope of practice. Participants wished to have more collaborative discussions around continence decision-making and goals to improve patient care.

KEY POINTS

1. Physiotherapists want to be more involved in urinary incontinence assessment and management discussions within the healthcare team.
2. Physiotherapists believe they are undertrained to perform formal assessment and management of urinary incontinence.
3. Physiotherapists believe that urinary incontinence is not being assessed or managed thoroughly by the healthcare team, leading to missed opportunities for best patient care.

DISCLOSURES

No funding was obtained for the completion of this study. There are no conflicts of interest that may be perceived to interfere with or bias this study.

PERMISSIONS

This research has been approved by the University of Otago School of Physiotherapy Ethics Committee (SoP/EC/2021/03).

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CONTRIBUTIONS OF AUTHORS

Conceptualization and methodology, DA, JH-S and RM; Formal analysis, TD, DA and RM; Investigation, TD; Writing – original draft preparation, TD; Writing – review and editing, DA, JH-S and RM; Supervision, DA, JH-S and RM.

ADDRESS FOR CORRESPONDENCE

Daniela Aldabe, School of Physiotherapy, University of Otago, Dunedin, New Zealand.

Email: daniela.aldabe@otago.ac.nz

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Valuing Professional and Cultural Diversity in Support for Hand Therapists in Aotearoa New Zealand: An Interpretive Description Study

Josie L. Timmins *MHSc (Hons), PGDip, BPhty*
Auckland University of Technology, Auckland, New Zealand

Nicola M. Kayes *PhD, MSc (Hons), BSc*
Director, Centre for Person Centred Research, Auckland University of Technology, Auckland, New Zealand

Daniel W. O'Brien *PhD, MHSc (Hons), BHSc (Physiotherapy)*
Senior Lecturer, Department of Physiotherapy; Active Living and Rehabilitation: Aotearoa New Zealand, Health and Rehabilitation Research Institute, School of Clinical Sciences, Auckland University of Technology, Auckland, New Zealand

ABSTRACT

This study explored the experiences and perspectives of associate hand therapists' (AHT) support in Aotearoa New Zealand. The hand therapy workforce has a diverse professional mix of physiotherapists and occupational therapists and cultural representation, including Māori and Pasifika. Research into the support of this workforce is limited. Using an Interpretive Descriptive methodology, 12 participants were interviewed, including physiotherapists and occupational therapists who identified as Māori, Pasifika, Asian, or Pākehā. Reflexive thematic analysis was used to analyse the data. The four themes constructed were: (1) *Recognising and valuing the diversity of Aotearoa New Zealand hand therapy*, (2) *A therapist-centred approach to learning*, (3) *An accessible community*, and (4) *Hand therapy as a unified professional identity*. *Recognising and valuing the diversity of Aotearoa New Zealand hand therapy* was a prominent theme that spoke to the dominance of Pākehā and physiotherapy worldviews and the inequities faced by AHTs who fall outside these spaces. Educating Pākehā physiotherapists and establishing support processes that recognise and value the identity of occupational therapists, Māori, and Pasifika is needed. This would allow all hand therapists to feel safe bringing their whole selves to their practice, build confidence in their abilities, develop a sense of belonging to the community, and could lead to meaningful change for the profession and patients.

Timmins, J. L., Kayes, N. M., & O'Brien, D. W. (2023). Valuing professional and cultural diversity in support for hand therapists in Aotearoa New Zealand: An interpretive description study. *New Zealand Journal of Physiotherapy, 51*(1), 24–32. https://doi.org/10.15619/NZJP/51.1.04

Key Words: Hand Therapy, Inequity, Support, Training, Qualitative

INTRODUCTION

Hand therapy involves rehabilitation of the distal upper limb undertaken by both physiotherapists and occupational therapists. At present, Aotearoa New Zealand has 388 hand therapists, of which 98 are associate hand therapists (AHTs) (undertaking their training) (Hand Therapy New Zealand, 2022). Physiotherapists and occupational therapists undertake the same hand therapy training and registration processes, involving postgraduate education, clinical experience, and supervision (Hand Therapy New Zealand, 2018). Physiotherapists make up the majority of the membership at 73%, compared to occupational therapists at 27% (L. Egbers, personal communication, September 13, 2021). In Aotearoa New Zealand, most hand therapists work in private practice (136 private clinics compared to 20 clinics within District Health Boards, now known as Te Whatu Ora) (R. Simmons, personal communication, July 18, 2021) and are likely to receive most of their funding through the Accident Compensation Corporation (ACC). However, occupational therapists, unlike their physiotherapist colleagues, are still waiting for ACC to update policy frameworks to allow them to autonomously lodge initial claims (Hand Therapy New Zealand, 2020a), thus limiting their practice within hand therapy.

In Aotearoa New Zealand, 17% of the population identifies as Māori, and 8% as Pasifika (Stats NZ, 2019). There are no statistics published or kept by Hand Therapy New Zealand (HTNZ) on the ethnicity of members. However, the statistics from the Occupational Therapy Board of New Zealand and the Physiotherapy Board of New Zealand indicate significant underrepresentation of Māori and Pasifika compared to national figures. Māori make up 4% of all registered occupational therapists and 5% of all registered physiotherapists, while Pasifika make up 2% of the occupational therapy workforce and 1% of the physiotherapy workforce (Physiotherapy Board of New Zealand, 2020; Stokes & Dixon, 2018). The Occupational Therapy Board of New Zealand and the Physiotherapy Board of New Zealand recognise the importance of better cultural representation within their professions and that a culturally responsive workforce is crucial to increasing access and improving health outcomes for Māori and Pasifika (Physiotherapy Board of New Zealand, 2020; Stokes & Dixon, 2018).

A vital component of this change is to have a workforce representing Māori and Pasifika ethnicity (Pacific Perspectives, 2013). Increasing the number of Māori health professionals improves the service Māori patients receive and has led to positive changes in the cultural landscape of the health sector (Physiotherapy New Zealand, 2018). Furthermore, Pasifika health providers successfully improve access to primary health care for Pasifika by delivering health services that are culturally responsive to Pasifika families and communities (Pulotu-Endemann & Faleafa, 2017).

The structures and supports for AHTs within the workplace are limited, with supervision being the only mandatory requirement set by HTNZ (Hand Therapy New Zealand, 2020b). Internationally, support is recognised as key to facilitating the development of future hand therapists (Short et al., 2020; Short et al., 2018; Valdes et al., 2022) and is primarily received through experienced clinicians passing on their skill and experience through supervision (Colditz, 2011; Short et al., 2018; Stanton, 2006). Research also indicates that a broad range of support is needed throughout all stages of a therapist's career to aid in competence, retention, and improved patient outcomes (Ellis & Kersten, 2001; Ellis & Kersten, 2002; Ellis et al., 2005; O'Brien et al., 2015; O'Brien & Hardman, 2014; Valdes et al., 2022; van Stormbroek & Buchanan, 2017).

Understanding AHT's experiences and perspectives of support, specifically from minority groups such as occupational therapy, Māori, and Pasifika, may be informative to strengthening support structures, making hand therapy's role visible and ultimately lessening inequities and strengthening the profession. The purpose of this study was to explore the experiences and perspectives of AHT support. We aimed to discover what supports are provided, how they are experienced, and how they can be improved.

METHODS

Design

We drew on Interpretive Description, an applied interpretive methodology aligned with the general tenets of naturalistic inquiry (Lincoln & Guba, 1985). Interpretive Description focuses on studying social phenomena in their natural setting, capturing subjective perceptions and understandings of a health-related experience, and interpreting them to inform credible and meaningful clinical understandings (Thorne et al., 1997). A flexible approach to methods selection is encouraged. It is acknowledged that a plurality of methods may be employed to address the aims and purpose of the research given the explicit focus on the development of findings that have high practice utility. Interpretive Description further acknowledges the theoretical and clinical knowledge the researchers bring to a study as essential to the scaffolding of the research. This clinical expertise is considered a platform to build or orientate the research, especially when the area of inquiry is yet to be evaluated in-depth. The primary researcher is a physiotherapist and hand therapist with over 10 years of experience in hand therapy practice. She has experienced training as an AHT in Aotearoa New Zealand and has supported other AHTs on their training journey. Understanding how to improve AHT support, especially in the professional minority (occupational therapy) and culturally diverse (Māori and Pasifika) groups, was fundamental to her interest in the research topic. Ethics approval was received from the Auckland University of Technology Ethics Committee (reference number 20/223) before study commencement.

Recruitment and sampling

Purposive sampling was used to identify potential participants as it allowed for targeted sampling of participants with the requisite knowledge and experience of being an AHT in Aotearoa New Zealand (Bradshaw et al., 2017). People were eligible to participate if they were Aotearoa New Zealand-trained hand therapists with a minimum of 3 months of experience as AHTs. We aimed for diversity in age, gender, ethnicity, undergraduate qualification, stage of registration, hand therapy experience, level of qualification, geographical area of work, and type of employer (government or private). These characteristics were important as they would have the capacity to capture the practice phenomena across time and context.

Advertisements through email to the HTNZ membership and hand therapy networks invited potential participants to participate. Those interested in taking part were asked to contact the research team directly or provide their contact details to receive the participant information sheet. Following initial and targeted advertising there remained a lack of ethnic diversity in the sample, particularly for Māori and Pasifika. Contact was made through hand therapy and Pasifika networks to see if any known Māori or Pasifika hand therapists could be identified and invited to take part. Potential participants who met all criteria were then contacted and invited to take part in an individual interview. Consistent with Interpretive Description, as the study progressed, theoretical sampling was employed to identify potential participants who could speak about issues identified in the emerging analysis or address aspects of inquiry that remained undeveloped or weak (Hunt, 2009).

Data collection

Data were collected through semi-structured interviews undertaken by the primary researcher. The interviews were offered via two mediums, in-person (for all those living in the wider Wellington region and all Māori and Pasifika participants living in Aotearoa New Zealand) or online via Zoom (all participants). Interviews used open-ended questions and followed an interview guide (see Table 1). The initial interview questions were constructed from the literature, disciplinary knowledge, and conceptual orientation held by the primary researcher. The initial questions consisted of general categories that were refined as the study progressed, highlighting the development of issues, emerging observations, and a deeper understanding of AHT support (Thorne, 2016). Discussion topics included participants' own experiences and journey as AHTs, their thoughts around hand therapy as a dual profession, cultural safety within the hand therapy community, and their views on the strategic direction of HTNZ.

All interviews were video-recorded and transcribed verbatim by the primary researcher. Supplementary field notes were written after each interview. Observations made during the interviews, such as reactions, nonverbal language, and annotations of emerging themes, were noted to help contextualise the data

during analysis and to maintain the integrity of the participants' stories (Thorne, 2008). A one-page summary of the key points from the interview was sent to participants within 1 week of their interview. Participants were invited to review the summary to ensure their main points were captured and provide the opportunity to add clarification or any missing statements. This process of receiving feedback from the participants allowed participants to contribute to developing the study findings (Thorne, 2008).

Data analysis

Data were analysed following the reflexive thematic analysis methods originally defined by Braun and Clarke (2006) and then further explicated by them (Braun & Clarke, 2019, 2021a, 2021b) and others (Terry & Hayfield, 2021). Reflexive thematic analysis is an interpretive analysis approach that positions the researcher as an active participant in knowledge production (Braun & Clarke, 2019), consistent with the epistemological assumptions of Interpretive Description. Braun and Clarke (2006) propose six iterative and recursive phases, including familiarisation undertaken through repeated engagement with the data, inductive coding and the development of latent codes, and theme construction. The primary researcher manually coded all transcripts. Theme development involved examining the codes and combining them into meaningful patterns. Provisional themes were developed by the primary researcher and presented to the research team for review and refinement. Support was also sought from a Māori researcher to ensure the interpretation of Māori data was culturally informed. Further, three hand therapists, recognised as experts in Aotearoa New Zealand hand therapy and representing the occupational therapy profession and Māori ethnicity, were presented with a summary of the themes and invited to provide feedback on their resonance and relevance to the field, consistent with Thorne et al.'s (2004) thoughtful clinician test. The primary researcher returned to the raw data and initial coding recursively throughout these processes before the final themes and theme names were decided. Participant quotes illustrative of constructed themes are included in the findings.

FINDINGS

Twelve hand therapists were purposely recruited and consented to take part. Participants ranged from 26 to 56 years of age; nine were females, and three were males. Six participants identified as Pākehā (including people who identified as New Zealand European and European), two as Asian, two as Māori, and two as Pasifika. Four participants were occupational therapists, and eight were physiotherapists. Two were current AHTs and 10 were registered hand therapists. Qualifications included bachelor's degrees, postgraduate certificates, postgraduate diplomas, and master's degrees. Hand therapy experience ranged from 4 months to 30 years. Nine participants worked in urban areas, two in rural, and one in both. Eleven participants worked in private practice, and one in a District Health Board setting; five of those working in private practice were practice owners. Some participants in private practice

Table 1

Example Interview Questions

Topic	Interview questions/guideline
A bit about you	Can you tell me about how and why you became involved in hand therapy? Tell me about your current role in hand therapy
A bit about your workplace	Tell me about your place of work during your time as an AHT What support did you receive? What support is/was available at your workplace? (orientation/ training/continuing professional development/ supervision/ mentorship/funds)? Does the support differ between your time as an AHT and what you see happening now? What process did you go through to gain a registered hand therapist supervisor? If you need help with a patient, what/where could you seek help?
Reflecting on where things are at	Thinking of your time as an AHT and the support you received… What is working/worked well? What are things that you and your team are proud of? What aligned with your cultural worldview? What clashed with your cultural worldview? Did you feel like your cultural worldview was supported? What are/were the challenges? What have you learnt along the way? Is there anything you would want to change for new AHTs coming into the profession?
Telehealth	Do/did you provide telehealth appointments during the COVID- 19 pandemic? What did the support look like during this time? What worked well? What didn't work well?
Practice owners	Can you tell me about the support provided for your staff? Can you tell me about the challenges around provision of support?
Other	Is there anything else you would like to say about professional support for AHTs?

Note. AHT = associate hand therapists.

reported having previously worked in a District Health Board setting, where they completed their AHT training. All participants have been given pseudonyms.

Four themes developed from the data: (a) *recognising and valuing the diversity of Aotearoa New Zealand hand therapy*, (b) *a therapist-centred approach to learning*, (c) *an accessible community*, and (d) *hand therapy as a united professional identity*. Theme 1, the predominant theme depicting inequities found in Aotearoa New Zealand hand therapy, forms the focus of this paper.

Recognising and valuing the diversity of Aotearoa New Zealand hand therapy

This theme highlights the perceived professional and cultural bias in hand therapy communicated by participants. For clarity, we first present findings about professional bias, followed by findings about cultural bias.

Recognising and valuing occupational therapy practice in hand therapy

Occupational therapists found they routinely experienced operational and professional barriers from the structures and dominance of physiotherapy. Some participants felt an idea had appeared within the profession that physiotherapy knowledge and undergraduate training are more suited to the clinical area of hand therapy. As such, occupational therapy AHTs are perceived to need increased training to gain the required knowledge base. For example, "I'd say that it's because there's a lot more commitment of getting them [occupational therapists] up to speed with things that are innately taught at physio school but aren't at OT (occupational therapy)" (Ivy, physiotherapist [PT], Pākehā, Employer). Ivy also stated, "I would insist that they [occupational therapists] have probably done the HAUL program [hand therapy academic paper] 'cause they don't have enough knowledge um otherwise".

The culture of occupational therapy inferiority was so dominant that occupational therapist AHTs themselves started to believe it: " … because I was an occupational therapist, I felt that I needed to bridge a gap of understanding that was, that I didn't have" (James, occupational therapist, Asian).

Occupational therapists expressed frustration at the perceived bias of their physiotherapy colleagues, employers, and authority figures, particularly given this was also perceived to impact their employment opportunities.

> I have found it really hard as an OT (occupational therapist), ah, to, to get into the hand therapy world because it is very … there is a degree of discrimination within the industry. There totally is, whether they [physiotherapists] mean for it to be that way or not. There just is. And that is the culture I think. (Mary, occupational therapist, Pākehā)

Mary also stated, " …she um didn't want to sell her business to an occupational therapist and she, yeh she, she told me she wanted to sell her business to another physio".

Participants also felt surrounding structures perpetuated these inequities. A leading barrier came from the power held by funding agencies, such as ACC and the practice limitations placed on occupational therapists (as described in the introduction). These practice limitations continue to devalue the clinical expertise held by occupational therapists and mean that physiotherapists are more employable than their occupational therapist counterparts: "It isn't a physio-biased position [profession]. But I think what it is, is that um ACC has made it as such" (James, occupational therapist, Asian).

> We [occupational therapists] don't have quite the same power, even the fact that we, we can't, we're not supposed to fill in the [ACC]45s, you know, when we're doing exactly the same job. Um, you know, it does feel a little bit like we are underrated. (Kathleen, occupational therapist, Pākehā)

> [Relaying an interaction with a physiotherapist employer] Oh, um it would be handy to have someone, another hand therapist um in our clinic. But how would you possibly fill in the ACC45 forms? No, I don't think this, that would work for us. We would need another physio. (Mary, occupational therapist, Pākehā)

The awareness of a higher standing for physiotherapy knowledge was also perceived during completion of the hand and upper limb paper (an academic component of the hand therapy training). Occupational therapy participants found that the paper was aimed at the physiotherapy profession and favoured physiotherapy views and knowledge. Kathleen (occupational therapist, Pākehā) conveyed that "there's a lot more physio stuff than OT (occupational therapy) stuff in that course. And so, I think if you're going in without anything, it's probably quite bamboozling".

This perceived bias was found to be reinforced by hand therapy lecturers.

> She [lecturer] started off saying OTs (occupational therapists), you're going to struggle with that and then the entire way through the lecture was saying about how 'oh, physios you can do this' and almost ignored the OTs … I just thought that as a hand therapist, she should have known better to you know, make allowances for both um, rather than just for, basically just saying I'm only just going to speak to the physios and just help them learn and just leave the OTs behind. (Kathleen, occupational therapist, Pākehā)

These findings show how occupational therapist hand therapists are not fully recognised or valued within the physiotherapy dominant hand therapy sector. These sentiments are similar for Māori and Pasifika hand therapists regardless of professional background.

Recognising and valuing the diversity of Māori and Pasifika hand therapists

Inequities for Māori and Pasifika were most notably seen through their low workforce numbers and the overall lack of cultural lens through all levels of Aotearoa New Zealand hand therapy. The hand therapy workforce shortage of Māori and Pasifika therapists was noted by participants, regardless of their ethnicity, as detrimental to hand therapy practice. It is thought few Māori and Pasifika hand therapists work in Aotearoa New Zealand, with only five hand therapists who offered to participate identifying as Māori or Pasifika after wide-ranging advertising and networking.

> I think ultimately being able to get more people of um different backgrounds into any profession is a good thing. But, like when you asked me whether I um knew of any other um Māori or Pasifika hand therapists, I really don't, and that like that's not great. (Rose, physiotherapist, Pasifika)

During the interviews, experiences and perspectives were specifically sought on cultural support. However, participants found it challenging to provide detail about this as they viewed cultural support within hand therapy as severely lacking: "I don't know if I'm aware of any cultural hand therapy stuff, to be honest" ("William", physiotherapist, Pākehā) and "I think that both you and I know there's no really specific thing about um culture and cultural support" (Mia, physiotherapist, Māori).

A lack of cultural support and guidance made hand therapists feel apprehensive about ensuring appropriate engagement with cultural practices.

> So many hand therapists would go 'Oh, I would like to use a greeting in my um, you know, my emails. But I don't want to get it wrong, and I don't want to offend'. Or 'somebody sent a greeting and I want to greet them back and I didn't know what to say. But I just felt like, you know, I might be overstepping the mark.' There's so much fear out there, that, and it comes from, you know, the fact that we are just amazingly lovely people, and we don't want to offend anybody. (Mia, physiotherapist, Māori)

Where cultural support in hand therapy was recognised, it was reported as a more recent development. The growth of cultural support in hand therapy was attributed to organisations such as Tae Ora Tinana, Māori leadership in HTNZ, and the openness and desire of the hand therapy community to embrace te ao Māori.

> My cultural needs were not even thought about, you know 10, 11 years ago. It just wasn't something that anybody thought 'Oh, she's Māori, I wonder if she's got any sort of particular needs or she can give us some, you know, some thoughts about cultural safety. But certainly, the organisation that I contracted to, really took on a lot and, and, you know, not because of me, but just because they've evolved in that cultural sense. (Mia, physiotherapist, Māori)

> There was no cultural support whatsoever. Um, and certainly with Tae Ora Tinana now we've got, we've got some more bridges between those new grads um coming through and trying to sort of and, and trying to make sure we monitor their cultural needs. So, Tae Ora Tinana are doing a really good job of that. And that's developing more and more as well. So that's, you know, I see things as becoming more positive in terms of cultural support for associates. (Mia, physiotherapist, Māori)

Participants reported that cultural practices were enthusiastically accepted and engaged with when cultural support was available and hand therapists were guided appropriately. Māori participants appreciated feeling connected as Māori through the engagement of culturally based activities by their peers. This engagement also allowed Māori practices to be visible and normalised in the environment.

> The pleasure that I get from hearing where you're from and hearing you say your pepeha is just phenomenal … (pause) and I was just so overwhelmed … (pause) it was just such a gift for us. Um, and, and we really feel like it's a real treasure that people make the effort. (Mia, physiotherapist, Māori)

When Māori and Pasifika hand therapists did receive individualised cultural support, this was primarily through mentoring and supervision relationships. Māori and Pasifika participants valued these supportive relationships built on whanaungatanga (friendships), kaitiakitanga (guardianship and protection), and manaakitanga (hospitality, welcoming into a new environment). Mia (physiotherapist, Māori) stated "I think it's about having a really positive, supportive, nurturing contact that's going to really sort of raise these people up and support them and identify problems before they become an issue" (PT, Māori). A similar sentiment was expressed by Rose (physiotherapist, Pasifika): "Having a mentor, having a person who's then assigned to you from the beginning that you then work with them through, that you learn from, I think that would be really helpful" (Rose, PT, Pasifika).

It was important and valuable for Māori and Pasifika therapists that the mentor or supervisor understood their learning style and needs and could teach them in a way that made sense and suited their learning style: "I think it would be really understanding how people learn and then being able to teach them in the way that really makes sense to them" (Linda, physiotherapist, Māori).

Culturally aligning the supervisor and AHT appeared to allow a safe relationship with more holistic support. A Pasifika participant (Rose, physiotherapist) shared an example of a positive therapist-centred learning approach. Although the example is not based on a clinical situation, the sentiments and views the participant relays are applicable. Rose recognised the need to truly understand and relate to her mentee's culture.

> We did a lot of stuff with food, we'd go out for dinner, we'd go out for, um and we went to the gym, and I found that when she was in those situations, we would then, she'd open up a lot and be able to um, to kind of talk about her concerns and what was going on at school and, and why she was finding it difficult. So, I think if you apply that to kind of hand therapy, work stuff, if you've got an associate who's learning and they're not um, necessarily doing well with the, the structure of the way that it would normally work, I think try to figure out how to get them to, to learn and to take that information on in a way that suits them … I think some of that was definitely a cultural thing … I kind of had, I kind of had to get through to her to be able to, to really, for her and I to be able to move forward with things.

The cultural inequities presented in these findings highlight that Māori and Pasifika have limited opportunities to engage with their own identities in hand therapy practice. Māori and Pasifika work within a Pākehā world, limiting their ability to bring their whole selves to their practice.

DISCUSSION

Our study explored the support for AHTs in Aotearoa New Zealand; this paper focuses on themes about the perspectives

and experiences of minority professional and cultural groups. The findings highlighted that hand therapy appears to privilege Pākehā and physiotherapy approaches with training and support structures that appear to align with them.

Recognising and strengthening occupational therapist hand therapists

Inequity was perceived to be widespread and ingrained into the culture of hand therapy and was attributed to the dominance of physiotherapy, both in workforce numbers and disciplinary perspectives. Participants described inequity within Aotearoa New Zealand hand therapy, notably as prejudice against hand therapists who had entered the practice with an occupational therapy background. Most participants referred to the widely regarded belief that foundational physiotherapy knowledge was superior to the foundational knowledge held by occupational therapists. This finding was reflected by employers and physiotherapist hand therapists and even believed by some occupational therapy hand therapists. This belief led to feelings of inferiority among occupational therapy participants.

The idealisation of physiotherapy knowledge has also been demonstrated within hand therapy internationally with the biomedical healthcare model, which commonly underpins physiotherapy knowledge more often employed in both hand therapy practice and hand therapy literature (Fitzpatrick & Presnell, 2004; Robinson et al., 2016). The biomedical view tends to be provider-centred and places value on objective measures to demonstrate health and wellbeing improvements (Robinson et al., 2016). In comparison, the occupation-based view, formed from the biopsychosocial model of health, is more holistic, patient-centred, and focuses on enabling occupation (Fitzpatrick & Presnell, 2004; Wilding & Whiteford, 2008). Research shows that the dominance of the biomedical view and lack of knowledge and acceptance of the occupation-based model of care has limited the practice and identity of occupational therapist hand therapists (Fitzpatrick & Presnell, 2004; Robinson et al., 2016).

The ongoing belief about the superiority of physiotherapy foundational knowledge further drives the inequity experience for occupational therapist AHTs. This inequity was demonstrated in the findings as some employers preferred to employ physiotherapy AHTs over occupational therapy AHTs and suggested that occupational therapy AHTs should complete the hand and upper limb paper before undertaking clinical work. These two findings highlight an underlying belief that occupational therapy training is inadequate for therapists who want to train as AHTs. These findings are similar to those by Short et al. (2018), who report that hand therapy clinical supervisors in the United States of America felt that the base knowledge of occupational therapy hand therapy students was insufficient and limited the occupational therapists' chances of securing a clinical training placement. However, occupational therapy professional educators refuted these findings. Instead, they argued that the holistic occupation-based model of care was more valuable in the preparation of occupational therapists wanting to train in hand therapy (Short et al., 2020).

Participants also described how ACC policies and procedures contributed to inequity between occupational therapy- and physiotherapy-trained hand therapists. Colaianni and Provident (2010) report that American-based hand therapists who employed occupation-based models of care experienced problems with reimbursement from insurance companies due to occupational-based models of care having limited evidence-based research. To compensate for this, occupational therapist hand therapists were found to have relinquished their occupational-based model of care and adopted biomedical practices to ensure ongoing payments, further diminishing their belief in their practice and standing as hand therapists.

The issues occupational therapist hand therapists face are further exacerbated by their lower numbers compared to physiotherapist hand therapists in Aotearoa New Zealand, with approximately 73% of hand therapists being physiotherapists. Having a majority profession dominate hand therapy practice has been recognised as a concern as hand patient outcomes are optimised with inclusiveness and bringing together the foundational knowledge of both professions (Keller et al., 2016; MacDermid, 2019). Furthermore, without the dual profession, hand therapy might lose the support and advocacy gained by having two parent organisations and reduce the credibility and specialty of having an interprofessional group with expertise and competency from two professions (MacDermid, 2019).

Embracing culture to empower Māori and Pasifika hand therapists

Participants recognised inequity for Māori and Pasifika hand therapists through the lack of ethnic diversity in the workforce and the lack of a cultural lens in hand therapy. Furthermore, in this study, Māori and Pasifika hand therapists reported difficulty in bringing their own identities to hand therapy practice. Reid and Dixon (2018) report similar findings from Māori and Pasifika physiotherapists in areas of low cultural integration who relayed ethnic bias, loneliness, and the need to remove their culture to survive in their roles.

Participants saw cultural support for Māori and Pasifika AHTs as incredibly important to improving workforce numbers and the overall AHT journey. However, even though there was willingness from their non-Māori and non-Pasifika peers to engage in cultural practices, this was not commonly actioned.

Participants also recognised that cultural support was required for all hand therapists to improve the support for Māori and Pasifika AHTs. This concept recognises that to fully support the development and journey of Māori and Pasifika AHTs, cultural support needs to be ingrained into the organisational and professional aspects of hand therapy and individually provided to all hand therapists irrespective of their ethnic background. This is consistent with Reid and Dixon (2018), who report the need to integrate cultural competency, particularly understanding of tikanga throughout physiotherapy education and practice, to allow Māori and Pasifika to feel accepted within the profession. The extended use of tikanga and culturally competent practice in health services was also recommended to improve health inequities for Māori consumers. Furthermore, improvement in cultural safety throughout professions and organisations can aid in health equity and help Māori feel confident and safe bringing their culture to their practice (Curtis et al., 2019; Main et al., 2006).

Supporting Māori and Pasifika AHTs through culturally-aligned supervision

The findings showed that supervision is a core support system for AHTs, which works well when there is a strong supervisor-supervisee relationship. Short et al. (2018) describe the importance of a supervisory relationship with an expert hand therapist in developing training hand therapists. Furthermore, recognition of a more comprehensive supervision practice has also been found, with Stanton (2006) stating that mentoring and collaborative relationships ensure hand therapists maintain clinical competency.

Participants, particularly Māori and Pasifika, commented on the potential benefit and value of aligning cultures between the supervisor and supervisee. They reported feeling more comfortable in their environment and more likely to engage with the support of someone from their own culture. Likewise, when participants spoke of their time in a supervisor role, they felt more connected, understood, and able to help those of a similar culture. These findings are consistent with Wallace (2019), who showed that Māori social workers valued and desired culturally aligned supervision. This alignment allowed social workers to receive the full support they required and felt was lacking with Pākehā supervision models. In contrast, international research found that matching characteristics (including ethnicity) did not significantly affect supervisee satisfaction (Cheon et al., 2009). Furthermore, Soheilian et al. (2014) and Watkins and Milne (2014) found that focusing on improvements in cultural safety between supervisor and supervisee helped supervisee satisfaction more than cultural alignment. Despite the conflict between the findings of this study and those seen elsewhere, these findings suggest there may be value in culturally aligning supervision in the Aotearoa New Zealand context, particularly for Māori and Pasifika. Furthermore, asking supervisees their preferences before making a match would ensure no assumptions are made.

Strengths and limitations

A strength of this robust Interpretive Description study was the extent to which a diversity of perspectives was achieved. Inclusion criteria were amended to include Pasifika hand therapists' perspectives, as this perspective was missing initially. However, extending recruitment to people who have left the profession may have added additional insights that could be explored in future research. A further key strength was the insider positionality held by the primary researcher. The researcher's experiences and perspectives of being an AHT in Aotearoa New Zealand and her additional understanding of the processes and procedures of HTNZ through her volunteer work on its executive committee aided in building the scaffolding of the research. However, the primary researcher was also a novice Pākehā researcher, which can limit access to and interpretation of the voices of Māori and Pasifika participants. Although multiple and comprehensive avenues of cultural consultation were sought, further insights could be gained through Māori or Pasifika researchers using kaupapa Māori or Talanoa methodologies. Furthermore, the primary researcher has a physiotherapy background, and while this aids insider positionality, further insights may have been gained from a researcher with an occupational therapy background.

CONCLUSION

This study is the first to delve into the experiences of AHTs in Aotearoa New Zealand. It has identified several factors that have positive and negative influences on AHT support. Furthermore, these findings highlight several challenges for AHTs and hand therapy practices that can, and should, be addressed. Most notably, they highlight the lack of diversity within hand therapy and the multilayer inequities that continue to enable the dominance of a Pākehā physiotherapy worldview within the profession. Strengthening support mechanisms for occupational therapists and Māori and Pasifika AHTs who experience barriers to accessibility alongside other inequities could lead to meaningful change for the profession and patients. Simple changes, such as recognising occupational therapist skills by ACC and providing holistic support and culturally aligned supervision, especially for Māori and Pasifika therapists, could begin to resolve some of these barriers and enhance hand therapy practice in Aotearoa New Zealand.

KEY POINTS

1. Inequity is alarmingly present in Aotearoa New Zealand hand therapy for the minority groups of occupational therapists, Māori and Pasifika.
2. Physiotherapists need to critically reflect on how they might contribute to the disparities experienced within hand therapy and their role in recognising and valuing the unique contribution occupational therapists make to the hand therapy profession.
3. To support developments towards a more culturally responsive profession, all hand therapists need to engage in cultural practices and integrate these practices throughout all areas of the profession.
4. Therapist-centred supervision is a key support for AHTs. Cultural alignment of supervisors may improve Māori and Pasifika engagement and supervision experience.

DISCLOSURES

The study costs were funded by a Hand Therapy New Zealand scholarship. There were no conflicts of interest that may be perceived to interfere with or bias this study.

PERMISSIONS

Ethical approval was obtained from Auckland University of Technology Ethics Committee (reference number 20/223). Ongoing, informed consent was obtained from all participants. No other permissions were required.

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CONTRIBUTIONS OF AUTHORS

Design, conceptualisation and methodology, JT NK and DOB; Project administration, investigation, and data curation, JT; Supervision, NK and DOB; Formal analysis, JT, NK and DOB;

Writing – original draft preparation, JT. Writing – review and editing, JT, NK, and DOB.

ADDRESS FOR CORRESPONDENCE

Josie Timmins, Auckland University of Technology, Auckland, New Zealand
Email: josietimmins@outlook.com

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The Otago Shoulder Health Study: A Feasibility Study to Integrate Formalised Patient Education with Usual Physiotherapy

Gisela Sole *PhD, MSc(Med)Exercise Science, BSc(Physio)*
Centre for Health, Activity and Rehabilitation Research, School of Physiotherapy, University of Otago, Dunedin, New Zealand

Craig Wassinger *PhD, PT*
Public Health and Community Medicine, Tufts University School of Medicine, Boston, USA

Meredith Perry *PhD, MManipTh, BPhty*
Centre for Health, Activity and Rehabilitation Research, School of Physiotherapy, University of Otago, Wellington, New Zealand

Nicola Swain *PhD, BSc(Hons)*
Centre for Health, Activity and Rehabilitation Research, School of Physiotherapy, University of Otago, Dunedin, New Zealand

ABSTRACT

The overall study aim was to explore feasibility of a complex intervention that integrates formalised patient education with pragmatic, individualised physiotherapy for patients with rotator cuff-related shoulder pain (RCRSP). Specific aims were to determine: (a) participant recruitment and retention rates, (b) changes in patient-reported outcomes, (c) intervention fidelity, and (d) to scope intervention costs. Twenty-nine participants (M = 60.0 years, SD = 10.5) with RCRSP (duration ≥ 3 months) were recruited within 3 months. They attended up to eight physiotherapy sessions that included structured education about age-related shoulder pathoanatomy, pain biology and self-management, shoulder-specific exercise, general physical activity, and lifestyle considerations. The Shoulder Pain and Disability Index (SPADI) and other patient-reported outcomes measures (PROMs) were assessed at baseline, discharge, and 3-month follow-up. Completion rates for physiotherapy and PROMs were > 80%, confirming feasibility for retention. The mean decrease for the SPADI-Total from baseline to 3-month follow-up was 21.5/100, 95% CI [14.7, 28.2]. Self-efficacy, general health, and patients' satisfaction with their condition improved from baseline to discharge and follow-up. Intervention fidelity was confirmed for integrating two of the four patient resources into treatment, but inconsistent for the remaining two resources and completion of participant diaries. The median number of treatments was 7.5, at a median cost of $600. More provider physiotherapist training is needed to enhance intervention fidelity in the research context.

Sole, G., Wassinger, C., Perry, M., & Swain, N. (2023). The Otago shoulder health study: A feasibility study to integrate formalised patient education with usual physiotherapy. *New Zealand Journal of Physiotherapy, 51*(1), 33–47. https://doi.org/10.15619/NZJP/51.1.05

Key Words: Feasibility, Rotator cuff, Pain, Patient Education, Physiotherapy

INTRODUCTION

A shift in care has been called for persons with musculoskeletal pain from passive interventions to active approaches to improve self-management, patient-centred communication, and patient education (Caneiro et al., 2020; Hutting et al., 2022). Such a shift also applies to shoulder pain. One of the most common shoulder conditions seen in primary care is rotator cuff related shoulder pain (RCRSP) (Virta et al., 2012; White et al., 2022). Statistics provided by the Accident Compensation Corporation (ACC) show a near 50% increase in costs from 2015/2016 to 2020/2021 for "gradual onset", "soft tissue" shoulder injuries for those > 40 years old. People with RCRSP who are otherwise healthy may have up to five weeks off work in the first six months of being diagnosed (Clausen, Nielsen, et al., 2021). It can be a costly condition from personal suffering perspectives (Gillespie et al., 2017), and health and work-related costs (Clausen, Nielsen, et al., 2021; Virta et al., 2012).

Patients' and clinicians' beliefs about RCRSP have largely centred on pathoanatomical models, such as imaging-verified decreased joint spaces (Kircher et al., 2010) or partial or full-thickness rotator cuff tears (Yamamoto et al., 2011). Besides potential pathoanatomical sources, other contributing factors need to be considered, particularly for persistent pain and disability. Patients' beliefs about their pain influence their behaviour and outcomes. For example, catastrophising and fear of harm may lead to avoidance behaviours and negatively influence recovery (Caneiro et al., 2021; Chester et al., 2018; Martinez-Calderon et al., 2018). In contrast, self-efficacy and high expectations for recovery are associated with enhanced outcomes (Chester et al., 2018; Martinez-Calderon et al., 2018). Persistent shoulder pain is often compounded by comorbidities such as cardiometabolic syndrome, diabetes, hypertension, and obesity (Burne et al., 2019; Tashjian et al., 2004) and associated with lifestyle factors such as smoking, poor sleep or diet, and physical inactivity (Börnhorst et al., 2020). Other factors that may be contributors for shoulder pain persistence include work-related loading (Miranda et al., 2006), social determinants of health (Kim et al., 2014; Menendez et al., 2018), and cultural factors (Hoeta et al., 2020; Magnusson & Fennell, 2011). Thus, contemporary

rehabilitation should include education about the biology or neuroscience of pain and the influence of lifestyle factors, as well as using behavioural approaches, contextualised for the individual patient (Meehan et al., 2020).

A pain neuroscience approach shifts the clinician's and patient's focus from pathoanatomical injury or damage to the need to protect the body from real or perceived danger (Louw et al., 2016; Nijs et al., 2015; Stanton et al., 2020). It supports a biopsychosocial approach, centred on the patient's goals, promoting self-management, and includes progressive return to physical activity/exercise and consideration of lifestyle factors (Littlewood et al., 2013; Louw et al., 2016; Nijs, D'Hondt, et al., 2020; Nijs et al., 2015; Stanton et al., 2020). Psychologically informed approaches such as motivational interviewing and cognitive-behavioural interventions may form part of the pain neuroscience approach (Nijs, Wijma, et al., 2020).

Integrating neuroscience pain education with manual therapy, exercise prescription, and general physical activity constitutes a "complex" intervention (Craig et al., 2008). Complex interventions contain various interacting components, often with shared mechanisms (Cook, 2022; Cook et al., 2018). Randomised controlled trials (RCT) of complex interventions require graduated preparatory progressions, spanning from proof-of-concept studies and end-user engagement, to feasibility and pilot studies (Craig et al., 2008). Feasibility studies determine whether defined components of a trial can be done, such as proposed methods for participant recruitment and retention, and treatment fidelity (Eldridge, Lancaster, et al., 2016). Treatment or intervention fidelity defines whether the treatment can be delivered as intended or as described in a research protocol (Carpenter et al., 2013). In the first step of our research pathway, we sought perspectives of participants with RCRSP to a single pain education session, in essence, a proof-of-concept study (Sole et al., 2020). Following the session, the participants had a greater understanding of factors influencing their shoulder pain, but they also sought information about pathoanatomical knowledge (Sole et al., 2020). Thus, in the current study, the second step in the research pathway, we added information about age-related pathoanatomy of the shoulder, and also addressed lifestyle factors that may contribute towards the pain experience to the resource (Nijs, D'Hondt, et al., 2020; Stokes et al., 2017). Our overall aim was to explore feasibility of a complex intervention that integrates formalised patient education with pragmatic, individualised physiotherapy for patients with RCRSP. Specific aims were to: (a) define participant recruitment and retention rates, (b) examine changes in patient-reported outcomes at discharge and at 3-month follow-up, and adverse responses, (c) determine intervention fidelity, and (d) scope intervention costs.

METHODS

Design, ethics, and setting

This observational cohort feasibility study was conducted at the University of Otago physiotherapy clinics (Dunedin and Christchurch) over a nine-month period (2018–2019). The protocol was registered prior to study commencement with the Australian New Zealand Clinical Trials Registry (ACTRN12618001507279) and was approved by the Health and Disability Ethics Committees, New Zealand. All patients provided written informed consent to participate. We used the TIDier framework to describe the intervention (Table 1) (Hoffmann et al., 2014) and the CONSORT checklist for Feasibility and Pilot studies (Eldridge, Chan, et al., 2016).

Participants

Being a feasibility study, a formal sample size calculation was not required (Eldridge, Lancaster, et al., 2016). Johanson and Brooks (2009) recommend a minimum of 24 participants for feasibility or pilot trials. We considered 25 participants to be sufficient to address the aims of the study. To allow for a maximum attrition rate of 15%, we aimed to recruit 30 patients. We recruited patients in the local communities via newspaper adverts and social media.

Inclusion criteria were: (i) age ≥ 40 years; (ii) primary complaint of shoulder pain with or without referral in the upper limb for ≥ 3 months; (iii) shoulder pain provoked with resisted abduction and/or lateral rotation contractions; and (iv) limitation to range of motion of glenohumeral joint in comparison to the contralateral side (≥ 10°). Exclusion criteria were: (i) shoulder surgery in the last 6 months; (ii) known systemic inflammatory disorders; (iii) cervical repeated movement testing affecting shoulder pain and/or range of movement; and (iv) severe depressive symptoms, suicidal inclination or psychotic illness (Patient Health Questionnaire, PHQ-9, score > 23) (Kroenke et al., 2001). Participants with severe depressive symptoms were excluded as we considered they would need expert care beyond the psychologically informed care of this study.

Screening of participants

Participants were screened using the electronic data capture tool, Research Electronic Data Capture (REDCap), hosted at the University of Otago. Those who met the self-reported criteria were then screened for the physical criteria by a physiotherapist. Enrolled participants completed a second questionnaire via REDCap that included demographic data, self-reported co-morbidities (Tashjian et al., 2004), and the following patient-reported outcome measures (PROMs, Appendix 1): Shoulder Pain And Disability Index (SPADI, the primary outcome) (Roach et al., 1991); Fear-Avoidance Beliefs Questionnaire (FABQ) (Kromer et al., 2014); Pain Catastrophizing Scale (PCS) (Kromer et al., 2014); Pain Self-efficacy Questionnaire (PSEQ) (Nicholas, 2012); Patient Acceptable Symptom State (PASS) (Kvien et al., 2007); the Short Form Health Survey (SF-12) (Fan et al., 2008); and EQ-5D-5L (EuroQol Group, 1990). The self-reported outcome measures were repeated at discharge and 3 months post-discharge (follow-up). The PROMs were selected to capture a range of domains relevant for the complex intervention that addressed pain-related behaviour and lifestyle factors, besides levels of pain and disability.

Interventions

Three physiotherapists were familiarised with the study aims and treatment approach. Patients received pragmatic rehabilitation based on the individual baseline physiotherapy assessment, delivered via up to eight sessions over a 3-month period. Up to three sessions could have a duration of one hour, and the remaining five were 30 min. The pragmatic rehabilitation included a symptom-modification approach, patient education,

Table 1.

Overview of Physiotherapy Intervention

TIDier item	Intervention
Name	Formalised neuroscience pain education integrated with pragmatic individualised physiotherapy care.
Why	Cognitive and psychological factors such as self-efficacy, fear avoidance behaviour, pain beliefs and patient expectations can influence the recovery of shoulder pain (Chester et al., 2018; Mallows et al., 2017). Health comorbidities may also compound the experience of pain (Burne et al., 2019). Rationale: Improving health literacy about shoulder pain, age- related changes, pain biology, and lifestyle factors may decrease fear avoidance behaviour, improve self-efficacy, locus of control, and self-management of recurrence (Mallows et al., 2018). Including lifestyle factors may expand the impact of rehabilitation on the pain experience as well as the patient's health and wellbeing.
What (materials)	Patient education: Set of four Microsoft® PowerPoint files and access to online videos developed by the research team. Usual care: Strength training equipment such as free weights and resistance bands. Participant diaries to document goals; progress; physical activity and exercise; pain medication; visits to other health professionals; direct and indirect treatment costs.
What (procedures)	Pragmatic care included: Individualised symptom-modifying processes, focusing on pain and/or stiffness reduction using manual therapy (Cook, 2012; Hing et al., 2015; Lewis, 2016), taping or active movements of the shoulder, and low-intensity shoulder exercises (Ho et al., 2009; Lewis, 2016; Lewis et al., 2015; Willmore & Smith, 2015). Progressive strengthening exercises focusing on the scapular and rotator cuff muscles; trunk mobility and trunk/lower limb strengthening. Physical activity and general exercises (for example walking, stationary cycling), guided by the participants' goals and health status. Patient education: PowerPoint files were used in-clinic to guide provision of information (Acker et al., 2023). Topic sequencing was individualised to each participant. The physiotherapist sent a link to the corresponding videos to participants who were able to watch them as often as they found helpful. Topics: Anatomy of the shoulder Surface anatomy of trapezius, deltoid, biceps, and triceps muscles; rotator cuff musculotendinous unit; Tendinopathy, partial and full tear; common age-related changes of the rotator cuff. Duration: 7:30 min. Connecting with our nervous system The messenger system: neurons, nervous system; the alarm system: sensitivity of the nervous system; factors influencing the alarm system and pain; patterns in the brain ("neurotags"); factors influenced by the "alarm system" (stress, memory, sleep, concentration, digestion, immunity). Duration: 10:30 min. Desensitising the nervous system Beliefs about pain; suffering, emotions, thoughts, and pain; desensitising the nervous system with exercise, breathing exercise, and relaxation. Duration: 6:30 min. Managing shoulder pain and wellness with movement: exercise and general physical activity Role of exercise and physical activity towards general health and wellness and desensitising the nervous system; role of specific exercises to strengthen the shoulder; pacing, "walking the line". Duration: 6:45 min.
Who	Physiotherapists and patient-directed home exercises.
How	Individual face-to-face treatment sessions, independent exercise sessions, and use of patient videos at home.
Where	University of Otago Physiotherapy Clinics (Dunedin and Christchurch) plus home-based programme.
When	A maximal 3-month treatment period, followed by 3-month follow-up period.
How much	Up to eight physiotherapy sessions. Up to three sessions could have a duration of 1 hour, with the remaining sessions being 30 min. The frequency of sessions was based on the physiotherapists' decision-making and participants' availability. The physiotherapist and participant made collaborative decisions regarding discharge. The participants had unlimited access to the videos up to the end of the 3-month follow-up period.
Tailoring	The symptom-modifications and exercise prescription were tailored to the participants' specific impairments, functional limitations, and participation requirements, as appropriate for their activities of daily living, work, and recreational/sports demands. The sequence of the educational topics could be varied based on the physiotherapists' judgement and their conversations with the participant.
How well	Participants recorded their activities in hard-copy diaries and physiotherapists recorded assessments and interventions as per clinical requirements. The diaries and patient documentation were audited and summarised qualitatively.

Note. TIDier: Template for intervention description and replication.

and progressive exercise. The symptom-modification focused on pain and/or stiffness reduction using the physiotherapists' preferred approach. Such interventions may have included manual therapy, taping, active movements of the shoulder, and low-intensity shoulder exercises (Ho et al., 2009; Lewis, 2016; Lewis et al., 2015; Willmore & Smith, 2015). Selection of manual therapy techniques was based on the individual patient assessment and the individual physiotherapists' clinical reasoning, and may have included techniques to the cervical or thoracic spine, glenohumeral joint, and soft tissue mobilisation techniques (Banks et al., 2013; Cook, 2012; Hing et al., 2015). Progressive exercises focused on increasing shoulder loading capacity, muscle strength, and general whole-person physical activity. Specific exercises and physical activities were based on the participant's goals, functional level and requirements in daily life, occupation, recreation, and sports.

Patient education was supported by patient resources developed for this study and included a set of four Microsoft™ PowerPoint files and corresponding online videos (Table 1, Acker et al., 2023). The PowerPoint files were used by the physiotherapists during the treatment sessions, applying the information to the patient's individual context, and the sequence of delivery was guided by the direction taken in the treatment sessions. The patients were able to watch videos using the same slides with a voice-over explanation following the session, review information, and ask the physiotherapists questions again at the subsequent sessions. The physiotherapists were instructed to place emphasis on reflective communication, goal orientation, and self-management of pain fluctuations throughout the treatment series.

Patients were asked to complete a daily exercise diary of their: (a) shoulder-specific exercises and (b) general physical activities. Referral to other providers (e.g., GPs) was based on the physiotherapists' typical practice in collaboration with the patient, and was documented in the clinical notes. The physiotherapist and patient made collaborative decisions regarding discharge. Following discharge, participants were invited to attend interviews to explore their experiences of the intervention (Acker et al., 2023).

Data analysis

Feasibility

Descriptive statistics were calculated for recruitment frequency, the number of eligible patients, the retention rate, and degree of missing data for the patient-rated outcomes measures. For the purpose of this study, the intervention would be considered feasible if 80% of participants completed the physiotherapy intervention until formal discharge, likewise for completion of the discharge and the 3-month follow-up questionnaires.

Clinical outcomes

The primary outcome was the SPADI-Total and all other PROMs were secondary outcomes. The SF-12 was processed using the Optum® Pro-Core software (v1.4, 2019, Optum, Inc, Johnston, RI, USA). Estimates of the treatment effect were calculated with mean differences (and 95% confidence intervals) from baseline to discharge and from discharge to 3-month follow-up for each outcome variables. Differences were analysed with paired t-tests. For non-parametric analyses, medians, and minimum and maximum values were calculated, and differences explored with Wilcoxon Signed Rank tests. Ordinal data were explored using Friedman's test. We used IBM SPSS v24 (Armonk, NY: IBM Corp) and the alpha level was set at 0.05.

PROMs were also compared with clinical meaningful differences or cut-off levels for "high" scores (Appendix 1). The main adverse event was defined as increased levels of pain (change > 3/10 on a Visual Analogue Scale, not subsiding within 24 hr following treatment and/or exercise). Intervention fidelity was determined by auditing the physiotherapists' clinical documentation and patients' diaries. The frequency of use of interventions was determined per patient and per treatment sessions. The number and duration of treatments and costs for the physiotherapy sessions were summarised descriptively (frequency; mean/*SD* for parametric distributions; median/ranges for non-parametric). Patient diaries were explored qualitatively.

RESULTS

Feasibility

Of 92 responders, 63 completed the screening questionnaire within 12 weeks (Figure 1). Of those, 52 attended the screening appointment. Twenty were excluded based on the screening criteria, and three decided not to participate. Twenty-nine (56% of 52) screened volunteers entered the study, with a frequency of two to three patients starting weekly across 12 weeks. Excluded volunteers were provided recommendations for physiotherapists close to them or to consult their GP.

The treatment retention rate was 97% (28 patients): one patient withdrew after four treatments. One patient completed the intervention and baseline demographic questionnaire, but not any PROMs, even after reminders. Twenty-four participants (83% of 29) completed the discharge questionnaires, and 27 (93% of 29) the 3-month follow-up questionnaire.

Clinical outcomes

The patients had a median shoulder pain duration of 21 months (Table 2). All PROMs improved statistically significantly from baseline to discharge and to the 3-month follow-up, respectively, with the exception of the SF-12-Mental Component Score (MCS) (Table 3). For the SPADI-Total, 20 of the 24 patients had an improvement of ≥ 10/100 scores at discharge (69% of 29), and 23 of 27 at 3-month follow-up (79% of 29).

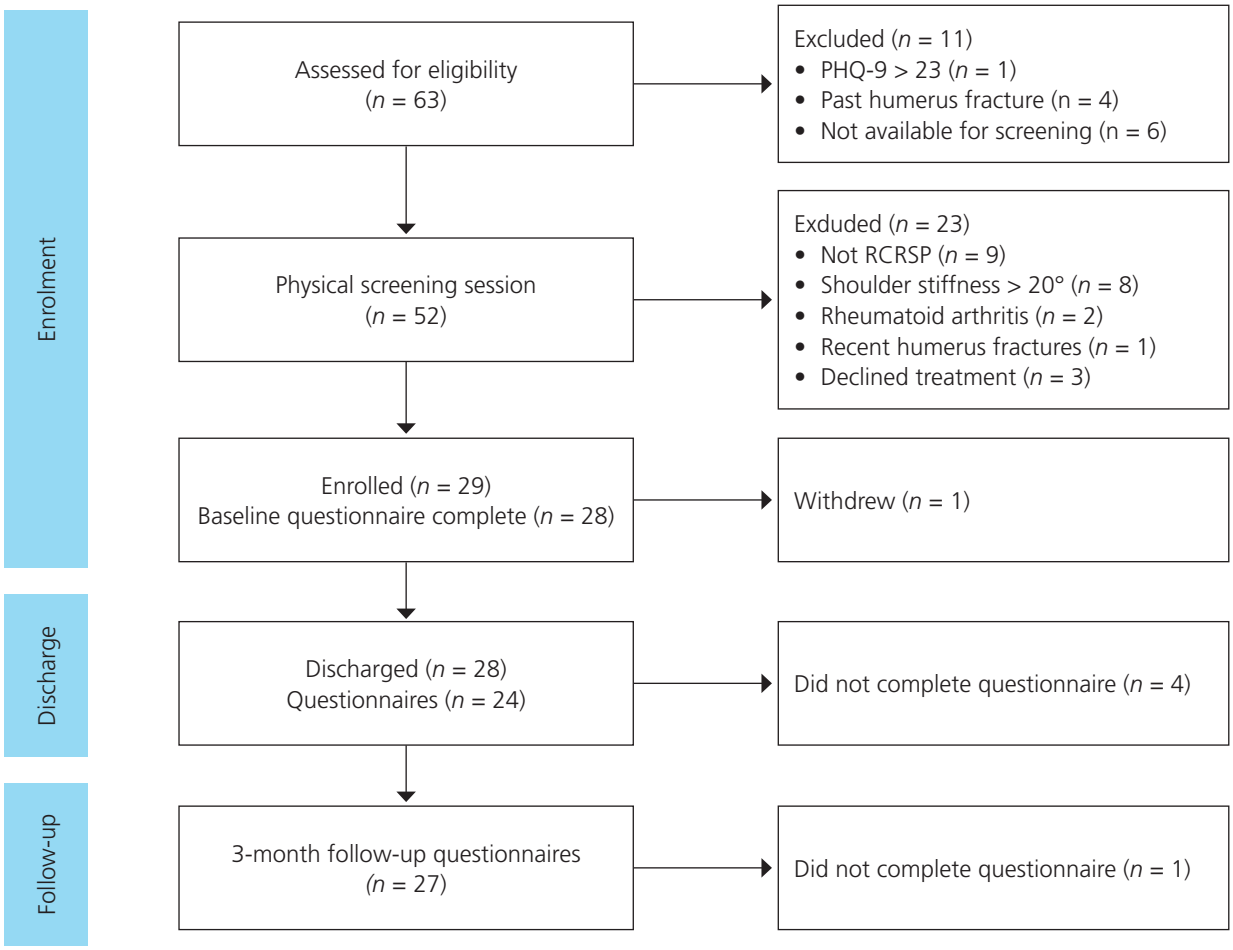
Eighteen patients had "high" fear avoidance beliefs measured with FABQ Physical Activity (≥ 13/24) and three patients with Work scores (≥ 29/42) at baseline. At discharge, four still had "high" fear avoidance for Physical Activity fear and three at 3-month follow-up; no patients had "high" work-related fear avoidance scores at discharge or 3-month follow-up.

The PCS were low (median 6/52) and decreased from baseline to discharge and to follow-up. For the PSEQ, 12 patients scored below 48/60 at baseline (low pain self-efficacy, Chester et al., 2019), compared to four at discharge and one at follow-up. An 8.5-point increase was evident from baseline to follow-up for 14 patients.

The SF-12 Physical Component Scores improved at discharge and follow-up respectively compared to baseline, but not at the pre-defined minimum important clinical difference of 5.4

Figure 1

CONSORT Diagram: Observational Study



Note. PHQ-9 = Patient Health Questionnaire; RCRSP = rotator cuff related shoulder pain.

(Appendix A) (Wong et al., 2016). The EQ-VAS and the EQ-index, respectively, improved by discharge and at follow-up compared to baseline. The follow-up difference for the EQ-index was greater than the reported MID of 0.08 (MacDermid et al., 2022). No participant had a "perfect health" index of "1" at baseline, while four participants achieved that score at follow-up.

For the PASS, decreasing frequencies were found for being "very dissatisfied" with the symptom state from 10 patients at baseline (34.5%) to one patient (3.4%) at discharge and none at follow-up (Figure 2). Increasing frequencies were evident for being "very satisfied". The frequency differences at the three time points were significant ($p < 0.001$).

Intervention fidelity

The clinical documentation audit suggested that physiotherapists had provided all participants with information from the first two education topics (Table 4). Topic 3 (desensitising exercise) appeared to have been explored with 23 participants (79%), and the topic of lifestyle factors and physical activity with 22 (76%). All four topics were included in sessions for only 18 participants (62%).

All participants were prescribed rotator cuff focused exercises and 21 (72%) had also received scapular focused exercises. Nineteen participants (66%) had received manual therapy for a median of three sessions, while the remainder did not. Prescription of physical activity was not recorded in the clinical notes.

All participants returned their diaries, but only four had completed comments about all four videos. Twenty had recorded their physical activity and duration but did not add the intensity consistently. Ten patients recorded use of pain medication (paracetamol, non-steroidal anti-inflammatory drugs). Two patients entered indirect costs related to their shoulder pain as transport costs to physiotherapy and time off work to attend those sessions. No other times off work related to shoulder pain were documented. No adverse events were recorded in the clinical documentation or participants' diaries.

Intervention costs

Table 5 presents analyses of screening and treatment sessions durations, number and frequency of physiotherapy sessions, and direct costs per patient. Two patients were offered nine treatment sessions. The median cost to deliver the physiotherapy

Table 2

Characteristics of Participants

Variable	Value
Age, years (mean, *SD*)	60.0 (10.5)
Gender, *n* (%) women/men	11 (38)/18 (62)
Ethnicity, *n* (%) [a]	
New Zealand European	23 (79)
Māori	2 (7)
European	2 (7)
Indian	1 (3)
Samoan	1 (3)
Chinese	1 (3)
African	1 (3)
Sri Lankan	1 (3)
Duration of shoulder symptoms, months (*Mdn*, min–max)	21 (3–300)
Pain laterality, *n* (%)	
Dominant side	14 (48)
Non-dominant side	10 (35)
Bilateral	5 (17)
Self-reported prior treatment, *n* (%)	
None	9 (31)
Physiotherapy	11 (38)
Osteopathy/chiropractic	2 (7)
Massage	4 (14)
Cortisone injections	5 (17)
Analgesics	9 (31)
Self-reported comorbidities, *n* (%)	
Back pain	13 (45)
High blood pressure	9 (31)
Headaches or migraines	6 (21)
Osteoarthritis	5 (17)
Depression	4 (14)
Diabetes	2 (7)
Cancer	1 (3)
Kidney disease	1 (3)
Lung disease	1 (3)
Ulcer or stomach disease	1 (3)
Other medical problems: thyroid condition, prostate disorder, cholesterolemia, asthma	6 (21)
Number of comorbidities, *n* (%)	
None	4 (14)
One	9 (31)
Two	10 (34)
Three	4 (14)
Four	2 (7)

Note. [a] 3 patients identified with two ethnicities.

sessions per patient was NZ$600. At follow-up, one patient reported having consulted their GP about their shoulder pain and was waiting for a magnetic resonance imaging referral and orthopaedic specialist review (SPADI-Total at baseline = 73.1/100; discharge = 54.6/100; follow-up = 46.2/100; EQ-Index = 0.681). Another patient requested a referral to an orthopaedic surgeon review (SPADI-Total at baseline = 34.6/100; discharge = 30.8/100; follow-up = 25.4/100, EQ-Index = 0.711). Costs for medication use and indirect costs, such as transport to physiotherapy or time off work to attend the sessions, could not be determined due to incomplete documentation.

DISCUSSION

We explored the feasibility of a complex intervention that integrated formalised patient education with pragmatic, individualised physiotherapy for participants with RCRSP in the New Zealand private practice context. The retention rates for treatment until discharge and for completion of the follow-up questionnaires were greater than 80%, meeting our *a priori* requirement for feasibility of the intervention. While the topics of pathoanatomy and pain neuroscience were discussed with all patients, exploring a "desensitising" exercise and considering lifestyle and physical activity were not consistently documented in the clinical notes. Two-thirds of the patients had received manual therapy for at least one session. Most recorded exercise prescription focused on rotator cuff and scapular function, with less frequent documentation of spinal mobility and upper limb closed kinetic chain exercises. There was no documentation of exercises for the trunk and lower limb strengthening, for general physical activity or other lifestyle factors such as sleep.

Participants and clinical outcomes

This cohort with persistent RCRSP had similar SPADI-total scores compared to those categorised as subacromial pain in a recent clinical audit of two physiotherapy practices in New Zealand (*M* = 35, *SD* = 22) (White et al., 2022), suggesting potential generalisability to people with RCRSP in this country. At baseline, only 15% of patients were "somewhat" or "very" satisfied with their current condition, compared to 85% at 3-month follow-up. They had low PCS scores (indicating that pain catastrophising was unlikely to occur) and variable levels of self-efficacy and activity-related fear avoidance. The mean EQ-VAS of 80.8 was comparable with those found in a cohort of 40–69-year-old New Zealanders (81–84/100) (Devlin et al., 2000).

We found decreased pain intensity (based on SPADI-Pain) and fear avoidance, improved function, and self-efficacy at discharge and 3-month follow-up. The improvements for SPADI-Pain and -Disability from baseline to 3-month post-discharge follow-up need to be considered in the context of the symptom duration of our cohort (*Mdn* = 21 months). Symptoms are likely to improve for most people with rotator cuff syndrome within a few weeks, but up to 50% of people can have persistent pain and disability between 6 to 12 months after the first consultation (Kuijpers et al., 2006; Virta et al., 2012). The participants of our study reflect those already with persistent or recurring pain and disability, thus, were part of a patient group potentially incurring the highest contribution to the health costs or work-related absence.

Table 3

Patient Reported Outcomes (PROMs) at Baseline, Discharge and 3-month Follow-up

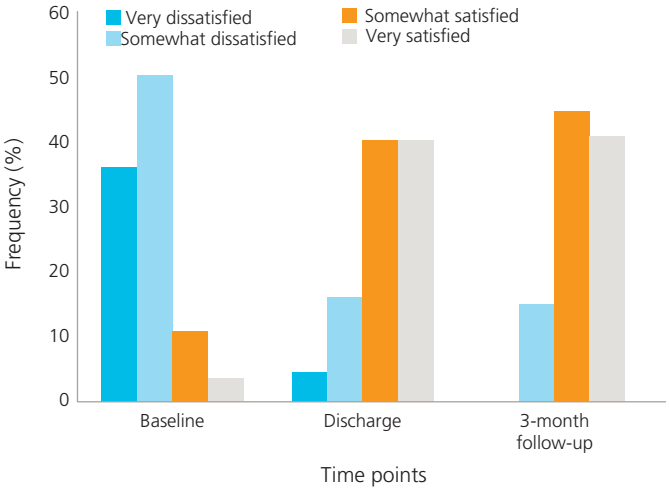
Variable	Baseline		Discharge						3-month follow-up					
	M	*SD*	*M*	*SD*	MD	95% CI		*p*	*M*	*SD*	MD	95% CI		*p*
						LL	*UL*					*LL*	*UL*	
N	28		24		24				27		27			
SPADI-Pain	45.3	20.1	23.6	18.5	–23.7	–32.4	–15.0	< 0.001	19.0	15.4	–26.8	–35.2	–19.0	< 0.001
SPADI-Disability	25.2	17.6	10.1	11.5	–17.1	–23.8	–10.5	< 0.001	7.1	7.5	–18.6	–25.4	–11.8	< 0.001
SPADI-Total	35.3	17.7	16.8	14.0	–20.3	–27.5	–13.3	< 0.001	13.1	10.7	–21.8	–29.8	–15.7	< 0.001
FABQ-Physical Activity	13.0	4.8	6.9	6.1	–6.4	–8.6	–4.3	< 0.001	6.7	5.4	–6.7	–8.7	–4.8	< 0.001
FABQ-Work	8.8	10.2	6.2	7.5	–3.5	–6.7	–0.3	0.032	6.3	7.5	–2.9	–5.2	–0.6	0.014
FABQ-Total Score	28.6	16.7	17.3	11.2	–12.8	–17.8	–7.8	< 0.001	17.6	12.8	–22.7	–15.4	–7.8	< 0.001
PCS	5	0–22 [a]	3	0–13 [a]	–2.0	–18.0	8.0 [b]	0.015 [c]	2	0–22 [a]	–2.0 [b]	–9.0	4.0 [b]	0.003 [c]
PSEQ	49.1	8.7	56.2	5.9	7.4	4.4	10.3	<0.001	57.6	5.2	8.4	5.0	11.9	<0.001
SF12 Physical Component Score	48.8	5.6	52.3	5.7	4.3	2.5	6.1	<0.001	53.3	4.2	4.6	2.5	6.7	<0.001
SF12 Mental Component Score	53.0	7.1	55.2	7.4	2.6	0.3	5.5	0.074	53.4	7.6	0.4	–2.2	3.0	0.754
EQ-5D-5L Index	0.718	0.092	0.783	0.125	0.065	0.023	0.107	0.004	0.806	0.125	0.083	0.036	0.129	0.001
EQ-5D-5L Visual Analogue Scale (%)	80.8	7.9	84.1	8.0	3.5	0.6	6.4	0.019	85.2	8.0	4.8	2.1	7.4	0.001

Note. CI = confidence interval; FABQ = Fear Avoidance Belief Questionnaire; MD = mean difference; PCS = Pain Catastrophising Scale; PESQ = Pain Self-Efficacy Questionnaire; SF-12 = Short Form Survey; SPADI = Shoulder Pain and Disability Index.

[a] Median (minimum to maximum). [b] Median difference (minimum to maximum). [c] Wilcoxon signed ranks test.

Figure 2

The Patient Acceptable Symptom States: Patients' Scores to the Question "If You Had to Live the Rest of Your Life with The Symptoms You Have Now, How Would You Feel?" at Baseline, Discharge, and 3-month Follow-up



The 3-month post-discharge change for SPADI-Total of 22 points was comparable with previously reported changes in response to physiotherapy for chronic rotator cuff disease or shoulder impingement (Bennell et al., 2010; Clausen, Hölmich, et al., 2021). Bennell et al. (2010) undertook a placebo-controlled RCT for people with rotator cuff disease. Standardised physiotherapy of the intervention arm comprised soft tissue and glenohumeral, thoracic, and cervical spine mobilisations, taping, scapular retraining and home exercises, and behavioural strategies (education, goal setting motivation, and positive reinforcement). Clausen, Hölmich, et al. (2021) undertook an RCT to determine effectiveness of higher strengthening exercise dose compared to usual physiotherapy for patients with chronic shoulder impingement referred to a Danish hospital orthopaedic department. Similar improvements for the SPADI-Total are thus apparent in various clinical trials for patients with RCRSP, despite differences in interventions (Bennell et al., 2010; Clausen, Hölmich, et al., 2021).

When comparing our results to the above trials (Bennell et al., 2010; Clausen, Hölmich, et al., 2021), the commonality for the interventions across different trials and our study may also be due to the patient-physiotherapist therapeutic alliance (Kinney et al., 2020; McParlin et al., 2022).

Table 4

Audit of Physiotherapy Clinical Patient Documentation

Item	*n*	%	Number of treatment sessions [a]	
			Mdn	Range
Provision of patient education				
Topic 1: Anatomy, age-related changes	29	100	1	
Topic 2: Pain education	29	100	1	
Topic 3: Desensitising exercise	23	79	1	
Topic 4: Lifestyle factors, physical activity	22	76	1	
Manual therapy				
Glenohumeral joint mobilisations	14	48	2	1–7
Cervical spine mobilisations	7	24	2	1–5
Thoracic spine mobilisations	8	28	2	1–4
Thoracic spinal manipulation	1	3	1	
Soft tissue mobilisations	15	52	2	1–5
All manual therapy	19	66	3	1–7
Taping				
Taping "to correct posture"	6	21	1	1–2
Home exercise programme				
Rotator cuff focused	29	100	3	1–7
Scapular focused	21	72	3	1–6
Spinal mobility	8	28	1	1–4
Upper limb closed kinetic chain	11	38	2	1–4

[a] Applicable to patients who received the interventions only.

Table 5

Cost of Screening and Physiotherapy

Item	Value
Screening: number of volunteers screened, duration of screening sessions, total time in hr	52, 30 min, 26 hr
Physiotherapy sessions: number of sessions, total time in hr	
60-min sessions	54, 54
30-min sessions	155, 77.5
Cost for physiotherapy sessions per patient, *Mdn* (min–max), NZ$120.00 per hr	NZ$600.00 (420–660) [a]
Number of treatments, *Mdn* (min–max)	7.5 (4–9)
9 sessions, *n* (%)	2 (7)
8 sessions, *n* (%)	13 (45)
7 sessions, *n* (%)	7 (24)
6 sessions, *n* (%)	5 (17)
5 sessions, *n* (%)	1 (3)
4 sessions, *n* (%) (patient withdrew)	1 (3)
Time period, *Mdn* (min–max), weeks	11.5 (5–18) [a]
Frequency per week, *Mdn* (min–max)	1.6 (1–2.1) [a]

[a] Excluding withdrawn patient.

Specifically for the current study, 10 participants took part in a post-intervention qualitative study. They highlighted the positive relationships with their provider physiotherapists and commented on their clear communication styles (Acker et al., 2023). They appeared to appreciate the in-depth conversations, perhaps building trust (Acker et al., 2023), which is considered to be critical for patient engagement and outcomes (White et al., 2020). The role of the professional relationship and interactions with the patients could be seen as a critical confounder to the outcomes of different interventions and needs further exploration (Hutting et al., 2022). To control for the therapeutic relationship, the same physiotherapists may need to provide interventions of different arms of RCTs; however, that may come at the cost of possible contamination bias (Bennell et al., 2010; Sterling et al., 2019). Contamination bias occurs when interventions of one arm of a RCT filters through to the intervention of other arm(s). Analyses of audio recordings of physiotherapy interactions with study participants have been used to monitor delivery of psychologically informed interventions by physiotherapists (Sterling et al., 2019). Such analyses may be suitable in future trials to monitor intervention fidelity of the therapeutic relationship.

Intervention fidelity

The patient education was formalised by providing the resources. Yet the full set of topics was provided to only 62% of the participants; thus, fidelity for the use of those resources can be considered to have been moderate. Expanding patient education may detract from time usually allocated by the physiotherapist for manual therapy and supervised exercise within the treatment sessions. With the observational cohort research design, the effectiveness of decreasing manual therapy and supervised exercise, and allocating more time to education and self-management were not explored.

Comorbidities were high for this group of participants, with 45% self-reporting also living with low back pain and 55% reporting two or more comorbidities. In comparison, only 15% of people at the age of 60 (similar to participants of our study) had two or more comorbidities in a New Zealand-based epidemiological study (Stanley et al., 2018). There is increasing awareness of the high incidence of metabolic comorbidities and lifestyle factors being associated with persistent shoulder disorders (Börnhorst et al., 2020; Burne et al., 2019; Clausen, Bandholm, et al., 2018; Tashjian et al., 2004). The frequency of comorbidities highlights the importance of lifestyle interventions, especially physical activity, as critical interventions for these participants. Yet, based on the clinical documentation audit, the fourth resource, focusing on the role of general physical activity and lifestyle factors, was not included for all participants. A recent Australian survey showed that physiotherapists do not regularly prescribe general physical activity for musculoskeletal conditions (Kunstler et al., 2019). As expected, they prioritise problems directly relating to the painful body segment, and may lack confidence to prescribe general physical activity to people with musculoskeletal pain (Barton et al., 2021; Kunstler et al., 2019). Existing physiotherapists' biomedical beliefs (Bernhardsson et al., 2015; Gibbs et al., 2021; Meehan et al., 2020) may encourage reliance on interventions such as manual therapy, allowing less time for patient education. Some participants taking part in our subsequent qualitative study reported that they did not find the fourth video (lifestyle) helpful or applicable (Acker et al., 2023). It is possible the reluctance of those participants to accept that information discouraged the physiotherapists from consistently including those resources. Physiotherapists may need more support to include behaviour and lifestyle-related changes for patients with persistent musculoskeletal disorders (Barton et al., 2021). Strategies are also needed to help patients understand why such interventions are important for their shoulder pain, besides for their general health and wellness (Cridland et al., 2020).

Access to medical care and physiotherapy can be challenging for patients due to social, economic, and geographic (including rural) factors, especially for those living with multi-morbidities (Stokes et al., 2017). Cultural preferences also influence access to care (Hoeta et al., 2020; Magnusson & Fennell, 2011).

Treatment costs for non-traumatic RCRSP are not covered by ACC; therefore, access to healthcare for such patients depends on self-funding or access to the national hospital system, often with long waiting lists. Physiotherapy waiting lists for people with musculoskeletal disorders, including those of the shoulder, can worsen health outcomes. Patients on such lists have higher health costs than those who receive earlier physiotherapy appointments (Deslauriers et al., 2021; Virta et al., 2012). By enhancing patients' health literacy, self-efficacy, and self-management of exacerbations, needed number of treatments (and thus costs) might decrease (Cridland et al., 2020). Yet a focus on patient education may be challenging in the context of patients expecting manual therapy from physiotherapists, as well as limited available treatment time in many clinical contexts (Cridland et al., 2020; Stanton et al., 2020). Our research pathway uses a stepwise approach to address those challenges, developing resources that may provide a basis for patient education, seeking input from people with shoulder pain (Acker et al., 2023; Sole et al., 2020) as well as physiotherapy clinicians.

Implications for future research

This was an observational cohort feasibility study undertaken to inform future RCTs. The recruitment rate provides estimates for the duration and number of volunteers needed to be screened to achieve a specified sample size across two centres, using our recruitment strategies and inclusion criteria (Table 5). We provide estimates for the number of treatments and costs likely to be needed for such pragmatic trials from funding perspectives (Table 5). The analysis also provides insights about treatment interventions that physiotherapists may select for patients with RCRSP in a pragmatic intervention in the New Zealand healthcare context (Table 4). When conducting research related to shoulder pain, provider physiotherapists may need to be familiarised to a greater extent about additional requirements of clinical documentation, as well as in the delivery of behaviour change strategies to underpin lifestyle and physical activity interventions. Such trials would need to provide funding for additional time for administration and documentation required for the research. Lack of documenting interventions in clinical patient notes does not verify that the intervention was not included in the sessions. In future trials, other strategies will be considered to monitor intervention fidelity, such as audio-recordings of selected treatment sessions (Sterling et al., 2019). Similarly, lack of documentation in patient diaries indicates non-compliance with documentation but does not confirm non-compliance with the prescribed activity. Instructions for patients about requirements for the diaries will need greater emphasis in future trials. Other formats for diaries may need to be considered, such as online diaries with automatic reminders via texting or emailing.

Methodological consideration

The study was designed to inform a future RCT that includes the complex intervention, the recruitment strategy, and participant inclusion and exclusion criteria in the New Zealand context. A strength of the study was the use of a pragmatic approach for the intervention, enhancing validity for clinical practice and translation. While a pragmatic approach enhances external validity for clinical practice, it decreases internal validity (homogeneity of treatment approach). We did not measure physical outcome measures such as range of motion and muscle strength but focused on PROMs. Physical measures have not changed significantly in previous trials with patients with RCRSP despite evident changes for PROMs (e.g., Clausen, Merrild, et al., 2018) but could be explored in a larger trial. As in most trials, the possible Hawthorne effect of participating in a trial without direct costs to the patient cannot be excluded for changes observed in the PROMs (Clausen, Hölmich, et al., 2021).

CONCLUSION

We explored the feasibility of conducting a study integrating defined patient pain neuroscience education with pragmatic physiotherapy for patients with persistent RCRSP. The patient pain neuroscience education focused on pain biology and its relevance for rehabilitation, self-management, physical activity, and lifestyle factors. The rates of physiotherapy completion to discharge, and patient completion of discharge and 3-month follow-up questionnaires above 80% indicate that the recruitment, intervention, and data collection processes are feasible. Clinically meaningful decreases in self-reported shoulder pain and disability, and enhanced pain self-efficacy were evident for the cohort and maintained for 3 months following discharge. The effectiveness of this complex intervention compared to usual physiotherapy or other interventions needs to be confirmed in an RCT. In future trials related to physiotherapy for RCRSP, more support and training may be needed for the physiotherapists to deliver behaviour change approaches and consider lifestyle factors. Similarly, strategies are needed to improve patient completion of activity, medication, and cost diaries.

KEY POINTS

1. We integrated patient pain education with usual physiotherapy for shoulder pain.
2. Patient education was supported by a set of four online videos and PowerPoint files.
3. Physiotherapists require more support to deliver behaviour change interventions.
4. On average, shoulder pain and disability improved over the course of the sessions.
5. As a feasibility study, results need to be interpreted with caution.

DISCLOSURES

This study was supported by a Jack Thomson Arthritis Grant, Otago Medical Research Foundation. There are no conflicts of interest that may be perceived to interfere with or bias this study.

PERMISSIONS

The protocol was registered prior to study commencement with the Australian New Zealand Clinical Trials Registry (ACTRN12618001507279) and was approved by the Health and Disability Ethics Committee (reference number 18/CEN/145), New Zealand.

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CONTRIBUTIONS OF AUTHORS

Project conception and study design, GS, CW, MP and NS. Data collection and analysis, GS. Data interpretation, GS, CW, MP and NS. Writing – original draft preparation, GS; writing – review and editing, GS, CW, MP, NS; funding acquisition, GS, CW, MP and NS.

ADDRESS FOR CORRESPONDENCE

Gisela Sole, Centre for Health, Activity and Rehabilitation Research, School of Physiotherapy, University of Otago, PO Box 56, Dunedin, 9054, New Zealand.

Email: gisela.sole@otago.ac.nz

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Appendix

Appendix A

Patient Reported Outcomes Measures

Outcome measure	Description and psychometric properties
SPADI (Breckenridge & McAuley, 2011; Roach et al., 1991; Roy et al., 2009)	The SPADI includes a 5-item subscale that measures pain and an 8-item subscale measuring disability on a score from 0 to 10, where "0" represents no pain/no difficulty and "10" represents worst pain imaginable/so difficult required help. Each subscale is summed and transformed to a score out of 100. The mean is taken for the two subscales to give a total SPADI score out of 100 (higher scores = greater impairment or disability). The SPADI has excellent reliability, validity, and responsiveness (Roy et al., 2009). Changes between 8.0 and 13.2 points in the SPADI-Total score are considered clinically meaningful (Roy et al., 2009). An MCID of 10 was selected for this study *a priori*.
FABQ (Inrig et al., 2012; Mintken et al., 2010)	The FABQ measures patient's pain-associated fear avoidance beliefs about physical activity and work. It consists of 16 items with a 7-point Likert scale where "0" is "completely disagree" and "6" is "completely agree". The total maximum score is 96, 24 for the subscale Physical Activity, and 42 for Work. A meaningful difference was defined as 8 for Physical Activity and 13 for Work. Cut-off values to indicate "high" scores for patients with shoulder pain have not been established, to our knowledge. In this study we consider scores to be "high" for fear avoidance beliefs for Physical Activity ≥ 13/24 and for Work ≥ 29/42, based on findings for patients with low back pain (Cleland et al., 2008; Inrig et al., 2012).
PCS (Kromer et al., 2014; Sullivan et al., 1995)	The PCS quantifies beliefs about pain (Sullivan et al., 1995). It consists of 13 statements about pain, each scored on a 5-point Likert scale where "0" is "not at all" and "4" is "all the time". The maximum score is 52 and higher scores indicate more strongly held fear avoidance beliefs. It has three sub-scales: rumination, magnification and helplessness. The total score is considered in this study. The PCS has demonstrated reliability and validity and is commonly used to evaluate pain catastrophising across a range of musculoskeletal conditions, including shoulder pain (Coronado et al., 2016; Osman et al., 1997; Sullivan et al., 1995). We define "high" pain catastrophising as a score of ≥ 21/52 (Park et al., 2016).
PSEQ (Maughan & Lewis, 2010; Nicholas, 2012)	The PSEQ assesses pain-related self-efficacy in people with chronic pain. It consists of 10 statements and respondents are asked to rate how confident they are with those scenarios/tasks despite the pain. Each statement is rated on a 7-point Likert scale where "0" is "not at all confident" and "6" is "completely confident". A higher score indicates higher self-efficacy beliefs. For low back pain, an 8.5-point increase has been defined to be clinically meaningful (Maughan & Lewis, 2010). We considered a score of ≥ 48/60 to indicate "high" self-efficacy (Chester et al., 2019).
PASS (Kvien et al., 2007)	PASS is the highest level of symptom beyond which patients consider themselves well, and has been used to determine to minimally important change for various patient reported outcome measures (Tran et al., 2020). It is used in adapted version in this study with the question "If you had to live the rest of your life with the symptoms you have now, how would you feel?", similar to Mintken et al. (2016). Patients were asked to rate their satisfaction on a 4-point Likert scale ranging from "1" (very dissatisfied) to "4" (very satisfied).
SF-12 (Fan et al., 2008)	The SF-12 consists of 12 items that assess eight dimensions of health: physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, and mental health (Ware et al., 1996). Outcomes from the SF-12 include an overall health score as well as component scores of physical and mental health (Ware et al., 1996). Responses are rated on a 5-point Likert scale with overall scores ranging from 0 (lowest health level) to 100 (highest health level) (Singh et al., 2006; Ware et al., 1996). The SF-12 is commonly used to determine health status in patients with musculoskeletal disorders (Scholten et al., 2017). MCIDs of 5.4 and 5.7 for the Physical Component Score and Mental Component Score have been reported respectively for patients undergoing shoulder arthroplasty (Wong et al., 2016).

Outcome measure	Description and psychometric properties
EQ-5D and EQ-5D-5L (EuroQol Group, 1990)	The EQ-5D-5L assesses overall health related quality of life and comprises two components (EuroQol Group, 1990). The first component is a descriptive system with five health dimensions (mobility, self-care, pain/discomfort, usual activities, and anxiety/depression), each scored on five response levels: no problems (Level 1), slight, moderate, severe, and extreme problems (EuroQol Group, 1990). These levels are collapsed into a utility/index score whereby "0" indicates death and "1" indicates perfect health. A MID of 0.08 has been reported (MacDermid et al., 2022). The second component consists of a visual analogue scale (EQ-VAS), providing a single global rating of self-perceived health on a 1 to 100 mm scale representing "the worst" and "the best health you can imagine", respectively. A survey of 1,350 New Zealanders showed a mean score for the EQ-VAS ranging between 81 and 84% for 40 to 69 year-olds, and 75% for those 70 years and older (Devlin et al., 2000). The mean for New Zealand Europeans (n = 1,127) across all age groups was 80.9%, for Māori (n = 124) 80.3%, and for all other ethnicities (n = 99) 80.7%. We report the EQ Index and the EQ-VAS. The Index calculator was downloaded from https://euroqol.org/eq-5d-instruments/eq-5d-5l-about/valuation-standard-value-sets/crosswalk-index-value-calculator/

Note. FABQ = Fear Avoidance Behaviour Questionnaire; MCID = minimal clinically important difference; MID = minimal important difference; PASS = Patient Acceptable Symptom State; PCS = Pain Catastrophising Scale; PSEQ = Pain Self-Efficacy Scale; SF-12 = Short Form Health Survey; SPADI = Shoulder Pain and Disability Index.

Pelvic Tilt in Sitting: Do You See What I See? (Maybe Not)

Matthew K. Bagg *PhD*
Post-Doctoral Research Fellow, Centre for Pain IMPACT, Neuroscience Research Australia; Curtin Health Innovation Research Institute, Faculty of Health Sciences, Curtin University; Perron Institute for Neurological and Translational Science, Perth, Australia

Dr Ian Skinner *PhD*
Senior Lecturer, Associate Head of School, Physiotherapy; School of Community Health, Faculty of Science, Charles Sturt University, Port Macquarie, New South Wales, Australia

Niamh Moloney *PhD*
Associate Professor, Department of Exercise Sciences, University of Auckland, Auckland, New Zealand

Martin Lock *BHSc (Physiotherapy)*
Lead Physiotherapist, Persistent Pain, Guernsey Therapy Group, Guernsey

James McAuley *PhD*
Senior Research Scientist, Director, Centre for Pain IMPACT, Neuroscience Research Australia; Professor, Faculty of Medicine and Health, University of New South Wales; Honorary Research Fellow, The George Institute for Global Health, Australia

Martin Rabey *PhD*
Adjunct Research Fellow, School of Allied Health, Curtin University, Perth, Australia

ABSTRACT

Examination of pelvic tilt movements are utilised across many fields of physiotherapy. It is important for physiotherapists to establish a clinically helpful, time-efficient test assessing pelvic tilt, reliable within and across multiple assessors. Elgueta-Cancino et al. (2014) described such a test; however, their methodology reduced clinical applicability and revealed limitations regarding examination of test reliability. This study aimed to independently evaluate the reliability of a clinical test of pelvic tilt. Twenty-three participants with chronic low back pain completed the test following standardised instructions and demonstration by one assessor. Participants tilted the pelvis forwards and backwards 10 times in sitting. The test was simultaneously scored on the scale originally described by three blinded assessors. Participants repeated the test one-week later. Inter-assessor reliability was determined using an intra-class correlation coefficient (ICC 2,1), with a resulting value of 0.52, 95% confidence interval [0.35–0.68]; and a standard error of measurement SEM (with a resulting value of 1.28). The following SEM values were found for intra-assessor agreement: Assessor 1 =1.52, assessor 2 =1.47, and assessor 3 = 1.19. These findings suggest the inter- and intra-assessor reliability of a clinical test of pelvic tilting has insufficient reliability to distinguish between participants across multiple assessors. An observed change of at least 1.5 points may be necessary to be confident true change in test performance has occurred.

Bagg, M. K., Skinner, I., Moloney, M., Lock, M., McAuley, J., & Rabey, M. (2023). Pelvic tilt in sitting: Do you see what I see? (Maybe not). *New Zealand Journal of Physiotherapy, 51*(1), 48–52. https://doi.org/10.15619/NZJP/51.1.06

Key Words: Low Back Pain, Movement Control, Reliability

INTRODUCTION

Many methods of examining lumbopelvic movement patterns, particularly in relation to low back pain, are described in the physiotherapy literature. However, examination of a person's ability to perform pelvic tilting, and subsequent rehabilitation of this movement, is utilised across many fields of physiotherapy – for example, musculoskeletal (Elgueta-Cancino et al., 2014), respiratory (Aramaki et al., 2021), continence (Berghmans et al., 2020), and neurology (Karthikbabu et al., 2017). In the research setting, pelvic tilt is commonly examined using electromyography and kinaesthetics (Dankaerts & O'Sullivan, 2011), which is expensive and impractical clinically. Therefore, it is important for physiotherapy practice to establish a clinically helpful test to assess pelvic tilt, which should be time-efficient and reliable both within and across multiple assessors.

Movement patterns, for example in people with chronic low back pain (CLBP) (Dankaerts & O'Sullivan, 2011; Hodges & Smeets, 2015) are complex. Therefore, even for a movement as seemingly simple as pelvic tilting, physiotherapists must consider factors including range of movement, localisation of the movement, muscular control of the movement, and concurrent respiratory pattern. A valid and reliable test incorporating such factors is important to facilitate practice across many fields of physiotherapy and communication between therapists. Elgueta-Cancino et al. (2014) describe a potentially comprehensive, time-efficient clinical test of pelvic tilting in sitting. The participants watched a standardised instruction video including a demonstration and verbal instructions to tilt the pelvis anteriorly and posteriorly 10 times, followed by 2 min supervised training of the movement. Subsequently, to standardise the movement examination, the assessor used a scale covering quality (smoothness, range) of

pelvic movement, control of adjacent regions (thoracolumbar movement, erector spinae activity), directional influence on movement quality, ability to breathe during movement, and ability to perform quality movements repeatedly. A total score was derived, ranging 0–10 points, with higher scores reflecting greater movement control. However, while use of the scale appears time-efficient, the training process participants completed may be impractical in a clinical setting.

Adequate inter- and intra-assessor reliability is important for the validity of clinical tests (Dankaerts et al., 2006). Elgueta-Cancino et al. (2014) report the inter- and intra-assessor reliability of their test of pelvic tilting to be substantial/moderate. However, intra-assessor reliability was examined with a single assessor and inter-assessor reliability with only two assessors. Whilst the reported kappa values might be interpreted as moderate (0.15–0.66), confidence intervals were large and deteriorated after training. The reliability of this test has also yet to be replicated independently.

Therefore, the aim of this study was to independently evaluate the reliability of a clinically applicable test of pelvic tilting across multiple assessors at two time-points in people with CLBP.

METHODS

A test-retest design was implemented, with participants rated by three assessors at two time-points, one-week apart. People with CLBP were recruited from the public via multimedia advertisements. We used an interval estimation to prospectively calculate sample size using the R package "presize" (Lenz & Haynes, 2020; R Core Team, 2020). Twenty-three participants were required to detect an intra-class correlation coefficient (ICC) of 0.85 with three assessors and a desired confidence interval of 0.2 with 95% confidence (Bonett, 2002). This research received approval from the Guernsey Ethics Committee (approval number IJG/C5.4) and complied with the Declaration of Helsinki (World Medical Association, 2013). Participants gave informed written consent.

Participants

Potential participants contacted researchers and were screened to determine compliance with inclusion (18–70 years old; CLBP > 3-months duration, with or without leg pain) and exclusion criteria (serious spinal pathology such as cancer or inflammatory arthropathy, diagnosed neurological conditions, clinically determined nerve root compromise, and pregnancy).

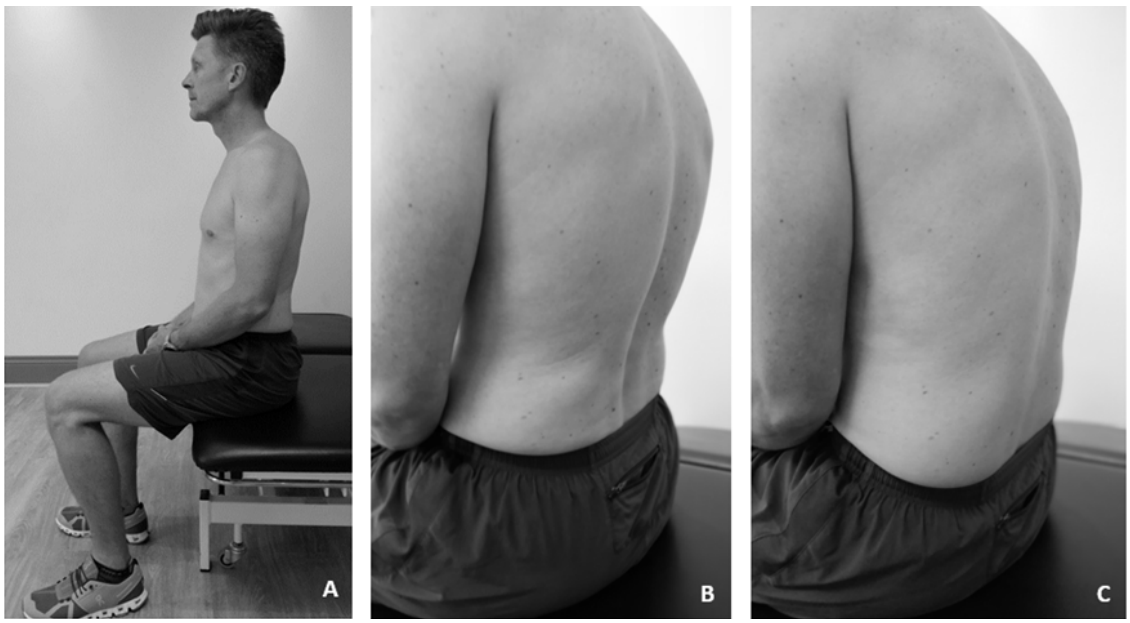
Testing procedure

Three physiotherapists were assessors (MR, NM, ML). Two assessors had 20 and 22 years of clinical experience, respectively, and Master's and PhD degrees in musculoskeletal pain/physiotherapy. The third had 13 years clinical experience. Assessors completed one 30 min preparatory session together on demonstrating the test to participants and familiarisation and standardisation of scoring.

Participants completed the following protocol for the clinical test of lumbopelvic control: Standardised verbal instructions, and demonstration of performance of the test were given by one assessor (randomly selected) using wording described by Elgueta-Cancino et al. (2014). Participants were seated on an adjustable height plinth so that both hips and knees were at approximately 90° of flexion, with the feet flat on the floor. The test involves tilting the pelvis forwards and backwards 10 times in sitting (Figure 1). All assessors concurrently watched the participant perform the test and scored the participant's performance on the scale described by Elgueta-Cancino et al. The scale includes scores for different movement components: quality (smoothness, range) of pelvic movement (0–3 points), control of adjacent regions (thoracolumbar movement, erector spinae activity) (0–3 points), directional influence on movement

Figure 1.

Clinical Test of Lumbopelvic Control



Note. Images showing the test position in sitting (panel A). The test involves anterior (panel B) and posterior (panel C) pelvic tilting, 10 repetitions.

quality (0–2 points), ability to breathe during movement (0–1 point), and ability to perform quality movements repeatedly between (0–1 point). The total score ranges between 0–10 points with higher scores reflecting greater movement control. Assessors were blinded to each other's scores.

Participants were instructed not to practise the movement and returned one week later to repeat the test. The verbal instructions, demonstration, and scoring procedures were repeated.

Data analyses

Data supporting the findings of this study were uploaded to the Open Science Framework (https://osf.io/) and are available from the corresponding author. Data are not publicly available due to ethical restrictions.

Inter-assessor reliability, inter-assessor agreement, and intra-assessor agreement were calculated using *total* scores for each participant. We did not evaluate reliability or agreement of *individual* items because we were interested in the overall test format in clinical use.

Inter-assessor reliability was calculated with an ICC (2,1) (Shrout & Fleiss, 1979) using a two-way random effect model with absolute agreement, using a single measurement (McGraw & Wong, 1996). The ICC provides a measure of relative reliability indicating the similarity of scores between two measurements, relative to the overall distribution of scores (Scholtes et al., 2011). ICC scores are comparable to the kappa values used by Elgueta-Cancino et al. (2014) but with the advantage of considering systematic differences between assessors and extending generalisability of scores to other assessors (Streiner et al., 2014). We considered an ICC of 0.7 indicative of sufficient inter-assessor reliability (Nunnally & Bernstein, 1994), in keeping with recommendations not to use arbitrary classification systems for interpretation of reliability coefficients (de Vet et al., 2011; Streiner et al., 2014).

Standard error of measurement (SEM) was calculated to assess inter- and intra-assessor agreement. The SEM provides a value, in the unit of measurement of the test, of the absolute difference in scores. We calculated the SEM as the square root of the error variance $\sqrt{\sigma^2_{error}}$ (de Vet et al., 2006). We accounted for systematic differences between assessors and testing sessions by including in the error variance both the residual variance ($\sigma^2_{residual}$) (and either the (i) assessor variance (σ^2_{pt}) or (ii) the session variance ($\sigma^2_{session}$), depending on whether (i) inter-assessor or (ii) intra-assessor SEM was being calculated (de Vet et al., 2006). Variance components were estimated in STATA (StataCorp. 2017. *Stata Statistical Software: Release 15*. College Station, TX: StataCorp LLC.), using a random effects model fit with restricted maximum likelihood and participants' score as the dependent variable. There are no strict criteria for evaluating minimum thresholds for SEM values. Values should be interpreted with reference to the context in which the measurement instrument is applied.

The SEM value for inter-assessor agreement provides information on the consistency between scores from different assessors of the same participant (Weir, 2005). A low SEM value is preferable. We calculated the SEM for inter-assessor reliability for the three assessors from both testing sessions, using the formula $\sqrt{(\sigma^2_{pt} + \sigma^2_{residual})}$ (de Vet et al., 2006). Participants and assessors were considered factor variables when estimating variance components. Data from both testing sessions were used and each testing session was considered an independent sample. We calculated the mean score and standard deviation for each assessor across all observations to provide perspectives of both time points.

The SEM value for intra-assessor agreement provides information on consistency between scores from the same assessor at repeat assessments of the same participant (Weir, 2005). A low SEM value is preferable. The intra-assessor agreement indicates the sensitivity of the tool to be used in an *evaluative* (longitudinal) manner, such as observing the effect of an intervention on lumbopelvic control. We calculated the SEM for intra-assessor agreement for all three assessors across both sessions, using the formula $\sqrt{(\sigma^2_{session} + \sigma^2_{residual})}$ (de Vet et al., 2006). Participants and testing sessions were considered factor variables when estimating variance components.

RESULTS

We recruited 23 participants (69.6% female, mean age 55.4 years; range 23–68 years) who attended both testing sessions.

The inter-assessor reliability of the clinical test of lumbopelvic control was ICC (2,1) = 0.52, 95% CI [35, 0.68]. The inter-assessor agreement of the test was SEM = 1.28. Table 1 contains mean scores, standard deviation, and variance values for the three assessors.

Intra-assessor agreement values were: assessor 1 SEM = 1.52, assessor 1 SEM = 1.47, assessor 3 SEM = 1.19. Table 2 contains mean scores, standard deviation, and variance values for sessions 1 and 2 for each assessor.

Table 1

Mean Scores, Standard Deviations, and Variance Values Used to Calculate Inter-Assessor Reliability and Inter-Assessor Agreement (n = 46)

Assessor	Mean score (0–10 points)	*SD* (0–10 points)	Participant variance	Assessor variance	Residual variance
1	3.52	1.92	1.78	6×10^{-2}	1.57
2	3.79	1.98			
3	3.17	1.57			

Table 2

Mean Scores, Standard Deviations, and Variance Values Used to Calculate Intra-Assessor Agreement (n = *23)*

Assessor	Session 1		Session 2		Participant variance	Session variance	Residual variance
	M	SD	*M*	SD			
1	3.59	2.05	3.46	1.83	1.40	4.31×10^{-18}	2.32
2	4.09	2.19	3.50	1.74	1.84	8.3×10^{-2}	2.06
3	3.26	1.69	3.09	1.47	1.06	9.19×10^{-17}	1.42

DISCUSSION

We independently evaluated the reliability and agreement of a clinical test of lumbopelvic control across multiple assessors at two time-points. Our results suggest that when the test is administered by multiple assessors there is considerable variance in scores not due to a true difference among participants. Therefore, the test may not distinguish between participants due to the comparatively higher variance of assessors and random variance in the test itself (ICC for inter-assessor reliability (2,1) = 0.52, 95% CI [0.35, 0.68] (Table 1). The upper bound (0.68) of the 95% CI does not meet the minimum criterion of 0.7 and the lower bound (0.35) is well short. The SEM for inter-assessor agreement indicates that if an assessment of the same person is made by multiple assessors, scores may vary by 1.28 points on the 0–10 scale. The SEM values for intra-assessor agreement ranged from 1.19 to 1.52, suggesting repeated assessments by the same assessor require that observations differ by at least 1.52 points to demonstrate change not attributable to measurement error.

SEM values for inter-assessor agreement can be used to interpret ICC values for inter-assessor reliability. ICC values indicate similarity of scores between participants relative to the overall spread of scores. The overall spread should be sufficient to adequately distinguish participants. The ICC will be low when this does not occur, even if assessors give similar scores (there is good consistency). Sufficient spread is judged using the standard deviation of scores and SEM. The standard deviation ranged from 1.57 to 1.98 (Table 1) – a small spread – indicating most participants scored within 2 points of one another. The SEM indicates scores varied by 1.28 points between assessors. Together, these values indicate insufficient spread to distinguish participants. The spread of scores is not much greater than the observed variability between assessors. This may have contributed to the low ICC values observed. Future evaluations of this test might consider adapting the scale to allow greater spread of scores.

Our results differ with those previously reported. Elgueta-Cancino et al. (2014) evaluated inter-assessor reliability using Cohen's kappa across two assessors and did not calculate agreement. We evaluated inter-assessor reliability with an ICC across three assessors and calculated agreement. Our result may be more robust because we evaluated three assessors and used a larger sample. Our results may have greater interpretability and clinical application because ICCs are more generalisable measures of inter-assessor reliability than Cohen's kappa (de Vet et al., 2011). Second, values for agreement are expressed on the test scale.

Elgueta-Cancino et al. (2014) evaluated intra-assessor reliability for a single assessor of 10 participants on two occasions. Participants were assessed *in vivo* on the first occasion and the assessor reviewed a video taken of that same performance on the second occasion. We evaluated intra-assessor reliability for three assessors of 23 participants at two time-points, under identical conditions *in vivo*. This more closely reflects clinical testing.

Our results may also differ because participants received less training than the study by Elgueta-Cancino et al. (2014). We did not train participants beyond standardised instructions and demonstration of the test (duration < 60 s). Whereas, Elgueta-Cancino et al. (2014) provided initial training using a video and 2 min of training following the first test performance. There may be an effect of training on test performance, although this is uncorroborated. Interestingly, inter-and intra-assessor reliability reduced from substantial to moderate after 2 min of training (Elgueta-Cancino et al., 2014). Regardless, the demonstration used in this study likely more closely reflects use of the test clinically.

Our work is robust in several respects. We prospectively calculated sample size for a broader number of measures of reliability. We employed three assessors, with broad experience, and conducted tests in clinically representative conditions *in vivo*. We prospectively registered the Statistical Analysis Plan and our data and analytic code are available upon request.

Unfortunately, limited data on participant characteristics complicate comparison with other studies. As potential change in participant's presentations was not considered, it is possible their ability to perform the test differed across time-points, adversely influencing examination of test reliability. In addition, we assumed that the total scores used to assess the SEM and ICC are continuous, an assumption generally accepted as necessary for using the SEM. An argument could be made that the total scores are not continuous, which should be considered. However recent evidence has indicated that ICC and SEMs may still be appropriate if the data is not continuous (de Raadt et al., 2021).

CONCLUSION

The clinical testing of lumbopelvic control is time-efficient and involves functional movement that can be used within rehabilitation. However, our results question the reliability of the

test. Examination of other tests may reveal an alternative test that is reliable. Conversely, it may be that more complex clinical movement examination processes or technological movement assessment equipment are necessary to capture lumbopelvic movement control reliably.

KEY POINTS

1. Inter- and intra-assessor reliability of a clinical test of pelvic tilting has insufficient reliability to distinguish between participants across multiple assessors.
2. An observed change of at least 1.5 points may be necessary to be confident true change in test performance has occurred.
3. Physiotherapists may need to consider other tests, complex clinical movement examination processes, or technological movement assessment equipment to capture lumbopelvic movement control reliably.

DISCLOSURES

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PERMISSIONS

This research received approval from the Guernsey Ethics Committee (approval number IJG/C5.4) and complied with the Declaration of Helsinki (World Medical Association, 2013). Participants gave informed written consent. The photographs in Figure 1 are of one of the authors, who provided permission for publication.

CONTRIBUTIONS OF AUTHORS

MB was involved in conception of the research idea, literature review, data analysis, interpretation and writing and review of the final manuscript. IS was involved in data analysis, interpretation and writing and review of the final manuscript. NM and ML were involved in data collection and writing and review of the final manuscript. JM was involved in conception of the research idea and writing and review of the final manuscript. MR was involved in conception of the research idea, literature review and writing and review of the final manuscript.

ADDRESS FOR CORRESPONDENCE

Martin Rabey, 1/13 Garden Terrace, Devonport, Auckland 0624, New Zealand.

Email: martinrabey@gmail.com

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Patient Acceptance of Knee Symptoms and Function after Anterior Cruciate Ligament Reconstruction Improves with Physiotherapy Treatment

Wayne Fausett *MHPrac*
Faculty of Health and Environmental Sciences, Auckland University of Technology, Auckland, New Zealand

Duncan Reid *DHSc*
School of Clinical Sciences, Auckland University of Technology, Auckland, New Zealand

Peter Larmer *DHSc*
Centre for Health and Social Practice, Waikato Institute of Technology, New Zealand; School of Clinical Sciences, Auckland University of Technology, Auckland, New Zealand

Nick Garrett *PhD*
Biostatistics and Epidemiology, Auckland University of Technology, Auckland, New Zealand

ABSTRACT

Physiotherapy is considered an important component of rehabilitation following anterior cruciate ligament reconstruction (ACLR). The relationship between physiotherapy treatment and patient-reported outcomes following ACLR in New Zealand (NZ) is not clear. We used repeated measures logistic regression to examine the relationship between patient-reported outcome data from the NZ ACL Registry and physiotherapy treatment data from the Accident Compensation Corporation (ACC). Outcome measures utilised were the patient acceptable symptom state (PASS) on the Knee Injury Osteoarthritis and Outcome Score (KOOS[4]) and a normative score on the Marx Activity Rating Scale (MARS) within 24 months of ACLR. Data from 5,345 individuals were included in the final analysis, with a mean (*SD*) of 11.7 (10.5) (range 0–91) physiotherapy treatments received, over an average (*SD*) of 185 (153) (range 0–725) days, in the two years following ACLR. Physiotherapy treatment post-ACLR increased the likelihood of achieving a KOOS[4] PASS score at 6 and 12 months, but not at 24 months, following surgery. Physiotherapy did not increase the likelihood of achieving a normative MARS score in the 24 months after ACLR. Multiple factors likely contribute to people who have had an ACLR in NZ receiving a low dosage of physiotherapy treatment following surgery. Physiotherapy treatment after ACLR may increase patient acceptance of any post-surgical symptoms and functional limitations, but the effect on post-operative activity levels is less clear.

Fausett, W., Reid, D, Larmer, P., & Garrett, N. (2023). Patient acceptance of knee symptoms and function after anterior cruciate ligament reconstruction improves with physiotherapy treatment. *New Zealand Journal of Physiotherapy, 51*(1), 53–69. https://doi.org/10.15619/NZJP/51.1.07

Key Words: ACL Reconstruction, Physiotherapy, Rehabilitation, Outcomes

INTRODUCTION

Functional rehabilitation following anterior cruciate ligament reconstruction (ACLR) is considered an effective intervention to increase the likelihood of a patient achieving their post-surgical goals (Lobb et al., 2012). In New Zealand (NZ), physiotherapists typically oversee rehabilitation following ACLR (Fausett et al., 2019). Therefore, the quantity and duration of post-operative physiotherapy treatment likely provides an accurate estimation of the dosage of rehabilitation received following ACLR in NZ. There remains no consensus on the optimal quantity and duration of post-ACLR physiotherapy treatment (Walker et al., 2020), with equivocal evidence as to whether the dosage of physiotherapy treatment following ACLR significantly influences patient-reported outcome scores, knee strength, functional ability, and graft re-rupture rates (Beynnon et al., 2011; Grant et al., 2005; Hohmann et al., 2011; Przybylak et al., 2019; Rhim et al., 2021; Vincent et al., 2017).

The dosage of treatment received by patients receiving community-based physiotherapy following ACLR can vary widely. Retrospective studies show patients post-ACLR receive between 15 and 50+ physiotherapy treatments following surgery (Burroughs et al., 2021; Christensen et al., 2017; Dempsey et al., 2019; Miller et al., 2017). The number of treatments physiotherapists report using following ACLR ranges from 20 to 60 but can exceed 100 (Dingenen et al., 2021; Ebert et al., 2019a; Korakakis et al., 2021). The reported duration of post-ACLR rehabilitation for community-based patients ranges between 127–175 days (Christensen et al., 2017; Dempsey et al., 2019; Miller et al., 2017), with the duration rarely exceeding 6 months (Dunphy & Gardner, 2020; Ebert et al., 2018; Edwards et al., 2018).

Outcomes following ACLR are typically evaluated with a combination of functional measures and patient-reported outcomes measures (PROMs) (Filbay & Grindem, 2019). There are over 50 PROMs related to the anterior cruciate ligament (ACL) deficient knee (Johnson & Smith, 2001). The Knee Injury Osteoarthritis and Outcome Score (KOOS) and the Marx Activity Rating Scale (MARS) are two PROMs consistently utilised in

ACL research and by ACL registries (Kanakamedala et al., 2016; Senorski, Svantesson, Engebretson, et al., 2019). As discrepancies can exist between post-operative PROM scores and patient satisfaction levels, the concept of a patient acceptable symptom state (PASS) may better facilitate interpretation of a PROM (Cristiani et al., 2020; Wright et al., 2015). The PASS is defined as the PROM score beyond which patients consider themselves well (Tubach et al., 2005). PASS thresholds have been developed for each subscale of the KOOS (Muller et al., 2016), and measurement of the PASS is a valuable complement to the KOOS in ACL injury (Svantesson et al., 2020). PASS thresholds, which are derived from a population with the condition of interest, differ from normative scores, which are derived from people who have never had the condition.

The Accident Compensation Corporation (ACC) of NZ is a government-funded no-fault insurance scheme, which funds treatment and rehabilitation costs for personal injuries caused by an accident, as defined by the ACC Act of 2001 (Todd, 2011). An injury claim is lodged on behalf of the patient by their treatment provider and, if accepted, treatment costs are funded under that specific claim (Bismark & Paterson, 2006). As ACL injuries in NZ are typically the result of an accident (Gianotti et al., 2009), treatment and rehabilitation costs for ACL injuries in NZ are usually met by ACC. ACC is the primary funder of private physiotherapy services in NZ (Reid & Larmer, 2007). Patients receiving treatment from private physiotherapists are typically charged a co-payment, as ACC funding does not usually cover the full cost of the treatment (New Zealand Government, 2007). ACC requires physiotherapy providers to collect visual analogue scale (VAS) pain scores and patient specific functional scale (PSFS) scores from patients; however, ACC does not collect this data from providers. Therefore, although ACC has visibility regarding the dosage of rehabilitation provided following ACLR, it has no knowledge of the specific outcome, or effectiveness, of that rehabilitation. ACC has also historically placed limits on the number of physiotherapy treatments it would fund following a musculoskeletal injury, with the maximum number of treatments following ACL injury being sixteen. Once the treatment number limit has been reached, the physiotherapist must apply to ACC for funding of additional treatments.

ACL registries provide a unique opportunity to understand and interpret factors affecting patient-reported outcomes after ACLR (Prentice et al., 2018). The NZ ACL Registry has been collecting PROM data for NZ ACLR patients since 2014, with almost 90% of ACLRs performed in 2020 enrolled by the registry (New Zealand ACL Registry, 2021). To date, it has not been possible to correlate these patient outcomes with the rehabilitation received, as the NZ ACL Registry does not collect data related to post-surgical physiotherapy treatment. Therefore, the purpose of this study was to explore the quantity and duration of physiotherapy treatment following primary, unilateral ACLR in NZ, and to determine the relationship between that dosage of physiotherapy treatment and patient-reported outcomes in the two years following surgery.

METHODS

Data sources

This retrospective study used outcome data from November 2014 to 1 December 2019 from the NZ ACL Registry. The data included pre-ACL injury MARS score, pre-ACLR KOOS/MARS scores, and post-ACLR KOOS/MARS scores at 6, 12, and 24 months. The data was forwarded to ACC's Analytics and Research department in a password-protected Microsoft Excel spreadsheet. As outcome data were collected independent of the physiotherapy provider, all individuals had the opportunity to complete PROMs at all data collection points, even if the individual was not engaged in physiotherapy treatment at the time of PROM data collection.

Using individual identifiers – National Health Index (NHI) number, and/or date of birth, and/or date of ACL injury – outcome data was matched to the ACC claim under which the ACLR was funded. Once individual outcome data and the ACC claim were matched, the following variables were extracted from the ACC claims management software system (Fineos) into a password-protected Microsoft Excel spreadsheet:

- Age at date of ACLR.
- Gender.
- Date of ACLR.
- Number of days between ACL injury and ACLR.
- Number of physiotherapy treatments in the 12 months prior to ACLR.
- Number of physiotherapy treatments between 0–6, 7–12, and 13–24 months post-ACLR.
- Date of first and last physiotherapy treatment after ACLR.
- Whether the individual had received vocational rehabilitation following ACLR.

Once extracted, patient data were de-identified and forwarded to the primary investigator for analysis. Individuals were excluded if patient-reported outcome data was either missing or unavailable from more than one post-ACLR time point. Unavailable data was defined as data yet to be collected, as that time point after ACLR had not yet been reached. Other exclusion criteria included ACLR revision, as subjective outcomes for this population are typically worse than for primary surgery (Lind et al., 2012; Wright et al., 2012), or non-ACC funded ACLR, as ACC would not hold physiotherapy treatment data for these individuals.

Outcome measures

The primary outcomes were the achievement of a KOOS[4] PASS score or a normative MARS score. The KOOS is composed of five subscales: pain, knee-related symptoms, activities of daily living (ADL), function in sport and recreation, and quality of life (Roos et al., 1998). Items on the KOOS are scored from 0 (no problem) to 4 (extreme problem) on a 5-point Likert scale. Scores from each subscale are transformed to a 0–100 scale, with 0 representing "extreme knee problems" and 100 representing "no knee problems". The KOOS[4] is an average of four subscales, where the ADL subscale is excluded to avoid a ceiling effect, as younger, more active patients rarely have difficulties with activities of daily living (Frobell et al., 2010). Excluding the ADL subscale mitigates the risk of a high score on the ADL subscale artificially inflating the KOOS[4] score.

The achievement of a KOOS[4] PASS score was based on individual KOOS subscale threshold values established by Muller et al. (2016), who asked ACLR patients: "Taking account of all the activity you have during your daily life, your level of pain, and also your activity limitations and participation restrictions, do you consider the current state of your knee satisfactory?" (p. 2821). Corresponding PASS values for the KOOS subscales were Pain > 88.9, Symptoms > 57.1, Sport and Recreation > 75.0, Quality of Life > 62.5, which equates to a KOOS[4] PASS score of 70.9. Individuals were not required to achieve a PASS score on each of the four subscales.

The MARS is a knee-specific questionnaire that evaluates activity level in people with various knee disorders (Marx et al., 2001). The MARS assesses the ability to perform four functional activities: running, cutting, decelerating, and pivoting. Participants record how often they perform these activities on a 0–4 scale, with 4 being most active. The maximum possible MARS score is 16. We used a MARS score of 11 for females and 12 for males as normative values (Cameron et al., 2015).

Statistical analysis

Initial descriptive analysis examined the distributions of the outcome and explanatory measures. The available confounding factors were identified as gender, age group, received vocational rehabilitation post-ACLR, and number of days between ACL injury. A repeated measures logistic regression with unstructured correlation was used to examine the association between dichotomous outcome measures and physiotherapy treatment, adjusting for the confounders and time varying effects.

RESULTS

Outcome data for 9,562 individuals was received from the NZ ACL registry (Figure 1). Outcome data was unable to be matched to an ACC claim for 4% of individuals due to a missing NHI number, date of birth, or date of ACL injury. Physiotherapy treatment data was not recorded for 7%. Two out of the possible three post-ACLR outcome data points were either missing or unavailable for 33%. Sufficient outcome data was available and able to be matched to the corresponding ACC claim, from which physiotherapy treatment data was able to be extracted, for 56% of individuals.

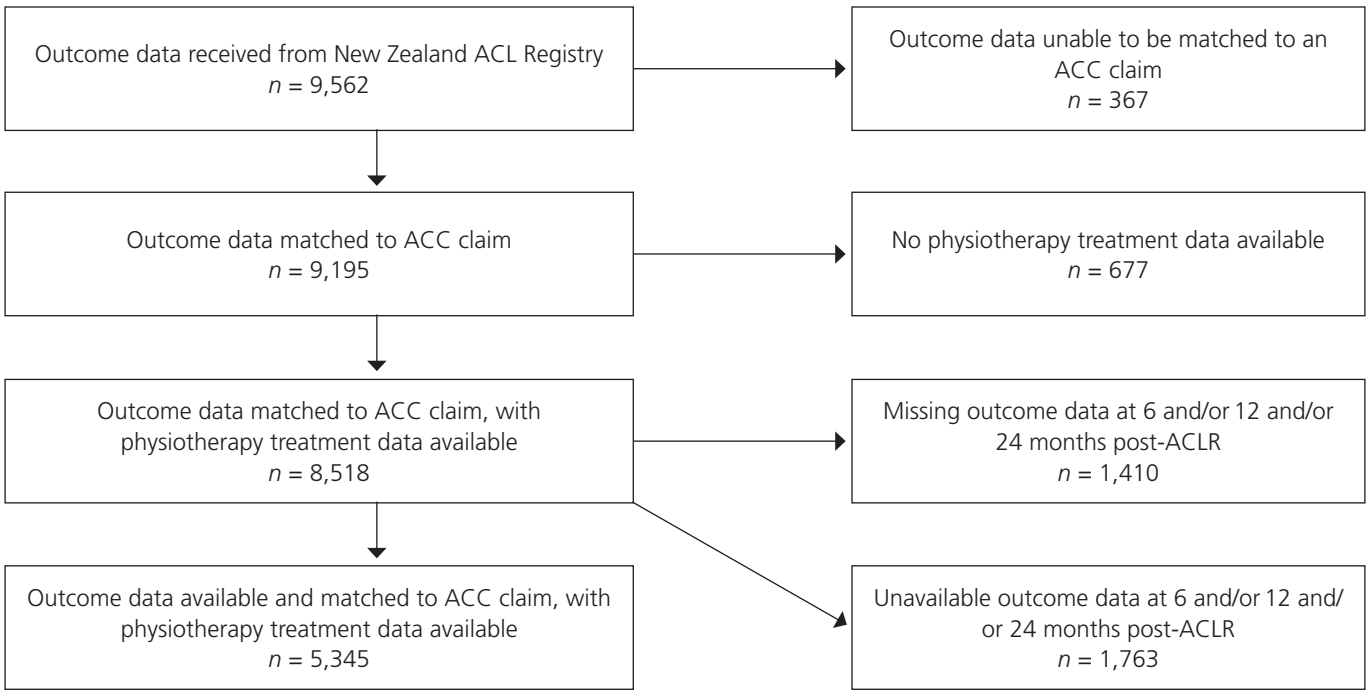
Descriptive analysis of the groups included and excluded from the final data set revealed the percentage of males differed across all groups, with males more likely to have missing physiotherapy treatment data and missing outcome data (Table 1). Individuals with missing outcome data were more likely to be younger at the time of ACLR but less likely to have received vocational rehabilitation. Those with missing physiotherapy treatment data had a longer delay to ACLR and were less likely to have received vocational rehabilitation.

Physiotherapy treatment following ACLR

The average (*SD*) number of physiotherapy treatments in the 12 months prior to ACLR was 5.5 (5.2) (range 0–39) (Figure 2). The average (with *SD* in parentheses) number of physiotherapy treatments 0–6 months post-ACLR was 9.2 (7.2) (range 0–67), 7–12 months post-ACLR was 1.9 (3.7) (range 0–54), and 13–24 months post-ACLR was 0.6 (2.4) (range 0–35). The average (*SD*)

Figure 1

Flow Chart Showing Derivation of Final Data Set



Note. ACC = Accident Compensation Corporation; ACL = anterior cruciate ligament; ACLR = anterior cruciate ligament reconstruction.

Table 1

Descriptive Covariate Values for Individuals Included and Excluded From the Final Data Set

Variable		Outcome data received from NZ ACL Registry (*n* = 9,562)	Outcome data unmatched to ACC claim (*n* = 367)	Physiotherapy treatment data missing (*n* = 677)	Outcome data missing (*n* = 1,410)	Outcome data unavailable (*n* = 1,763)	Physiotherapy treatment data and outcome data available and matched (*n* = 5,345)	*p* [b]
					% [a]			
Gender	Male	57.6	63.2	69.4	70.7	54.3	53.3	< 0.0001
Age at ACLR, *M* (*SD*), range, years		27.8 (11.1), 8–70	28.8 (10.5), 11–64	29.4 (10.9), 9–70	25.6 (9.3), 10–63	28.7 (10.8), 10–69	29.4 (11.2), 8–69	
Age at ACLR, years	8–20	29	20	23	36	26	24	< 0.0001
	21–30	38	47	38	40	38	37	
	31–40	18	18	22	15	20	20	
	41–69	15	15	17	9	16	19	
Days from ACL injury to ACLR, *M* (*SD*), range, years		289 (723), 12–16,025	290 (928), 14–15,418	422 (975), 17–8,801	252 (637), 16–14,406	234 (605), 12–16,025	287 (708), 14–12,163	
Days from ACL injury to ACLR	14–79	26	29	22	27	26	25	< 0.0001
	80–126	24	20	24	23	24	25	
	127–230	25	23	23	25	29	25	
	231+	25	23	31	25	21	25	
	Missing	–	5	–	–	–	–	
Had vocational rehabilitation	Yes	33.4	–	22.2	40.1	32.3	35.6	< 0.0001
	No	66.6	–	77.8	59.9	67.7	64.4	
Pre-injury MARS score, *M* (*SD*)		11.4 (4.9)	11.4 (5.0)	10.4 (5.3)	11.2 (5.2)	11.6 (4.8)	11.7 (4.8)	

Note. ACC = Accident Compensation Corporation; ACL = anterior cruciate ligament; ACLR = anterior cruciate ligament reconstruction; NZ = New Zealand.

[a] Except where indicated. [b] Chi-square test.

total number of physiotherapy treatments in the 24 months post-ACLR was 11.7 (10.5) (range 0–91). The percentage of individuals who did not receive physiotherapy treatment pre-ACLR, and 0–6, 7–12, and 13–24 months post-ACLR, was 22%, 12%, 57%, and 88% respectively (Figure 2).

The duration of post-ACLR physiotherapy treatment was less than 6 months for 57% of individuals, while post-ACLR physiotherapy treatment lasted longer than 9 months for 25% of individuals (Figure 3). The average (*SD*) number of days from the first post-ACLR physiotherapy treatment to the last treatment was 185 (153) days (range 0–725).

Patient-reported outcomes following ACLR

KOOS[4]

The likelihood of an individual achieving a KOOS[4] PASS score following ACLR increased significantly over time ($p < 0.0001$) (Table 2). The percentage of individuals achieving a KOOS[4] PASS score pre-ACLR, and at 6, 12, and 24 months post-ACLR, was 17%, 53%, 70%, and 75% respectively (Figure 4).

MARS

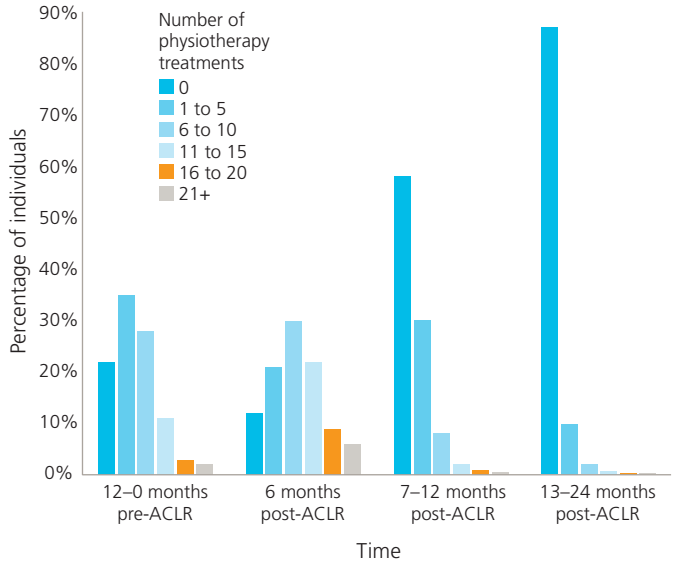
The likelihood of an individual achieving a normative MARS score following ACLR increased significantly over time ($p < 0.0001$) (Table 3). The percentage of individuals achieving a normative MARS score pre-ACLR, and at 6, 12, and 24 months post-ACLR, was 5%, 11%, 23%, and 28% respectively (Figure 5).

Relationship between physiotherapy treatment and patient-reported outcomes – univariate analysis

Post-ACLR physiotherapy treatment was initially grouped into 0, 1, 2–4, and 5+ treatments, as these treatment numbers approximated quartile divisions within the complete data set. Initial analyses showed a statistically significant increase in the likelihood of achieving a KOOS[4] PASS score for one physiotherapy treatment over no physiotherapy treatments 0–6 and 7–12 months post-ACLR ($p = 0.04$), with lesser non-significant increases for 2–4 and 5+ treatments (Table 4). There was no effect of different quantities of post-ACLR physiotherapy

Figure 2

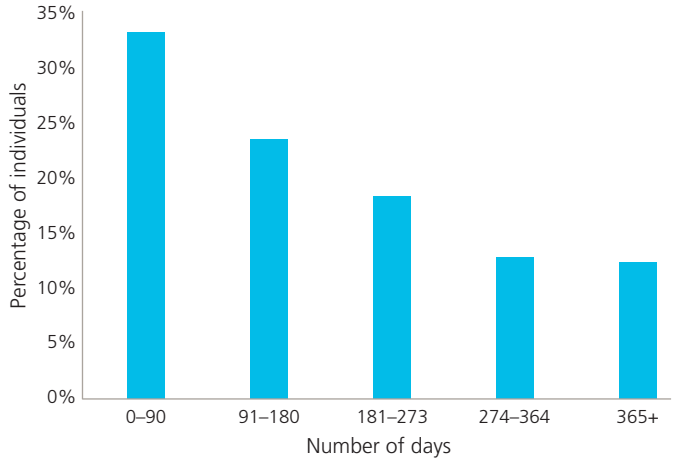
Average Number of Physiotherapy Treatments Per Individual



Note. ACLR = anterior cruciate ligament reconstruction.

Figure 3

Number of Days Between First and Last Physiotherapy Treatment Following ACLR



Note. ACLR = anterior cruciate ligament repair.

Table 2

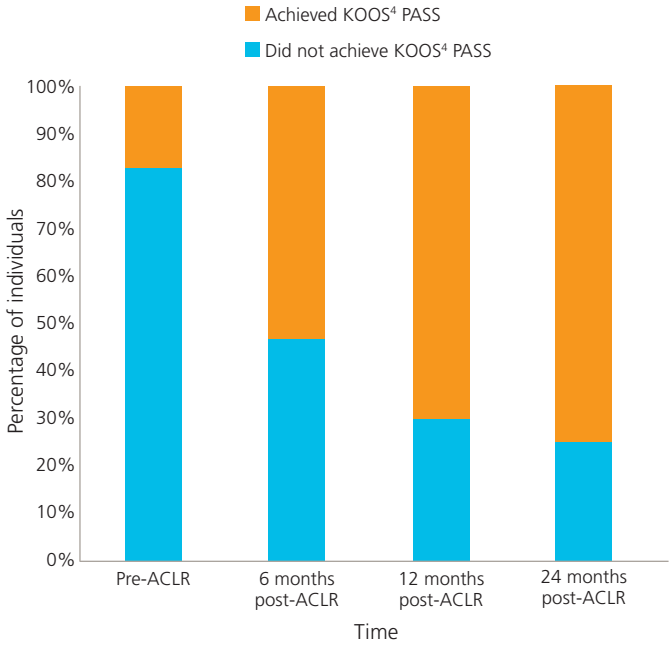
Unadjusted Odds Ratios For the Likelihood of Achieving a KOOS⁴ PASS Score Following ACLR

Time since ACLR	*OR*	95% CI		*p*
		LL	*UL*	
Pre-ACLR	1.00	–	–	
6 months	5.34	4.92	5.79	
12 months	10.87	9.96	11.86	
24 months	13.99	12.64	15.49	< 0.0001

Note. ACLR = anterior cruciate ligament reconstruction; CI = confidence interval; KOOS⁴ PASS = Knee Injury Osteoarthritis and Outcome Score, patient acceptable symptom state; *LL* = lower limit; *UL* = upper limit.

Figure 4

Individuals Achieving a KOOS⁴ PASS Score Over Time



Note . ACLR = anterior cruciate ligament reconstruction; KOOS⁴ PASS = Knee Injury Osteoarthritis and Outcome Score, patient acceptable symptom state.

treatment on the likelihood of achieving a normative MARS score. Therefore, the physiotherapy treatment groups were collapsed into whether or not physiotherapy treatment was present.

KOOS⁴

The percentage of individuals who achieved a KOOS⁴ PASS score at each time point, based on whether they received physiotherapy treatment, is shown in Figure 6. Overall, there was a significant association between receiving physiotherapy treatment and the likelihood of achieving a KOOS⁴ PASS score following ACLR (p = 0.0024), with physiotherapy treatment at 7–12 months associated with an increased likelihood of achieving a KOOS⁴ PASS score at 12 months post-ACLR (Table 5).

MARS

The percentage of individuals who achieved a normative MARS score at each time point, based on whether they received physiotherapy treatment, is shown in Figure 7. Overall, there was a significant association between receiving physiotherapy treatment and the likelihood of achieving a normative MARS score following ACLR (p = 0.0003), with physiotherapy treatment between 7–12 and 13–24 months associated with an

Table 3

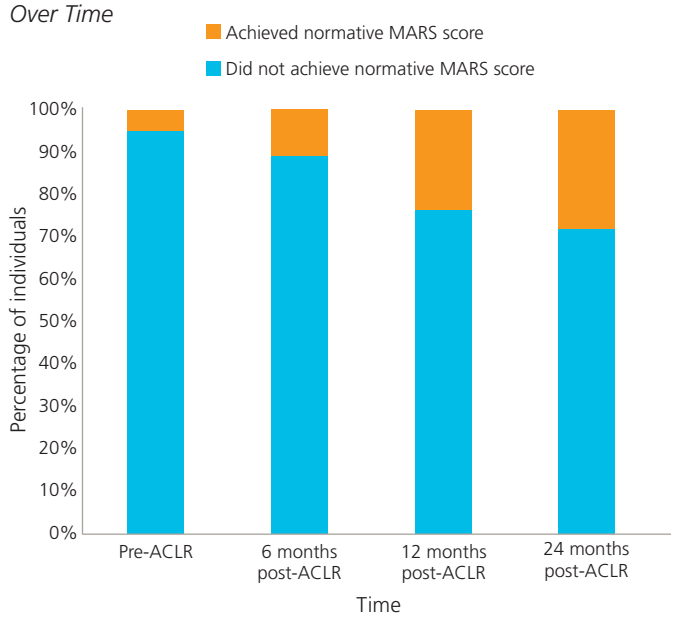
Unadjusted Odds Ratios for the Likelihood of Achieving a Normative Marx Activity Rating Scale Score Following ACLR

Time since ACLR	*OR*	95% CI		*p*
		LL	*UL*	
Pre-ACLR	1.00	–	–	
6 months	2.20	1.90	2.55	
12 months	5.86	5.10	6.73	
24 months	7.53	6.52	8.70	< 0.0001

Note. ACLR = anterior cruciate ligament reconstruction; CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

Figure 5

Individuals Achieving a Normative Marx Activity Rating Scale Over Time



Note. ACLR = anterior cruciate ligament reconstruction; MARS = Marx Activity Rating Scale.

increased likelihood of achieving a normative MARS score at 12 and 24 months after surgery respectively (Table 6).

Relationship between physiotherapy treatment and patient-reported outcomes – multivariate analysis

When adjusted for confounding variables, there was a significant relationship between physiotherapy treatment and likelihood of achieving a KOOS[4] PASS score following ACLR ($p = 0.0035$) (Table 7). Physiotherapy treatment between 0–6 months and 7–12 months increased the likelihood of achieving a KOOS[4] PASS score at 6 and 12 months respectively. However, when adjusted for confounders, the relationship between physiotherapy treatment and the likelihood of achieving a normative MARS score following ACLR did not reach significance ($p = 0.15$). Physiotherapy treatment during all post-operative time periods was not associated with an increased likelihood of achieving a normative MARS score at any post-operative time point. Unadjusted and adjusted odds ratios for KOOS[4] PASS scores and normative MARS scores for all variables are presented in Appendices A and B.

Table 4

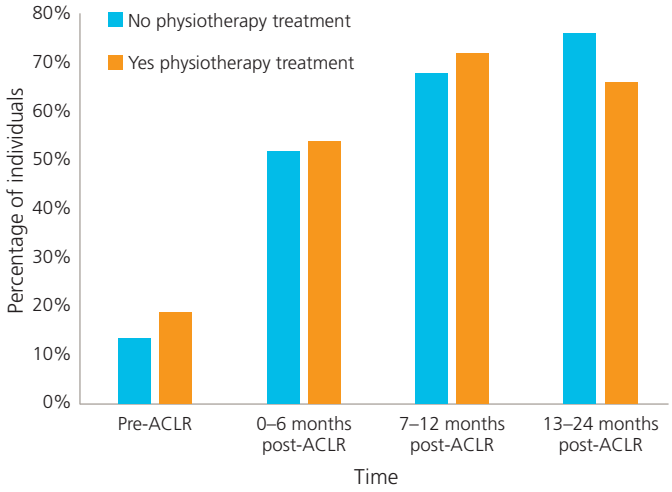
Unadjusted Odds Ratios for Physiotherapy Treatment and the Likelihood of Achieving a KOOS[4] PASS Score Following ACLR

Time since ACLR	Number of physiotherapy treatments	*OR*	95% CI	
			LL	*UL*
0–6 months	0	1.00	–	–
	1	1.45	1.01	2.09
	2–4	1.20	0.96	1.49
	5+	1.18	0.99	1.39
7–12 months	0	1.00	–	–
	1	1.31	1.08	1.59
	2–4	1.12	0.96	1.31
	5+	1.17	0.99	1.39
13–24 months	0	1.00	–	–
	1	0.90	0.62	1.33
	2–4	0.88	0.60	1.27
	5+	0.77	0.50	1.17

Note. ACLR = anterior cruciate ligament reconstruction; CI = confidence interval; KOOS[4] PASS = Knee Injury Osteoarthritis and Outcome Score, patient acceptable symptom state; *LL* = lower limit; *UL* = upper limit.

Figure 6

Individuals Achieving a KOOS[4] PASS Score and If They Received Physiotherapy Treatment



Note . ACLR = anterior cruciate ligament reconstruction; KOOS[4] PASS = Knee Injury Osteoarthritis and Outcome Score, patient acceptable symptom state.

Table 5

Unadjusted Odds Ratios for Individuals Receiving Physiotherapy Treatment and the Likelihood of Achieving a KOOS[4] PASS Score Following ACLR

Time since ACLR	Physiotherapy treatment	*OR*	95% CI	
			LL	*UL*
0–6 months	No	1.00		
	Yes	1.12	0.95	1.31
7–12 months	No	1.00		
	Yes	1.21	1.08	1.36
13–24 months	No	1.00		
	Yes	0.86	0.68	1.09

Note. ACLR = anterior cruciate ligament reconstruction; CI = confidence interval; KOOS[4] PASS = Knee Injury Osteoarthritis and Outcome Score, patient acceptable symptom state; *LL* = lower limit; *UL* = upper limit.

Figure 7

Individuals Achieving a Normative Marx Activity Rating Scale and If They Received Physiotherapy Treatment

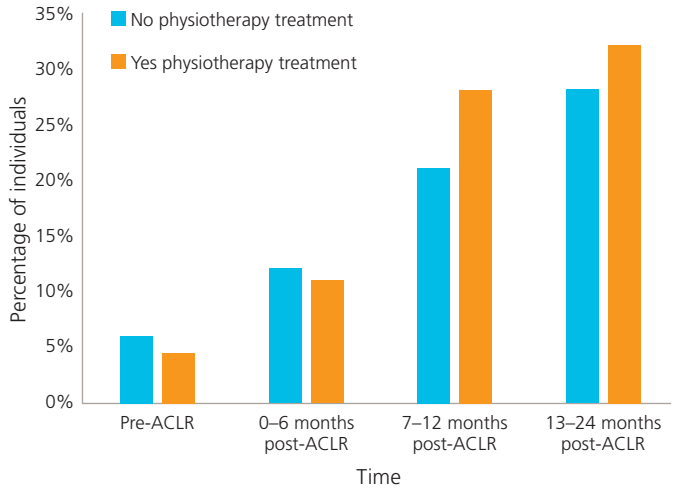


Table 6

Unadjusted Odds Ratios for Individuals Receiving Physiotherapy Treatment and the Likelihood of Achieving a Normative Marx Activity Rating Scale Score Following ACLR

Time since ACLR	Physiotherapy treatment	*OR*	95% CI	
			LL	*UL*
0–6 months	No	1.00		
	Yes	0.95	0.71	1.27
7–12 months	No	1.00		
	Yes	1.27	1.12	1.46
13–24 months	No	1.00		
	Yes	1.40	1.12	1.75

Note. ACLR = anterior cruciate ligament reconstruction; CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

Table 7

Adjusted Odds Ratios for Receiving Physiotherapy Treatment and the Likelihood of Achieving a KOOS[4] PASS Score and a Normative Marx Activity Rating Scale Score Following ACLR

Variable	Time since ACLR	Physiotherapy treatment	*OR*	95% CI	
				LL	*UL*
KOOS[4]	0–6 months	No	1.00		
		Yes	1.19	1.01	1.41
	7–12 months	No	1.00		
		Yes	1.18	1.05	1.33
	13–24 months	No	1.00		
		Yes	0.84	0.67	1.07
MARS	0–6 months	No	1.00		
		Yes	0.91	0.68	1.23
	7–12 months	No	1.00		
		Yes	1.13	0.97	1.31
	13–24 months	No	1.00		
		Yes	1.24	0.97	1.58

Note. ACLR = anterior cruciate ligament reconstruction; CI = confidence interval; KOOS[4] PASS = Knee Injury Osteoarthritis and Outcome Score, patient acceptable symptom state; LL = lower limit; MARS = Marx Activity Rating Scale; UL = upper limit.

DISCUSSION

The aim of this study was to explore the dosage of physiotherapy treatment following ACLR in NZ, and to determine the relationship between the quantity of physiotherapy treatment and patient-reported outcomes in the 2 years following surgery. Our results showed physiotherapy treatment in the first 12 months following ACLR was associated with an increased likelihood of achieving a KOOS[4] PASS score. Physiotherapy treatment in the 24 months following ACLR was not associated with an increased likelihood of achieving a normative MARS score. A greater number of physiotherapy treatments following ACLR was not associated with an increased likelihood of achieving a KOOS[4] PASS score or a normative MARS score in the 24 months following surgery. Overall, individuals received a low dosage of physiotherapy treatment following ACLR in NZ.

This is the first study to show a relationship between physiotherapy treatment and the achievement of a KOOS[4] PASS score following ACLR. Other factors associated with achieving a KOOS[4] PASS score after an ACLR include the absence of a concomitant medial collateral ligament injury and receiving a hamstring tendon graft (Senorski et al., 2018). Age, gender, quadriceps symmetry, absence of concomitant cartilage and meniscal injuries, and hop test performance are also associated with achieving PASS scores on subscales of the KOOS following ACLR (Cristiani et al., 2020; Senorski et al., 2018). Of these factors, only quadriceps symmetry and hop test performance

can be modified by rehabilitation, i.e., physiotherapy treatment. Physiotherapy treatment following ACLR has been shown to improve quadriceps and hamstring strength (Dempsey et al., 2019; Rhim et al., 2021; Walston & Barillas, 2021) and lower limb function (Ebert et al., 2018; Lim et al., 2019). Therefore, physiotherapy treatment potentially contributes to the positive correlation between functional performance and KOOS scores following ACLR (Reinke et al., 2011).

Physiotherapy treatment between 13 and 24 months after ACLR was associated with decreased likelihood of achieving a KOOS[4] PASS score, both in the univariate and multivariate analyses, although results did not reach statistical significance. A lower percentage of individuals who received physiotherapy treatment from 13 to 24 months achieved a KOOS[4] PASS score at 24 months. Physiotherapy treatment after ACLR is recommended to last up to 12 months (van Melick et al., 2016). Therefore, if physiotherapy treatment is required after 12 months, there have potentially been post-operative complications (Eckenrode et al., 2017; Lord et al., 2020), which necessitated prolonged physiotherapy treatment and likely contributed to a worse outcome.

In the univariate analysis, physiotherapy treatment between 7–12 and 13–24 months after ACLR was associated with a significantly increased likelihood of achieving a normative MARS score. When considered with other confounding variables, there was a trend for physiotherapy treatment between 7 and 24 months to be associated with an increased likelihood of achieving a normative MARS score, but significance was not reached. The relationship between physiotherapy treatment and MARS scores following ACLR has not been previously reported. However, physiotherapy treatment following ACLR has been associated with higher scores on the Tegner Activity Scale (Przybylak et al., 2019; Revenäs et al., 2009), which, as with the MARS, quantifies activity level following knee injury (Collins et al., 2011).

Not unexpectedly, the percentage of individuals achieving KOOS[4] PASS scores and normative MARS scores improved over time following ACLR. Our results show 75% of patients post-ACLR perceive their symptoms as acceptable at 2 years post-surgery, which is consistent with previous research (Ingelsrud et al., 2015). Only 28% of individuals had achieved a normative MARS score at 2 years post-ACLR. Although the percentage achieving a normative MARS score increased over time, the average MARS score at 24 months post-ACLR was only 61% of the average pre-injury score, suggesting a low rate of return to pre-injury activity levels after 24 months. Previous research, using MARS data from the same population, reported only 11.1% and 15.5% of patients in NZ have returned to pre-injury activity levels at 12 and 24 months respectively following ACLR (Rahardja et al., 2021). Our study therefore adds to the body of work showing a significant number of people do not achieve pre-injury activity levels 2 years after ACLR (Antosh et al., 2018; Cox et al., 2014; Dunn et al., 2010).

Preliminary analysis of the KOOS[4] data used a normative score as the dependent variable in the statistical model. However, the number of individuals achieving a normative KOOS[4] score at each time point was so low the statistical model failed. Previous research has shown most people do not achieve normative KOOS scores within 2 years of ACLR (Herrington, 2013). As a significant number of patients achieve a PASS score on four out of the five KOOS subscales at 12 months after ACLR (Senorski et al., 2018), a KOOS[4] PASS score was therefore selected as a dependent variable. A normative MARS score was selected as a dependent variable in the current study, as, to date, no PASS scores have been published for the MARS.

Normative values need to be considered in the context of the population from which they were derived. The normative MARS values used in the current study were derived from a cohort of United States military academy recruits, with an average (*SD*) age of 18.8 (0.9) years for males and 18.7 (0.7) years for females (Cameron et al., 2015); the only published normative MARS scores to date. In the current study, average age of individuals at time of ACLR was 29.5 years for males and 29.3 years for females, with an age range from 8 to 69 years. Only 11% of individuals were aged 17–19 years. Younger people have higher participation rates in ACL-dependent activities (Eime et al., 2016), which would be reflected in higher MARS scores. Following ACLR, MARS scores decline with increasing age (Randsborg et al., 2022; Spindler et al., 2018). Therefore, the average age of individuals in the current study likely contributed to the low percentage achieving a normative MARS score following ACLR.

Patient-reported outcome measures are not routinely utilised by physiotherapists in clinical practice (Jette et al., 2009). Although there is no data on the general utilisation of PROMs by NZ physiotherapists, only 52% of NZ physiotherapists report using PROMs when considering a return to sport after ACLR (Fausett et al., 2022). Patient-reported outcome data following ACLR in NZ is collected by an ACL Registry. This is an ACC-funded organisation set up by the Knee and Sports Society, which is a branch of the NZ Orthopaedic Association (New Zealand ACL Registry, 2021). The NZ ACL Registry has no links to physiotherapy providers in NZ. Therefore, the collection of PROM data following ACLR is independent of the providers delivering the post-surgical rehabilitation, arguably independence that eliminates any bias the physiotherapist may introduce by their collection of the PROM data. However, collection of the PROM data is not correlated specifically to a particular stage of rehabilitation and the physiotherapist has no visibility of the PROM scores. PROM data is collected by the NZ ACL Registry at 6, 12, and 24 month intervals following ACLR. More frequent collection of PROM data by the physiotherapist may offer greater insights into the patient's rehabilitation progress, with the rehabilitation plan able to be adjusted or modified if required.

Our results show individuals in NZ receive a low dosage of physiotherapy treatment following ACLR, with less than 12 treatments over 185 days. Previous retrospective studies have shown community-based patients can receive 15–58 treatments over 127–175 days following ACLR (Christensen et al., 2017; Dempsey et al., 2019; Miller et al., 2017). This large range reflects the lack of a consensus regarding an optimal number of physiotherapy treatments following ACLR (Walker et al., 2020). While no optimal number of physiotherapy treatment sessions exists that can be applied to all patients, the number of treatments required by each patient will be a product of

their post-operative goals and individual progress through their rehabilitation programme. Following ACLR, a fortnightly review with the treating physiotherapist is suggested as the minimum requirement (Filbay & Grindem, 2019), and if rehabilitation lasts the recommended 9–12 months (van Melick et al., 2016), then the minimum number of post-ACLR physiotherapy treatments would be 18–24. Ultimately, the optimal number of physiotherapy treatments for each individual will be the number of treatments they require to achieve their post-operative goals.

The temporal utilisation of a limited number of physiotherapy treatments following ACLR could also influence the duration of rehabilitation. Individuals in the current study received 79% of post-ACLR physiotherapy treatments within 6 months of surgery – a finding consistent with a recent database analysis of over 11,000 ACLR patients that reported 90% of post-ACLR physiotherapy treatments were received within 4 months of surgery (Burroughs et al., 2021). If the majority of allocated treatments are utilised within a short timeframe after surgery, then the premature cessation of rehabilitation may be decided by the allocated number of treatments rather than the achievement of patient goals.

For almost 60% of individuals in the current study, post-ACLR physiotherapy treatment lasted less than 6 months, with physiotherapy lasting at least 9 months for only a quarter of individuals. Although time-based rehabilitation following ACLR has now been succeeded by criterion-based rehabilitation (Meredith et al., 2020), time from surgery is still the most considered factor when assessing a return to sport (Burgi et al., 2019). Few patients achieve recommended criteria to resume pre-injury activities within 9 months of ACLR surgery (Herbst et al., 2015; Toole et al., 2017; Welling et al., 2018), and a return to pre-injury activities before 9 months significantly increases the risk of re-injury (Beischer et al., 2020; Bodkin et al., 2022; Grindem et al., 2016). The risk of re-injury following ACLR is also highest in the first 6–12 months of a return to pre-injury activities (Paterno et al., 2012; Webster & Feller, 2016). Therefore, physiotherapist treatment and oversight of rehabilitation 7–12 months after ACLR may help reduce the risk of ACL re-injury at a time when most patients are considering returning to pre-injury activities.

The final phase of ACLR rehabilitation typically involves a resumption of functional activities, sport-specific training, and a graduated return to pre-injury sports (Buckthorpe, 2019), with most patients expecting a return to pre-injury activities 6–12 months after surgery (Armento et al., 2020; Feucht et al., 2016). Individuals in the current study received on average less than two physiotherapy treatments 7–12 months after ACLR, with 58% receiving no physiotherapy treatment during this time. Therefore, our results suggest NZ ACLR patients are undertaking end-stage rehabilitation without adequate professional oversight (Ebert et al., 2019a; Filbay & Grindem, 2019). Low numbers of physiotherapy treatments at 7–12 months could reflect increased self-management (Ebert et al., 2019a), decreased patient compliance (Risberg et al., 2016), a lack of physiotherapist skill and knowledge to manage a patient through the return to sport phase following ACLR (Walker et al., 2020), or the use of non-physiotherapy providers for rehabilitation guidance (Walker et al., 2021).

Multiple factors likely contribute to patients receiving a low dosage of physiotherapy treatment following ACLR, including low motivation to complete rehabilitation (Thorstensson et al., 2009), a lack of patient education regarding post-ACLR rehabilitation (Cailliez et al., 2012), or a lack of surgeon endorsement of rehabilitation (Ebert et al., 2019b). Patients also report frustration and disappointment with a physiotherapist's ability to manage late-stage ACLR rehabilitation (Walker et al., 2022), which could lead to patients prematurely disengaging in physiotherapy, resulting in a low number of treatments.

From a NZ-specific perspective, the provider co-payment, which can be up to $50 per treatment, for a private physiotherapy treatment, likely represents a significant barrier to a patient receiving the recommended dosage of physiotherapy following ACLR. The limits placed on the number of physiotherapy treatments for an ACL injury by ACC have also potentially contributed to low numbers of treatments being used in the current study. The physiotherapist has to submit a request to ACC for funding of additional treatments by providing their clinical records and a completed ACC32 form, which includes details regarding the patient's current condition, how the current condition is linked to the covered injury, and a plan for the additional treatments. The request is then clinically assessed by ACC, with a subsequent decision issued to either approve or decline the request. This prior approval process represents a barrier to receiving additional physiotherapy treatments, as a decision to decline additional funding results in the patient being liable for the full cost of any further physiotherapy treatment, further compounding any financial burden on the patient. Other potential factors preventing engagement in physiotherapy following ACLR include patient-specific barriers (health literacy/understanding of the condition, cultural beliefs, socioeconomic status), provider-specific barriers (patient interactions), and healthcare system barriers (waiting times, location of services, involvement of multiple providers) (Fausett et al., 2019).

A strength of the current study is the large number of individuals, which provides a level of statistical robustness. However, large cohorts increase the likelihood of significant results, even if those results may not be clinically relevant (Senorski, Svantesson, Baldari, et al., 2019). We used deterministic linkage to match two large, separate data sets, which can produce false negative links due to missing data and erroneous entries (Zhu et al., 2015). The retrospective design, while allowing a large cohort, prevents any causal links being established. ACC clients with an ACL injury may have more than one knee claim related to their ACL injury. Therefore, we cannot rule out the possibility of individuals receiving post-ACLR physiotherapy treatment under a knee claim that the ACLR was not funded under. However, this scenario is unlikely to apply to a large number of individuals, as ACC processes are designed to ensure all entitlements are funded under the correct claim. By choosing to use PROM data from the NZ ACL Registry, there was no control over the outcome measures used, and other PROMs may be more appropriate measures to assess patient outcomes within 2 years of ACLR. The International Knee Documentation Committee form is a more useful tool to evaluate patients in the first year after ACLR (van Meer et al., 2013) and the Tegner

activity scale (TAS) is recommended when assessing activity levels in ACLR patients, particularly in conjunction with the International Knee Documentation Committee (Wera et al., 2014).

CONCLUSION

Physiotherapy treatment improves subjective patient-reported outcomes following ACLR, although the effect of physiotherapy treatment on activity levels is less certain. The majority of individuals report acceptable symptoms and function at 2 years following ACLR, which is in contradiction to a low rate of return to pre-injury activity levels. Individuals undergoing ACLR in NZ receive a low dosage of physiotherapy treatment following surgery. The optimal number of physiotherapy treatments following ACLR remains unclear and is likely dependent on multiple factors. A well-controlled prognostic study examining the effects of various quantities of physiotherapy treatment on outcomes following ACLR is warranted. However, ethical issues would likely render the undertaking of such a study challenging. Future prospective research on outcomes following ACLR should consider the appropriateness of the outcome measures used and how the demographics of the cohort might influence any findings.

KEY POINTS

1. In the first 12 months following ACLR, physiotherapy treatment increases the likelihood of an individual accepting any ongoing symptoms or functional limitations; however, in the 24 months following ACLR, the effect of physiotherapy on activity levels is less clear.
2. The dosage of physiotherapy treatment received by NZ patients following ACLR is less than previous research suggests is required.
3. Multiple factors potentially influence the dosage of post-ACLR physiotherapy treatment in NZ, including financial barriers and health system requirements.
4. Regular assessment of the patient's status during ACLR rehabilitation, using both functional and patient-reported outcomes, will likely have multiple benefits, including providing an objective basis for the progression and modification of rehabilitation, and increasing and maintaining patient motivation.

DISCLOSURES

No funding was obtained for this research. At the time of this study, WF was employed by ACC as a clinical advisor, but this research was not undertaken in his capacity as an ACC employee. Although ACC provided the physiotherapy treatment data for analysis, ACC did not commission this research and was not involved in the planning and conducting of this research. ACC was made aware of the study prior to its commencement and was fully supportive of the research. All other authors report no conflict of interest.

PERMISSIONS

Ethical approval for this research was granted by the Auckland University of Technology Ethics Committee (reference number 19/293).

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CONTRIBUTIONS OF AUTHORS

Conceptualisation, design, and methodology, WF, DR, and PL; Formal analysis, NG and WF; Writing – original draft preparation, WF; Writing – review & editing, WF, DR and PL.

ADDRESS FOR CORRESPONDENCE

Wayne Fausett, 94 Grey St, Tauranga, New Zealand.

Email: wayne.fausett@autuni.ac.nz

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Appendices

Appendix A

Odds Ratios for the Likelihood of Achieving a KOOS[4] PASS Score

Variable			Unadjusted [a]				Adjusted [b]			
			OR	95% CI		*p*	*OR*	95% CI		*p*
				LL	*UL*			*LL*	*UL*	
Time	Pre-surgery		1.00			< 0. 0001	1.00			< 0.0001
	0–6 months		5.34	4.92	5.79		6.37	4.76	8.53	
	7–12 months		10.87	9.96	11.86		13.92	10.55	18.53	
	13–24 months		13.99	12.64	15.40		16.08	11.63	22.22	
Time x gender	Pre-surgery	Female	0.72	0.62	0.83	< 0.0001	0.67	0.58	0.78	< 0.0001
		Male	1.00				1.00			
	0–6 months	Female	0.79	0.70	0.88		0.72	0.64	0.82	
		Male	1.00				1.00			
	7–12 months	Female	0.98	0.86	1.11		0.89	0.78	1.02	
		Male	1.00				1.00			
	13–24 months	Female	1.06	0.90	1.25		1.00	0.84	1.18	
		Male	1.00				1.00			
Time x age at date of ACLR	Pre-surgery	8–20 years	1.00			< 0.0001	1.00			< 0.0001
		21–30 years	0.70	0.58)	0.83		0.72	0.60	0.87	
		31–40 years	0.57	0.46	0.71		0.56	0.45	0.70	
		41–69 years	0.47	0.37	0.59		0.46	0.37	0.58	
	0–6 months	8–20 years	1.00				1.00			
		21–30 years	0.68	0.58	0.79		0.76	0.64	0.89	
		31–40 years	0.59	0.50	0.71		0.66	0.55	0.79	
		41–69 years	0.63	0.53	0.76		0.69	0.58	0.83	
	7–12 months	8–20 years	1.00				1.00			
		21–30 years	0.75	0.63	0.90		0.87	0.72	1.05	
		31–40 years	0.52	0.43	0.64		0.63	0.52	0.78	
		41–69 years	0.65	0.53	0.79		0.76	0.62	0.94	
	13–24 months	8–20 years	1.00				1.00			
		21–30 years	0.79	0.62	0.99		0.90	0.71	1.14	
		31–40 years	0.65	0.51	0.83		0.77	0.60	1.00	
		41–69 years	0.87	0.68	1.12		0.99	0.77	1.29	
Time x any physiotherapy treatment	Pre-surgery	No	1.00			0.0024	1.00			0.0035
	0–6 months	Yes	1.12	0.95	1.31		1.19	1.01	1.41	
		No	1.00				1.00			
	7–12 months	Yes	1.21	1.08	1.36		1.18	1.05	1.33	
		No	1.00				1.00			
	13–24 months	Yes	0.86	0.68	1.09		0.84	0.67	1.07	
		No	1.00				1.00			

Variable			Unadjusted [a]				Adjusted [b]			
			OR	95% CI		*p*	*OR*	95% CI		*p*
				LL	*UL*			*LL*	*UL*	
Time x vocational rehabilitation	Pre-surgery	Yes	0.64	0.54	0.75	< 0.0001	0.69	0.59	0.82	< 0.0001
		No	1.00				1.00			
	0–6 months	Yes	0.57	0.5	0.64		0.60	0.52	0.68	
		No	1.00				1.00			
	7–12 months	Yes	0.56	0.49	0.64		0.59	0.52	0.68	
		No	1.00				1.00			
	13–24 months	Yes	0.61	0.52	0.72		0.63	0.53	0.75	
		No	1.00				1.00			
Time x days from ACL injury to ACLR	Pre-surgery	14–79	1.00			< 0.0001	1.00			< 0.0001
		80–126	1.61	1.29	2.01		1.62	1.29	2.02	
		127–230	1.84	1.48	2.29		1.94	1.56	2.42	
		230+	2.11	1.70	2.61		2.27	1.83	2.81	
	0–6 months	14–79	1.00				1.00			
		80–126	1.08	0.92	1.27		1.07	0.91	1.26	
		127–230	1.19	1.01	1.40		1.23	1.04	1.45	
		230+	1.27	1.08	1.50		1.31	1.10	1.55	
	7–12 months	14–79	1.00				1.00			
		80–126	1.12	0.93	1.34		1.13	0.94	1.36	
		127–230	0.95	0.79	1.14		0.98	0.82	1.18	
		230+	0.91	0.76	1.09		0.93	0.78	1.12	
	13–24 months	14–79	1.00				1.00			
		80–126	1.17	0.92	1.48		1.16	0.92	1.47	
		127–230	1.03	0.82	1.29		1.03	0.82	1.30	
		230+	0.94	0.75	1.17		0.91	0.72	1.14	

Note. ACL = anterior cruciate ligament; ACLR = anterior cruciate ligament repair; CI = confidence interval; KOOS[4] PASS = Knee Injury Osteoarthritis and Outcome Score, patient acceptable symptom state; *LL* = lower limit; *UL* = upper limit.

[a] unadjusted except for time effects.

[b] adjusted for gender, age at date of ACLR, presence of vocational rehabilitation post-ACLR, and number of days between ACL injury and ACLR.

Appendix B

Odds Ratios for the Likelihood of Achieving a Normative Marx Activity Rating Scale Score

Variable			Unadjusted [a]				Adjusted [b]			
			OR	95% CI		*p*	*OR*	95% CI		*p*
				LL	*UL*			*LL*	*UL*	
Time	Pre-surgery		1.00			< 0.0001	1.00			< 0.0001
	0–6 months		2.20	1.90	2.55		14.66	6.66	32.28	
	7–12 months		5.86	5.10	6.73		37.85	18.37	77.96	
	13–24 months		7.53	6.52	8.70		35.14	16.75	73.73	
Time x gender	Pre-surgery	Female	0.85	0.65	1.09	0.0001	0.80	0.62	1.04	< 0.0001
		Male	1.00				1.00			
	0–6 months	Female	0.82	0.68	1.00		0.75	0.62	0.92	
		Male	1.00				1.00			
	7–12 months	Female	0.74	0.64	0.85		0.65	0.55	0.75	
		Male	1.00				1.00			
	13–24 months	Female	0.77	0.65	0.90		0.70	0.59	0.84	
		Male	1.00				1.00			
Time x age at date of ACLR	Pre-surgery	8–20 years	1.00			< 0.0001	1.00			< 0.0001
		21–30 years	0.53	0.40	0.71		0.54	0.40	0.74	
		31–40 years	0.42	0.29	0.62		0.45	0.31	0.67	
		41–69 years	0.23	0.14	0.38		0.31	0.19	0.51	
	0–6 months	8–20 years	1.00				1.00			
		21–30 years	0.47	0.37	0.58		0.49	0.39	0.62	
		31–40 years	0.24	0.18	0.34		0.27	0.19	0.38	
		41–69 years	0.20	0.14	0.28		0.25	0.17	0.36	
	7–12 months	8–20 years	1.00				1.00			
		21–30 years	0.56	0.47	0.66		0.64	0.53	0.77	
		31–40 years	0.28	0.22	0.35		0.35	0.28	0.45	
		41–69 years	0.16	0.12	0.20		0.22	0.17	0.29	
	13–24 months	8–20 years	1.00				1.00			
		21–30 years	0.69	0.56	0.85		0.73	0.59	0.91	
		31–40 years	0.34	0.26	0.44		0.38	0.29	0.50	
		41–69 years	0.18	0.13	0.24		0.23	0.17	0.32	
Time x any physiotherapy treatment	Pre-surgery	No	1.00			0.0003	1.00			0.15
	0–6 months	Yes	0.95	0.71	1.27		0.91	0.68	1.23	
		No	1.00				1.00			
	7–12 months	Yes	1.27	1.12	1.46		1.13	0.97	1.31	
		No	1.00				1.00			
	13–24 months	Yes	1.40	1.12	1.75		1.24	0.97	1.58	
		No	1.00				1.00			

Variable			Unadjusted [a]				Adjusted [b]			
			OR	95% CI		*p*	*OR*	95% CI		*p*
				LL	*UL*			*LL*	*UL*	
Time x vocational rehabilitation	Pre-surgery	Yes	0.81	0.61	1.06	< 0.0001	1.04	0.77	1.38	< 0.0001
		No	1.00				1.00			
	0–6 months	Yes	0.65	0.52	0.80		0.85	0.68	1.07	
		No	1.00				1.00			
	7–12 months	Yes	0.51	0.43	0.59		0.57	0.48	0.68	
		No	1.00				1.00			
	13–24 months	Yes	0.77	0.65	0.92		0.89	0.73	1.08	
		No	1.00				1.00			
Time x days from ACL injury to ACLR	Pre-surgery	14–79	1.00			< 0.0001	1.00			< 0.0001
		80–126	1.14	0.80	1.62		1.20	0.84	1.72	
		127–230	1.00	0.69	1.44		1.16	0.8	1.69	
		230+	1.10	0.77	1.57		1.39	0.97	2.01	
	0–6 months	14–79	1.00				1.00			
		80–126	0.94	0.73	1.21		0.98	0.76	1.27	
		127–230	0.73	0.56	0.95		0.82	0.62	1.07	
		230+	0.61	0.46	0.80		0.72	0.54	0.97	
	7–12 months	14–79	1.00				1.00			
		80–126	0.79	0.65	0.95		0.81	0.66	0.99	
		127–230	0.47	0.39	0.58		0.50	0.41	0.62	
		230+	0.45	0.37	0.56		0.52	0.42	0.65	
	13–24 months	14-–9	1.00				1.00			
		80–126	0.91	0.73	1.14		0.96	0.76	1.22	
		127–230	0.65	0.52	0.81		0.71	0.56	0.91	
		230+	0.51	0.40	0.64		0.60	0.47	0.77	

Note. ACL = anterior cruciate ligament; ACLR = anterior cruciate ligament repair; CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

[a] unadjusted except for time effects.

[b] adjusted for gender, age at date of ACLR, presence of vocational rehabilitation post-ACLR, and number of days between ACL injury and ACLR.

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Feasibility of Ballistic Strength Training to Improve Mobility of Inpatients with Traumatic Brain Injury: A Study Protocol

Izel Gilfillan *BPhysT (Physiotherapy)*
Postgraduate Student, Department of Physiotherapy, School of Healthcare Sciences, Faculty of Health Sciences, University of Pretoria, Pretoria, South Africa

Diphale J. Mothabeng *PhD (Rehabilitation)*
Head of Department, Department of Physiotherapy, School of Healthcare Sciences, Faculty of Health Sciences, University of Pretoria, Pretoria, South Africa

Annelie van Heerden *MPhysio (Physiotherapy)*
Lecturer, Department of Physiotherapy, School of Healthcare Sciences, Faculty of Health Sciences, University of Pretoria, Pretoria, South Africa

ABSTRACT

Traumatic brain injury is a major cause of mortality and long-term disability, often resulting in limited mobility. Limited mobility is associated with poor community participation and reduced health-related quality of life. Mobility, particularly walking, requires rapid force generation, which can be improved using ballistic strength training. This study aims to investigate the feasibility of ballistic strength training for improving mobility in people recovering from traumatic brain injury in an inpatient rehabilitation setting.
The feasibility study will use a quasi-experimental single group pre-test–post-test design. We will recruit inpatients with first-ever, moderate-to-severe traumatic brain injury, less than 6 months post-injury. We plan to measure recruitment capability, attendance, the incidence of adverse events, acceptability of the intervention, and ability to perform exercises. Preliminary effects of the intervention will be measured as a change in self-selected walking speed, change in walking capacity, and participant perceived difference in walking ability. The data will be descriptively analysed. In this study protocol, we outline the rationale for implementing a feasibility study to test the feasibility of ballistic strength training for inpatients who have experienced traumatic brain injuries.

Gilfillan, I., Mothabeng, D. J., & van Heerden, A. (2023). Feasibility of ballistic strength training to improve mobility of inpatients with traumatic brain injury: A study protocol. *New Zealand Journal of Physiotherapy, 51*(1), S1–S8. https://doi.org/10.15619/NZJP/51.1.08

Key Words: Ballistic Strength Training, Feasibility, Mobility, Rehabilitation, Traumatic Brain Injury

INTRODUCTION

Traumatic brain injury (TBI) often results in complex clinical presentations, and rehabilitation teams perceive this condition to be one of the most challenging to treat (McNamee et al., 2009; Røe et al., 2019). In New Zealand, TBI is a major cause of disability and death (Te Ao et al., 2015), with substantial economic costs for society (Te Ao et al., 2014). In 2010, men and women in the 40- to 49-year-old age group had the highest prevalence of TBI in New Zealand (Te Ao et al., 2015). Survivors of moderate-to-severe TBI may have long-term healthcare needs, with associated costs running into billions of dollars (Centers for Disease Control and Prevention, 2022; Ma et al., 2014; Prang et al., 2012).

Impact of TBI on mobility outcomes

People recovering from moderate-to-severe TBI present with manifold, multi-system physical, cognitive, and neurobehavioral impairments (Riggio & Wong, 2009; Walker & Pickett, 2007). These impairments often result in limited mobility (Walker & Pickett, 2007; Williams & Willmott, 2012), including slower walking speed, reduced walking distance, and impaired quality of gait (Katz et al., 2004; McFadyen et al., 2003; Williams et al., 2009). Walker and Pickett (2007) report that more than one-third of patients with TBI continue to display neuro-motor abnormalities two years after acute rehabilitation. People with limited mobility struggle to navigate their homes and community environments, often suffering from falls and limited participation (Lasry et al., 2017; Williams & Schache, 2010). Restoring walking skills is often the main long-term rehabilitation goal for people recovering from moderate-to-severe TBI, as being able to walk will enhance their performance in activities of daily living and participation in recreational activities (Katz et al., 2004; Wilson et al., 2019).

Aspects of walking ability can be measured in terms of endurance and speed. Reduced walking endurance can restrict a person's ability to perform daily activities, from crossing a road to accessing the community (Charrette et al., 2016; Mossberg & Fortini, 2012). Walking speed is a particularly important outcome in neurological populations because it is relevant to community ambulation (Andrews et al., 2010). Walking speed also inversely correlates with the risk of falls (Fritz & Lusardi, 2009), with slower walking speeds being associated with more frequent falls (Morone et al., 2014; Tilson et al., 2012). Klima et al. (2019) report that patients with TBI have a mean walking velocity of 0.96 m/s, significantly slower than age-matched controls and speeds reported in published norms (Bohannon,

1997). People aged between 20 and 69 years have a normal walking speed between 1.2 m/s and 1.55 m/s (Bohannon & Andrews, 2011).

A key research priority for individuals with TBI is to develop, evaluate, and implement interventions for optimising independent function and participation (Nalder et al., 2018). Muscle weakness has been identified as the leading cause of walking limitation for most people with neurological conditions (Nadeau et al., 1999; Williams et al., 2013). Muscle weakness is usually treated using conventional strength training methods, which follow the overload principle of slow and heavy resistance. However, conventional strength training does not promote rapid force generation, which is needed for walking (Williams et al., 2019; Williams, Kahn et al., 2014). Consequently, walking ability in people with neurological conditions does not seem to respond to conventional strength training (Dorsch et al., 2018; Williams, Kahn, et al., 2014). Therefore, current interventions to rehabilitate walking may not be specific enough to the task of walking (Williams, Kahn, et al., 2014).

Ballistic strength training

Ballistic strength training (BST) is a type of strength training performed at high velocity with lighter loads and high repetition (Williams et al., 2016). BST is a task-focused approach healthy athletes use to improve muscle strength, maximal power generation, and functional ability (Newton et al., 2006). Recently, BST has shown potential as a therapeutic tool for improving mobility outcomes in neurologic populations (Hendrey et al., 2018; Van Vulpen et al., 2017). However, research on the use of BST in patients with neurological conditions, including TBI, is relatively novel, and evidence is limited.

Currently, most research on the use of BST in adult neurologic populations focuses on participants who were at least 6 months post-injury. These studies on BST found that combining BST principles with conventional leg strengthening exercises resulted in increased power generation with increased peak jump height and peak velocities (Williams, Clark, et al., 2014). BST appears to improve muscle strength and power generation. BST is safe, feasible, and effective in neurological conditions, including adults with stroke, Parkinson's disease, and multiple sclerosis (Cordner et al., 2020).

The impact of BST on mobility outcomes during the early inpatient TBI rehabilitation phase is of particular interest because BST is highly task specific. This task-specificity plays an important role in improving functional outcomes (Anthony & Brown, 2016; Hendrey et al., 2018). In a randomised feasibility trial investigating the use of BST in participants who were less than 6 months post-stroke (median = 56 days), Hendrey et al. (2018) report that BST improved self-selected walking speed and muscle power generation. However, their study used a small sample size, and the results cannot be generalised to the TBI population.

Inpatient rehabilitation can be optimised using evidence-based interventions to improve mobility following TBI. There is a need for high-quality research to inform clinical practice, particularly when considering the current lack of high-quality evidence to inform interventions for improving mobility outcomes. We will add to the current body of evidence by examining whether BST can improve mobility outcomes of inpatients with TBI less than 6 months post-injury. A feasibility trial will provide preliminary information on whether BST can work for inpatients with TBI by measuring acceptability, safety, and preliminary effects (Harvey, 2018; Orsmond & Cohn, 2015). A feasibility trial will also inform the translation of BST into clinical practice and lay the foundation for future larger definitive trials (Harvey, 2018).

METHODS AND ANALYSIS

Research aim

To establish the feasibility of implementing BST to improve mobility outcomes following moderate-to-severe TBI in an inpatient rehabilitation setting.

Study objectives

Our primary objective is to establish the feasibility of implementing BST in an inpatient rehabilitation setting by:

1. Determining the recruitment rate of participants by investigating the eligibility and subsequent uptake of participants.
2. Establishing the safety of BST by recording adverse events.
3. Determining training attendance per participant.
4. Determining participant acceptance of the intervention.
5. Evaluating clinical feasibility by determining the following:
   (a) the ability of participants to complete BST exercises using participant logs.
   (b) the ability of participants to develop skills during BST exercises.

Our secondary objective is to examine the preliminary effects of BST on the following mobility outcomes:

1. Determining changes in self-selected walking speed.
2. Determining changes in walking capacity.
3. Determining participants' perceived impression of change in walking ability.

Study design

The proposed feasibility study will use a quasi-experimental single group pre-test–post-test design (01 X 02). A quasi-experimental study is ideal for maximising sample size in proof-of-concept studies where participants are not randomly assigned to experimental groups (Harris et al., 2006). In this study, pre-test measurements will be taken (01), the intervention (X) will be implemented, and post-test measurements will be taken (02) to examine preliminary effects on mobility outcomes.

This feasibility study will be a non-randomised pilot study without a control group (Eldridge et al., 2015). The feasibility of BST will be established using the following criteria as specified by Orsmond and Cohn (2015): recruitment capability, training attendance, safety, participant acceptability of the intervention, and preliminary evaluation of participant response to the intervention.

Research setting

The study will be conducted in a 33-bed specialist acquired brain injury rehabilitation centre that provides interdisciplinary care to inpatients in Auckland, New Zealand.

Study population

Eligibility criteria

Inclusion criteria for participants are adults, 18–65 years of age, with first-ever diagnosis of moderate-to-severe TBI, fewer than 6 months post-injury. Participants will have had independent, unaided baseline mobility before TBI; and after TBI, will be able to walk with standby assistance of one therapist for at least 14 m (the use of mobility aids and orthoses is permitted). Participants must be able to understand written and spoken English.

Exclusion criteria include: Individuals unwilling or unable to give informed consent; Severe cognitive or behavioural problems that prevent assessment and participation; Medically unstable and unable to perform cardiovascular exercise; Recent spinal surgery in the last 6 weeks or orthopaedic injuries restricting weight bearing; Lower limb muscle weakness from a peripheral cause (e.g., peripheral nerve injuries); Previously diagnosed central nervous system disorder (e.g., previous moderate to severe TBI, multiple sclerosis, or Parkinson's disease); Individuals who are able to walk independently, unaided, with a self-selected walking speed of faster than 1.55 m/s.

Sampling method

Sample size

The study will take place over 6 months. Even though feasibility studies do not require a powered sample (Orsmond & Cohn, 2015), we asked a statistician to estimate the ideal sample size. The power analysis showed that for parametric tests such as a paired *t*-test with a large effect size of 0.6, using G*Power 3.1.9.2, at an alpha level of 5% and a power of 80%, a sample size of 23 would be required. To allow for attrition, we will aim to include 27 participants.

Recruitment

Physiotherapists at the rehabilitation centre will screen ambulatory inpatients for eligibility. We will determine whether a participant can provide informed consent for each prospective participant. Each potential participant will be assessed using an interdisciplinary model in line with the rehabilitation centre's policy. A medical officer will sign off on the potential participant's ability to provide informed consent. An independent representative from the rehabilitation centre will invite eligible prospective participants. Potential participants will receive a participant information sheet and an informed consent form, and will be given time to consider the trial and ask questions. Those willing to participate in the study will be asked to sign the written informed consent form. Participants will be consecutively enrolled as they consent to participate. Participants can withdraw at any stage without negatively affecting their treatment. Participants will be informed that, should they wish to withdraw during the study, the data collected cannot be erased and may still be used in the final analysis.

Intervention

Following enrolment and baseline assessments, participants will have two 30 min BST sessions per week instead of the usual conventional physiotherapy sessions. Participants will attend BST sessions for at most 4 weeks, which is dependent upon and reflective of the typical inpatient length of stay. The BST exercise programme has been peer reviewed and validated by an expert in the field, Professor Gavin Williams, and two neurology lecturers at the Department of Physiotherapy, University of Pretoria. Each BST session will be performed in the therapy gym at the rehabilitation centre. Each participant will be directly supervised by a physiotherapist or a physiotherapy assistant trained in the BST exercise programme to ensure correct technique and appropriate progression. The proposed BST exercise programme is based on the theoretical framework designed for neurologic rehabilitation (Williams, Clark et al., 2014; Williams et al., 2019). The BST exercise programme will comprise two parts, each with four exercises. Each participant will perform the same exercises, and the progression of exercises will be individualised. Part A includes low resistance (below body weight) exercises performed on a reclined slide-board. Part B comprises bodyweight exercises performed in parallel bars using equipment such as a mini trampoline, with or without upper limb support, and additional resistance. The BST exercise programme and progression principles are similar to the BST exercise programme used by Hendrey et al. (2018) in a stroke population. First, the aim will be to ensure the correct movement pattern is achieved. Thereafter, speed of movement will be increased as a progression. The desired speed of movement will be set to one beat per second, the usual time for a typical gait cycle. As per consultation with an expert in BST, Professor Gavin Williams, we will use a metronome to provide auditory feedback. Finally, load will be increased as a progression (by increasing the incline in Part A or by adding external resistance in Part B), without altering speed and quality of movement.

The level of intensity will be set to the maximum level the participant can manage while maintaining the correct lower limb alignment, using the correct technique and desired range of motion. Each exercise will be performed for 2 min, during which the participant will be encouraged to perform as many repetitions as possible. Although the BST programme will strengthen all major lower limb muscle groups, we will target the three muscle groups critical for power generation during forward propulsion when walking. These three muscle groups include the ankle plantar flexors used during push-off in terminal stance, hip flexors at toe-off to accelerate the leg through swing phase, and hip extensors at initial contact (Neptune et al., 2008; Requião et al., 2005).

Therapists will demonstrate exercises and assist participants where necessary. We will keep an exercise log for each participant to capture the assistance and progression level required for each exercise. There will be at least 48 hours between each BST session. The severity of adverse events will be recorded using the Common Terminology Criteria for Adverse Events (CTCAE v5) (US Department of Health and Human Services, 2017). As the study's primary aim is to establish feasibility, the study will be terminated early if the supervisors judge there are excessive adverse events or complaints. Participants will continue to receive routine physiotherapy care on the remaining five days of the week.

Data collection, management, and analysis

Demographic characteristics

Participant demographic information will be extracted from medical records and captured in Microsoft Excel spreadsheets. Information will pertain to participants' date of TBI, date of admission to the rehabilitation centre, classification of injury (moderate or severe; severity will be determined by the medical team of the rehabilitation centre according to the initial Glasgow Coma Scale score and the length of Post Traumatic Amnesia), mechanism of injury, age, gender, and orthopaedic injuries (weight-bearing restrictions).

Pre-test–post-test outcome measures

The use of mobility aids, orthoses, and/or amount of assistance required will be recorded on the pre-test and post-test assessment sheets. A trained and accredited user will score the locomotion item of the Functional Independent Measure (FIM) for comparison between pre-test and post-test analysis.

Pre-test outcome measures

We will complete the following baseline assessments:

10-metre Walk Test (10mWT): A performance measure used to assess self-selected walking speed, also known as comfortable walking speed. A dynamic start and stop will be used. A total distance of 14 m will be used, of which the middle 10 m will be timed. The participants will be allowed to use mobility aids and orthoses. Self-selected walking speed (m/s) will be calculated by dividing the distance (10 m) by the time (s) taken to walk the distance.

6 Minute Walk Test (6MWT): To measure functional walking capacity, we will determine how far (m) a participant can walk in 6 min. The 6MWT is a self-paced walking test. A 50 m track will be used with the assessor walking behind the participant. Participants may use mobility aids and orthoses. Data will be recorded in spreadsheets. The 6MWT evaluates if a person can increase their activity level and then maintain a moderate level of physical activity over a period representative of activities of daily living (Mossberg & Fortini, 2012).

Post-test outcome measures

After completing the intervention, we will repeat the 10mWT and 6MWT.

10-metre Walk Test (10mWT): Minimal detectable change of > 0.05 s is considered clinically relevant; this change is also greater than assessor error (Watson, 2002). In our study, a minimum worthwhile change in self-selected speed of 0.175 m/s will be considered statistically significant (Fulk et al., 2011).

6 Minute Walk Test (6MWT): TBI population-specific normative values have not been clearly defined in the current literature. Clinically meaningful changes in distance are between 14 m and 30.5 m for adults with pathology (Bohannon & Crouch, 2017) and between 45 m and 54 m following stroke (Tyson & Connell, 2009). In our study, as indicative of improved endurance in post-stroke populations, a clinically meaningful change of 34.4 m in distance will be used (Tang et al., 2012).

The following measures will also be completed after the intervention.

Visual Analogue Scale (VAS): To evaluate participant acceptance of BST (Sekhon et al., 2017). Participants will be asked to rate their agreement with the statement *'I find the BST exercise programme acceptable'* using a 10-point VAS ranging from 0 (I totally disagree) to 10 (I totally agree). Using a ruler, the score will be determined by measuring the distance (mm) on the 10 cm line between the "totally disagree" anchor and the participant's mark (providing a range of scores from 0 to 100). Higher scores show greater acceptability (Lamontagne et al., 2014; Tverdal et al., 2018). In our study, a score of more than 5/10 will indicate acceptance of the intervention.

Global Rating of Change Scale (GRoC): To determine each participant's perceived change in walking ability following the intervention. GRoC is a generic 15-point ordinal scale, ranging from –7 to +7, with positive scores showing improvement and negative scores showing regression. Participants who answer between –4 and +4 will be considered to perceive minimal or no change (stable/not improved). Participants who answer +5 or more will be considered to perceive clinically important change or marked improvement. Traditionally, a cut-off of +3 is deemed to represent a minimal change, and participants who answer +4 or more perceive a marked improvement (Jaeschke et al., 1989). We chose a ≥ 5 cut-off for two reasons: all patients during this early time frame after TBI will likely experience some change in walking ability. We are interested in identifying changes in aspects of mobility that are more than just 'minimally' important. A score of ≥ 5, 'a good deal better', may reflect a bigger improvement than 'somewhat' or 'moderately' better, which would indicate 'minimally important' improvement (Fulk & Echternach, 2008; Fulk et al., 2011).

Feasibility measures

We will establish feasibility using data from screening (number of eligible and recruited participants with reasons for exclusion), participant BST exercise logs, and pre-test–post-test assessment sheets. We will use the exercise logs to record the number of sessions attended, the level of assistance required for each exercise, and skills acquisition. Skills acquisition refers to how much help the participant requires to achieve the desired speed of movement during exercises, as well as whether the participant can perform the exercise. Reports of discomfort or adverse effects will also be captured. We will screen the participants' clinical notes to identify any adverse events.

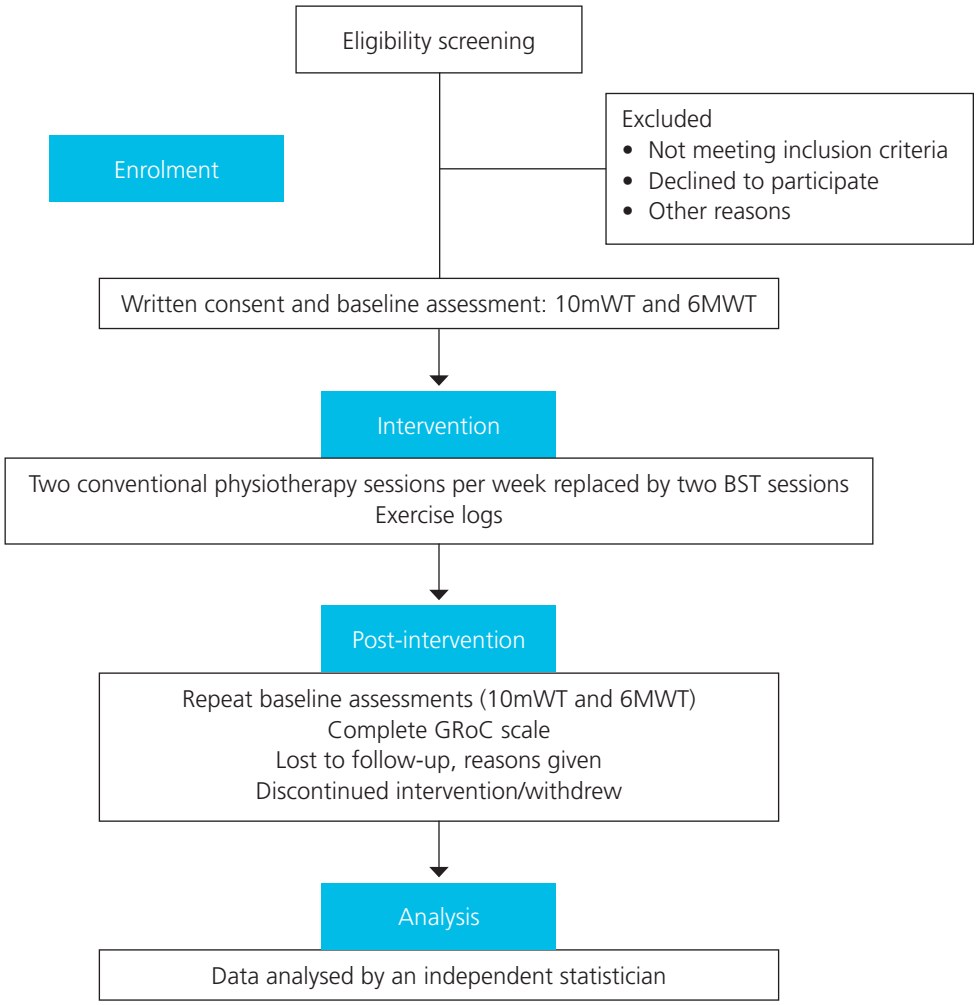
To enhance rigour, an independent physiotherapist or physiotherapy assistant will conduct the pre-test–post-test assessments. The same assessor will be used for pre-test and post-test assessments where practicable. Assessors will be trained in the research methodology, and assessors will use standardised instructions to complete the outcome measures. Guidelines for managing patients during COVID-19 will be adhered to during the trial. See Figure 1 for details of the flow of participants through the proposed study.

Data management

Each participant will be assigned a unique alpha-numerical code, which we will use on anonymised study forms and in the electronic database. Only approved personnel will have access to the study forms. Study-specific source documents will be stored in the secure electronic cloud-based system used by the

Figure 1

Participant Flow Diagram of the Proposed Ballistic Strength Training Feasibility Study



Note. GRoC = Global Rating of Change scale; 6MWT = 6 minute walk test; 10mWT = 10-metre walk test.

rehabilitation centre. These records will be stored according to good clinical practice for 10 years from the last intervention. Anonymised data will be irreversibly stripped of the unique participant code and any other identifiers. Anonymised data will be held securely, password protected, and retained indefinitely by the researcher.

Data analysis

The data will be analysed in consultation with an independent statistician using Microsoft Excel spreadsheets and Windows statistical software. The data will be descriptively analysed, and we will report appropriate means, medians, standard deviations, confidence intervals, frequencies, and proportions. Data will be graphically represented where applicable. If the recruited sample size and collected data allow, paired *t*-tests may be performed to determine changes between pre-test and post-test mobility outcome measures. If inferential tests are performed, a *p* value of 0.05 will be set.

Based on Campbell et al. (2020), we will use a traffic light system to evaluate whether the feasibility study could progress to a full-scale randomised controlled trial. Green indicates implementation is feasible and the study design will require minor or no change. Amber will indicate an element requires major modification before progressing, and red will indicate it is not feasible to progress with this design. Table 1 summarises the progression criteria for each objective.

DISCUSSION

This protocol outlines the procedure we will follow to test the feasibility of BST to improve the mobility of inpatients with moderate-to-severe TBI. Best-practice guidelines recommend testing the feasibility and acceptability of trial procedures before undertaking a definite trial. The feasibility study will reveal any potential issues related to recruitment, safety, and participant acceptance of BST as an intervention. We will also assess the preliminary efficacy of BST for improving mobility. We will investigate self-selected walking speed, walking capacity, and participants' perceived impression of change in walking ability. This study will generate data and experience to guide future trials.

Table 1

Traffic Light Progression Criteria for Each Element of the Proposed Ballistic Strength Training Feasibility Study

Progression criteria	Measurement	Green	Amber	Red
Recruitment capability	Number of participants recruited	15–20	10–15	< 10
	Proportion of eligible participants consented	> 70%	50–69%	< 50%
Attendance	Number of BST sessions attended per participant	> 75%	50–75%	< 50%
Participant safety	AEs: incidence, type, and severity	Minor modifications made to BST to accommodate discomfort	AEs in a large proportion of the sample size	Occurrence of serious AEs
Intervention acceptability	Participants' acceptance: VAS	Most participants (> 50%) find BST acceptable (> 5/10)	Conflicting views on acceptance of BST, or major revisions needed	Most participants (> 50%) find BST unacceptable (< 5/10), or changes required are unfeasible
Clinical feasibility	Participants' ability to complete BST	Most participants can complete BST	Participation possible with minor adjustments	Most participants cannot complete BST
	Skills acquisition: assistance and speed of movement Data collected from participant exercise logs	Most (> 50%) of participants do not require assistance and achieve skills acquisition	< 50% of participants require assistance Conflicting results on skills acquisition	Most (> 50%) participants require assistance, which may be unfeasible. Exercises require unfeasible changes
Indication of effect on mobility outcome measures	Self-selected walking speed (if completed ≥ 75% of BST sessions)	Clinically important change between pre-test and post- test	Minimally clinically important change between pre-test and post-test	No change between pre-test and post-test
	Walking capacity (if completed ≥ 75% of BST sessions)	Clinically important change between pre-test and post- test	Minimally clinically important change between pre-test and post-test	No change between pre-test and post-test
	Participants' perception of change in walking ability: GRoC	Most GRoC scores are between +5 to +7	Most GRoC scores are between +3 to +5	Most GRoC scores are < 3

Note. This table was adapted from Campbell et al. (2020). AE = adverse event; BST = ballistic strength training; GRoC = Global Rating of Change scale; VAS = Visual Analogue Scale.

TRIAL REGISTRATION AND DISSEMINATION

The trial is registered on the Australian New Zealand Clinical Trials Register (ACTRN12621001073897). The results of this study will be shared via publication in a peer-reviewed academic journal. The BST exercise programme and progression principles will accompany the results in a peer-reviewed international journal as a supplementary appendix. All participants will be offered a lay summary of the results.

DISCLOSURES

The authors have no conflicts of interest to declare. HQH Fitness New Zealand has sponsored a Total Gym Jump Trainer for this study. The equipment sponsor will have no role in the study design, data collection, analysis, or interpretation of results. The research project received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

PERMISSIONS

Ethical permission has been obtained from the following Ethics Committees: The Faculty of Health Sciences Research Ethics Committee, University of Pretoria (reference number 399/2021), and the Health and Disability Ethics Committee of New Zealand (reference number 21/CEN/238). The research study will be conducted according to the declaration of Helsinki. Formal Māori consultation was completed for this study. The principles of the Treaty of Waitangi and the guidelines on health research involving Māori participants (Te Ara Tika) will be applied.

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CONTRIBUTIONS OF AUTHORS

IG: Conceptualization, methodology manuscript drafting, manuscript review, and editing. DJM: Supervision, conceptualisation, initial manuscript review, and editing. AvH: Supervision, conceptualisation, initial manuscript review, and editing.

ADDRESS FOR CORRESPONDENCE

Mrs Izel Gilfillan, Department of Physiotherapy, School of Healthcare Sciences, Faculty of Health Sciences, University of Pretoria, Pretoria, 0031, South Africa. Email: u10128523@tuks.co.za

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