

NEW ZEALAND JOURNAL OF PHYSIOTHERAPY

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- Advanced physiotherapy impacts: Narrative literature review
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Is it time to make regular cardiopulmonary resuscitation training mandatory for all New Zealand registered physiotherapists?

CARDIOPULMONARY RESUSCITATION (CPR) SAVES LIVES

Cardiopulmonary resuscitation (CPR) is the technique of chest compressions combined with rescue breathing that has been clearly shown to save lives (Australian and New Zealand Committee on Resuscitation, 2016b). Health professionals play a vital role in ensuring the performance of all links of the cardiac arrest *Chain of Survival* (Figure 1) occur in a timely and proficient manner (Nolan, Soar, & Eikeland, 2006). A recent survey of New Zealand registered physiotherapists identified that 20% of participants had used CPR in an emergency (Harvey, O'Brien, Moran, & Webber, 2019). With the knowledge that our population is ageing and that patients are often presenting with more concurrent complex health conditions, this figure could increase in the future. While many physiotherapists hold CPR certification due to employment or contractual requirements, currently CPR certification is not mandatory for all physiotherapists practising in New Zealand (Physiotherapy Board of New Zealand, 2018). In their survey, Harvey et al. (2019) found over three-quarters of physiotherapists who responded to the survey believed CPR training should be mandatory. These factors led us to raise the question: *Is it time to make regular cardiopulmonary resuscitation training mandatory for all New Zealand registered physiotherapists?*



Figure 1: The cardiac arrest Chain of Survival

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PATIENT SAFETY

The New Zealand Physiotherapy Standards Framework states that all physiotherapists must incorporate safety and risk management strategies within physiotherapy practice to ensure the safety of patients and staff (Physiotherapy Board of New Zealand, 2018). However, the only area of physiotherapy practice that specifically requires CPR certification is in the sports environment where individuals receive sports physiotherapy services. The framework states that *“sports physiotherapists must hold up-to-date competencies in basic life support and management of acute trauma situations”* (Physiotherapy Board of New Zealand, 2018, p. 80). Surprisingly, the recent survey of New Zealand physiotherapists found that clinicians working in private practice, public hospitals and community settings were more likely to have CPR certification compared to those working with sports teams (Harvey et al., 2019).

Harvey et al. (2019) reported that about half (56%) of respondents had completed formal CPR training in the 12 months before participating in the survey. Conversely, the New Zealand Resuscitation Council recommends repeated refresher training for individuals who are not performing resuscitation regularly – stating that individuals should refresh their CPR skills annually (Australian and New Zealand Resuscitation Committee on Resuscitation, 2013). In contrast to registered physiotherapists, final year physiotherapy students at both Auckland University of Technology and the University of Otago must gain CPR certification to take part in clinical placements. Having regular CPR training would ensure all New Zealand physiotherapists are prepared to respond in an emergency in a safe, competent, and accountable manner.

A DUTY OF CARE

Of the 688 New Zealand physiotherapists recently surveyed, 97% agreed with the following statement: *“At work, it is my duty to intervene and perform CPR in an emergency”* (Harvey et al., 2019, p. 98). A duty of care is a legal obligation to provide a reasonable standard of professional care to patients, and to act in a way to protect and maintain their safety. Once a health professional has accepted a patient into his or her care, that health professional has a duty of care to that person (Johnson & O'Brien, 2010). The New Zealand Physiotherapy Standards Framework (Physiotherapy Board of New Zealand, 2018) does not explicitly address the duty of care of physiotherapists in an emergency.

The Physiotherapy Board of Australia Code of Conduct (2014) states that when Australian registered physiotherapists are treating patients in an emergency:

Good practise involves offering assistance in an emergency that takes account of the practitioner's own safety, skills, the availability of other options and the impact on any other patients or clients under the practitioner's care, and continuing to provide that assistance until services are no longer required. (p. 9)

Within the New Zealand Physiotherapy Standards Framework (Physiotherapy Board of New Zealand, 2018) are the New Zealand and Australia physiotherapy practice thresholds which *“describe the threshold competence required for initial and continuing registration as a physiotherapist in both Australia and Aotearoa New Zealand”* (p. 93). There is an opportunity to align the duty of care of New Zealand physiotherapists with Australian physiotherapists when responding to a patient in an emergency.

CPR IS ONLY PART OF THE PICTURE: WHERE IS THE NEAREST DEFIBRILLATOR?

Access to an automated external defibrillator (AED) dramatically increases the chances of survival during a cardiac event. Following early CPR as in the *Chain of Survival*, the time to defibrillation is a crucial factor that influences survival. For every

minute defibrillation is delayed, there is approximately a 10% reduction in survival if the victim is in cardiac arrest due to ventricular fibrillation (Australian and New Zealand Resuscitation Committee, 2016a). Hence, it is crucial to know the location of the nearest accessible AED and how to use it correctly. Harvey et al. (2019) found physiotherapists older than 39 years of age were more likely to be incorrect to specific AED knowledge questions than younger physiotherapists. Modern technology has made locating AEDs easier with mobile phone applications that can put this information in the palm of your hand. Two such phone applications in New Zealand are AED Locations (<https://www.aedlocations.co.nz>) and GoodSAM (<https://www.stjohn.org.nz/First-Aid/goodsam/>). If regular trainings and a response plan is in place, AEDs can be effective in public settings and places of work where witnessed cardiac arrest can occur (Australian and New Zealand Resuscitation Committee, 2016b).

CONCLUSION

New Zealand registered physiotherapists are exposed to situations that require CPR at rates much higher than the general population. Furthermore, it is our opinion that physiotherapists have a duty of care to their patients to be competent in CPR to ensure patient safety. We believe that registered physiotherapists should offer themselves to assist in an emergency to the level of their training. We would therefore value the Physiotherapy Board of New Zealand entering into a discussion with the profession to review the current CPR training requirements for New Zealand registered physiotherapists.

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Physiotherapy treatment and rehabilitation following anterior cruciate ligament injury in New Zealand: Are we doing enough?

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ABSTRACT

Physiotherapists are lead providers of rehabilitation following anterior cruciate ligament injury in New Zealand. Rehabilitation is considered an essential component following anterior cruciate ligament injuries, but there is considerable variability regarding pre- and post-operative management. This study used data from the Accident Compensation Corporation (ACC) for the years 2013/14 to 2015/16 to gain insight into the physiotherapy management of anterior cruciate ligament injuries in New Zealand. Data were extracted from 647 claims from people with a completed anterior cruciate ligament reconstruction and 221 claims from people with a confirmed injury who did not undergo surgery. In the 12 months following either anterior cruciate ligament injury or surgery, 81% of claimants had fewer than 15 ACC-funded physiotherapy treatments, and 13% of claimants had no ACC-funded physiotherapy treatments. Nine percent of claimants had a previous or subsequent claim for an anterior cruciate ligament injury. Compared to best practice literature, the results indicate a significant number of people in New Zealand received fewer than the recommended number of physiotherapy treatments following anterior cruciate ligament injury. Possible reasons may include the cost of private physiotherapy services, a lack of endorsement from the respective orthopaedic surgeons, decreased patient adherence/motivation and decreased patient understanding of the importance of rehabilitation.

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Key Words: Anterior Cruciate Ligament, Physiotherapy, Treatment, Rehabilitation

INTRODUCTION

Injury to the anterior cruciate ligament (ACL) of the knee is a common occurrence in an active population (Gianotti, Marshall, Hume, & Bunt, 2009; Majewski, Susanne, & Klaus, 2006). Following ACL injury, the two traditional management pathways are: 1) early ACL reconstruction (ACLR) surgery followed by rehabilitation; and 2) conservative management consisting of rehabilitation, with the option of delayed ACLR if required (Beynon, Johnson, Abate, Fleming, & Nichols, 2005; Risberg, Lewek, & Snyder-Mackler, 2004; Zadro & Pappas, 2018). The exact incidence of ACL injury is not known as not all ACL injuries are diagnosed or proceed to surgery (Janssen, Orchard, Driscoll, & Van Mechelen, 2012). ACL surgical rates are often used as surrogate estimates of injury rates (Moses, Orchard, & Orchard, 2012; Sanders, Maradit Kremers, Bryan, Larson, et al., 2016), with rates of ACLR increasing worldwide (Abram, Price, Judge, & Beard, 2019; Sanders, Maradit Kremers, Bryan, Larson, et al., 2016; Zbrojkiewicz, Vertullo, & Grayson, 2018). An increasing ACLR rate is associated with increased work absenteeism,

rehabilitation costs and an increased rate of degenerative knee conditions and knee joint arthroplasty (Barenis et al., 2014; Cinque, Dornan, Chahla, Moatshe, & LaPrade, 2017; Janssen et al., 2012; Khan et al., 2018; Suter et al., 2017).

The Accident Compensation Corporation (ACC) of New Zealand provides 24-hour comprehensive no-fault accident insurance to compensate the injured person and assist them in returning to independence by covering medical costs, other entitlements and ensuring timely access to treatment (Flood, 2000). Annually, ACC spends over \$25 million on ACL surgeries and over \$100 million on physiotherapy services for all injuries (ACC, 2018a). Entitlements and the cost of physiotherapy treatment will vary depending on the injured person's work status or capacity and the contracts held by the treating physiotherapist. ACC purchases physiotherapy treatment in three ways: either via the cost of treatment regulations or the physiotherapy services contract (ACC, 2018b) or vocational rehabilitation services (VRS). The ACC contribution may not fully cover the cost of treatment and some private physiotherapy practices charge a co-payment

of up to \$50 per treatment (Fitzjohn, 2007). Claimants who are unable to complete work duties and receive earnings-related compensation (ERC) are entitled to VRS, which support and facilitate a return to work (ACC, 2015), are fully funded and may include physiotherapist-led functional rehabilitation (ACC, 2018c).

Rehabilitation following ACL injury or ACLR should encompass a biopsychosocial approach (Scott, Perry, & Sole, 2018), which addresses patient education, physical rehabilitation and psychological barriers (Filbay & Grindem, 2019; Risberg, Grindem, & Oiestad, 2016; Zadro & Pappas, 2018). The physical component of rehabilitation involves restoration of knee range of movement, lower limb strengthening, neuromuscular and proprioceptive retraining, and activity specific exercises (Adams, Logerstedt, Hunter-Giordano, Axe, & Snyder-Mackler, 2012; Myer, Paterno, Ford, Quatman, & Hewett, 2006). Physical rehabilitation following ACL injury is safe and efficacious (Eitzen, Moksnes, Snyder-Mackler, & Risberg, 2010), with the ultimate goal of rehabilitation to achieve a sustainable return to pre-injury activities (Risberg et al., 2004). Physiotherapists with expertise in the function of the musculoskeletal system have the knowledge and skills to implement and progress the physical and functional components of ACL rehabilitation (van Melick et al., 2016).

A structured pre-operative physical rehabilitation programme produces better post-operative functional outcomes (Eitzen, Risberg, & Holm, 2009; Failla et al., 2016; Logerstedt, Lynch, Axe, & Snyder-Mackler, 2013). Supervised physiotherapy is routinely prescribed following ACL surgery (Han, Banerjee, Shen, & Krishna, 2015), and supervised rehabilitation can be associated with better outcomes than unsupervised (Christensen, Miller, Burns, & West, 2017). Physical rehabilitation lasting up to 12 months is recommended after ACLR to restore function and stability to the knee (Adams et al., 2012; Zadro & Pappas, 2018), and to optimise post-surgical outcomes (Grindem, Granan, et al., 2015). Recent evidence suggests people may not be completing sufficient post-ACLR rehabilitation before returning to pre-injury activities (Ebert, Edwards, et al., 2018; Grindem, Arundale, & Ardern, 2018). Irrespective of how an ACL injury is managed, a significant percentage of people do not return to pre-injury activity levels (Ardern, Taylor, Feller, & Webster, 2014; Øiestad, Holm, & Risberg, 2018; Webster & Feller, 2018), or they suffer a subsequent ACL injury (Crawford, Waterman, & Lubowitz, 2013; Lai, Ardern, Feller, & Webster, 2017; Wright, Magnussen, Dunn, & Spindler, 2011).

The content and quality of ACL rehabilitation protocols is highly variable (Ajuied et al., 2014), which may lead to confusion among patients and physiotherapists (Makhni et al., 2016). Patient outcomes following ACL rehabilitation could also be influenced by patient individuality and variability in the implementation of specific ACL rehabilitation protocols by physiotherapists (Adams et al., 2012; Greenberg, Greenberg, Albaugh, Storey, & Ganley, 2018; Myer et al., 2006).

The aim of this study was to undertake a retrospective review of a three-year period of ACC claim data to gain insight into the

management of ACL injury in New Zealand, with a particular focus on the quantity and duration of physiotherapy treatment following injury, and during the pre- and post-operative rehabilitation periods.

METHODS

Ethical approval was sought retrospectively. However, as advised by the Auckland University of Technology Ethics Committee, this study did not meet the threshold to require ethical approval as all data remained de-identified during collection and analysis. Use of ACC claim data complied with standard ACC consent and legal obligations related to ACC cover.

A descriptive methodology was undertaken for the study. The study cohort included all claims with an approved ACLR request for the years 2013/14, 2014/15 and 2015/16 (the year being 1 July to 31 June). Claims with an approved ACLR request were assumed to have a confirmed diagnosis of an ACL rupture. ACC claim numbers were used to identify claims. Claims were categorised as either surgical for those who had undergone surgery (Surgery Group) or non-surgical (Non-Surgery Group), and were stratified by gender and age at the date of injury (DOI) (<20, 20-29, 30-39, 40-49, 50+ years of age). Using a random number generator in Microsoft Excel, a sample of 20 claims was selected from each year according to age and gender. Where there were fewer than 20 claims for an age and gender group for that year, all claims were included in the sample. Convenience sampling was used to ensure the total sample included a similar number of males and females, and that all age ranges were equally represented. In addition, all claims where individuals had undergone ACL surgery more than 365 days after DOI were categorised as "delayed surgery" (Delayed Surgery Group), and data from this group were analysed separately.

For the Surgery Group and Non-Surgery Group, data collected via ACC's internal database and payments system included:

- mechanism of injury
- activity being performed when ACL injury occurred
- date of last physiotherapy treatment
- total earnings-related compensation (ERC) days paid under that claim
- whether there was an approved purchase order for vocational rehabilitation in the 12 months following surgery or injury
- whether the client had suffered a previous or subsequent ACL injury.

Additional data collected for the Surgery Group included the date of surgery, number of pre-ACLR physiotherapy treatments and number of post-ACLR physiotherapy treatments within 12 months of surgery. Additional data collected for the Non-Surgery Group included the total number of physiotherapy treatments within 12 months of injury. The 12-month period was chosen as this is the recommended duration of rehabilitation following ACL injury (van Melick et al., 2016).

RESULTS

The selection of claims for analysis is described in Figure 1. From the Surgery Group, two claims were excluded as the clients had not undergone ACLR, and one claim was excluded as the ACL was found intact at the time of surgery. From the Non-Surgery Group, six claims were excluded as the ACL was subsequently

revealed to be intact, and seven claims were excluded as the clients had undergone ACLR within 12 months of injury. Overall, the Surgery Group, Delayed Surgery Group, and Non-Surgery Group represented 8%, 2.5%, and 3.5% respectively of the total population.

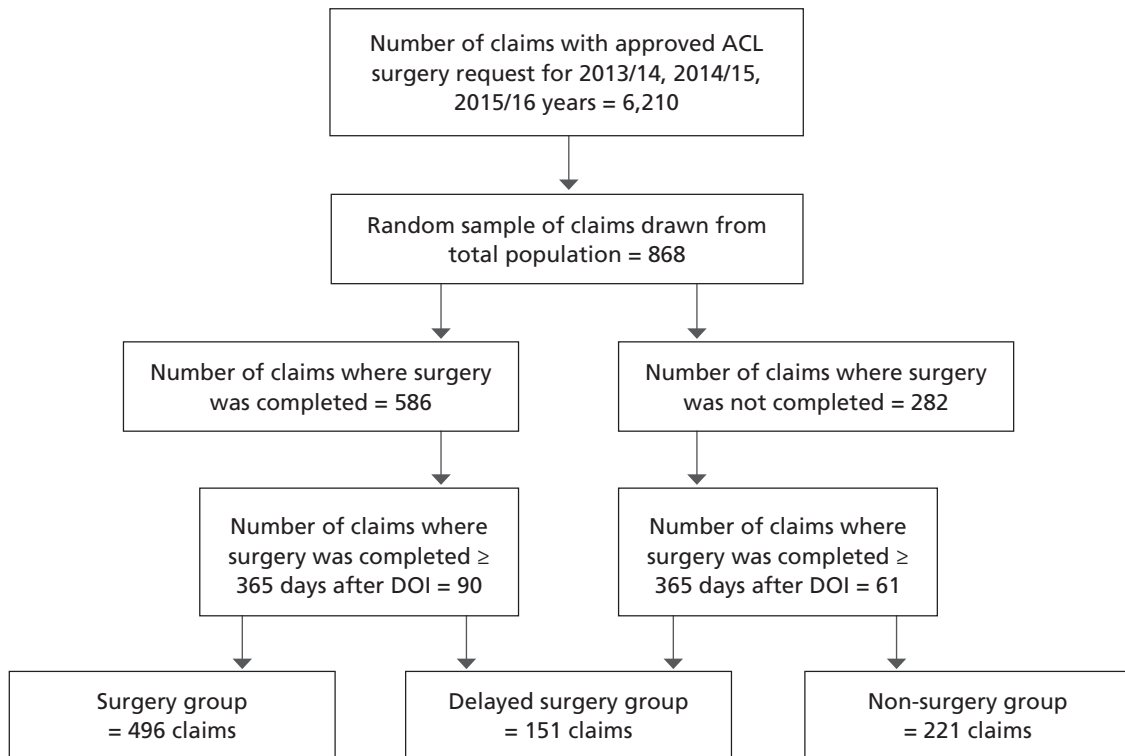


Figure 1: Flow diagram describing sample selection and how each study group was determined

Note: ACL, anterior cruciate ligament; DOI, date of injury

Across the three groups, average age at DOI was 33.4 ± 13.2 years (range 9-74 years). The percentage of male subjects was 48%, 62% and 58% respectively. The most common activity being performed when suffering an ACL injury was sports followed by recreational activities (Figure 2). Netball was the most common sport being played when suffering an ACL injury, followed by rugby, soccer and touch rugby (Figure 3). Notably, 74% (642/868) of ACL injuries involved a non-contact mechanism of injury.

Duration and quantity of physiotherapy treatment

For the Surgery Group ($n = 496$), 120 claims (24.2%) had no pre-ACLR physiotherapy treatments. Of the 376 claims (75.8%) with pre-ACLR physiotherapy treatments, the number of treatments averaged 7 ± 5 (range 1-33) (Figure 4). In the 12 months following ACLR, 456 claims (91.9%) had post-ACLR physiotherapy treatment, with the average number of treatments being 12 ± 8 (range 1-54) (Figure 5). The average time between surgery and the last physiotherapy treatment was 161 ± 143 days.

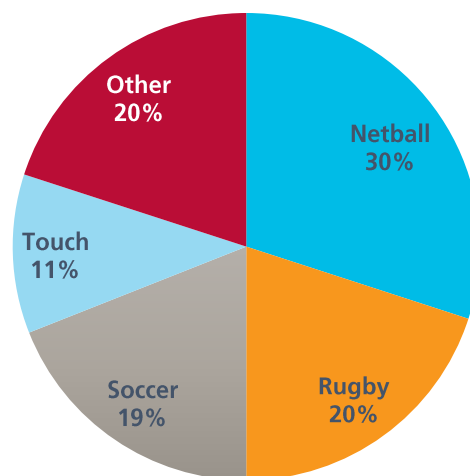


Figure 2: Activity being performed when anterior cruciate ligament injury occurred

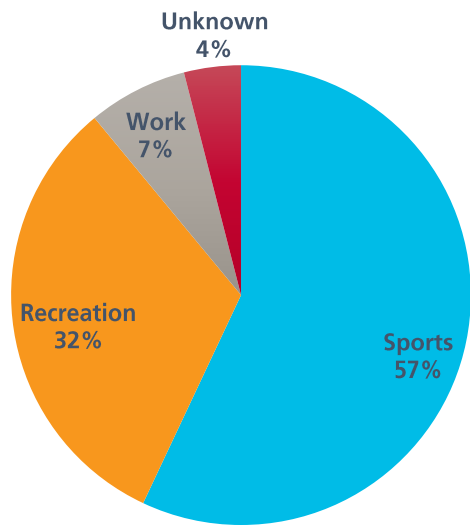


Figure 3: Sport being played when anterior cruciate ligament injury occurred

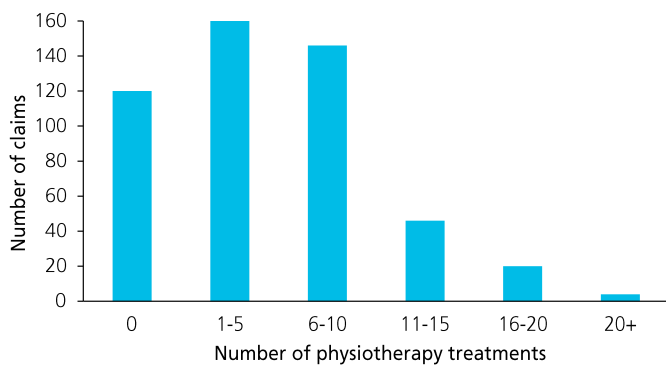


Figure 4: Number of physiotherapy treatments for the Surgery Group prior to anterior cruciate ligament surgery

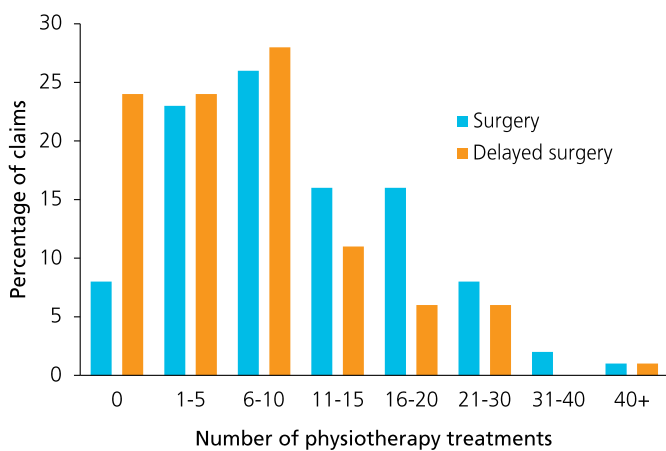


Figure 5: Number of physiotherapy treatments per claim for the Surgery Group and Delayed Surgery Group in the 12 months following anterior cruciate ligament surgery

For the Delayed Surgery Group (n = 151), 109 claims (72.1%) had physiotherapy treatment in the 12 months following DOI, with an average of 8 ± 8 (range 1-49) treatments (Figure 6). In the 12 months following ACLR, 115 claims (76.1%) had physiotherapy treatment, with the average number of treatments being 10 ± 9 (range 1-59) (Figure 5). The average time between surgery and the last physiotherapy treatment was 143 ± 95 days.

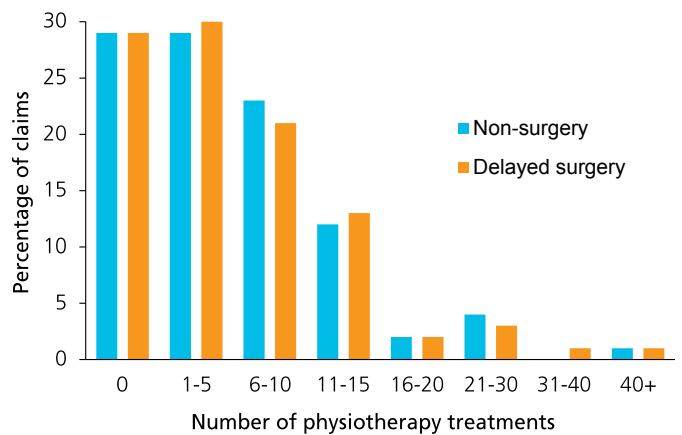


Figure 6: Number of physiotherapy treatments per claim for the Non-Surgery Group and Delayed Surgery Group in the 12 months following anterior cruciate ligament injury

For the Non-Surgery Group (n = 221), 157 claims (71.0%) had physiotherapy treatment in the 12 months following DOI, with an average of 8 ± 6 (range 1-42) treatments (Figure 6). The average time between DOI and the last physiotherapy treatment was 90 ± 84 days.

Earnings related compensation and vocational rehabilitation

For the Surgery Group, 80 claims (16.1%) had ERC paid in the two weeks prior to ACLR. Following surgery, 247 claims (49.8%) had ERC paid for an average of 102 ± 93 days (range 3-809). In the 12 months after ACLR, 129 claims (26.0%) had approved VRS, with an average duration of 149 ± 100 days (range 3-809) of ERC paid. For claims with approved VRS, the average number of physiotherapy treatments in the 12 months following ACLR was 11 ± 8 (range 1-54). Of the 40 claims (8.0%) with no post-ACLR physiotherapy treatments, nine had approved VRS, and the average number of ERC days paid on those claims was 181 ± 63 .

For the Delayed Surgery Group, nine claims (6%) had ERC paid in the two weeks prior to ACLR. Following surgery, 63 claims (41.7%) received ERC for an average of 93 ± 104 days (range 11-611). In the 12 months after ACLR, 35 claims (23.1%) had approved VRS, with an average duration of 118 ± 122 days (range 27-611) ERC paid. For claims with approved VRS, the average number of physiotherapy treatments in the 12 months following ACLR was 11 ± 7 (range 2-29). Of the 36 claims (23.8%) with no post-ACLR physiotherapy treatments, three had approved VRS, with an average number of ERC days paid of 84.

For the Non-Surgery Group, in the 12 months following injury, nine claims (4.0%) had approved VRS, with an average of 147 ± 98 days (range 44-317) of ERC paid. For claims with approved VRS, the average number of physiotherapy treatments in the 12 months following DOI was 9 ± 7 (range 2-23). Of the 64 claims (28.9%) with no physiotherapy treatments in the 12 months following DOI, two had approved VRS, with an average of 173 days paid ERC.

Time to surgery

For the Surgery Group, the average number of days between DOI and ACLR was 121 ± 74 (range 22-361), with 228 people (45.9%) undergoing ACLR within 90 days of injury and 397 people (80.0%) undergoing ACLR within 180 days of injury (Figure 7). For the Delayed Surgery Group, the time between DOI and ACLR was on average 908 ± 565 days (range 369-2939).

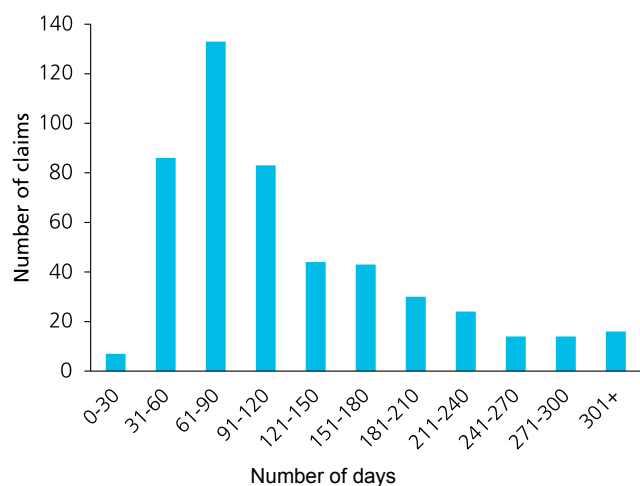


Figure 7: Number of days between anterior cruciate ligament injury and surgery for the Surgery Group

Subsequent ACL injury

For all groups ($n = 868$), 95 people (10.9%) had suffered multiple ACL injuries. Across the Surgery Group and Delayed Surgery Group ($n = 647$), 50 people (7.7%) suffered a subsequent ACL injury following ACLR, i.e. 33 (5.1%) ACL graft ruptures and 17 (2.6%) contralateral ACL injuries. The average duration between ACLR and subsequent ACL injury was 617 ± 371 days and $1,210 \pm 855$ days for the Surgery Group and Delayed Surgery Group, respectively. For both groups, 28 people (4.3%) had suffered a previous contralateral ACL injury and three had sustained a previous ipsilateral ACL injury.

For the Non-Surgery Group, one individual suffered a contralateral ACL injury 392 days after the initial ACL injury; 11 had suffered a previous contralateral ACL injury, eight of whom had undergone ACLR, with two sustaining subsequent ACL graft ruptures.

DISCUSSION

The aim of this study was to present a retrospective descriptive analysis of ACC claim data to gain insights into the duration and quantity of physiotherapy treatment following ACL

injury in New Zealand. Our findings show that sporting and recreational activities accounted for the majority of ACL injuries, with popular change-of-direction activities in New Zealand (e.g. netball, rugby, soccer and touch rugby) responsible for the greatest number of sporting ACL injuries, which is similar to previous findings (Gianotti et al., 2009; New Zealand ACL Registry, 2018). Nearly three-quarters of all ACL injuries in the current study involved a non-contact mechanism of injury, which is consistent with previous reports of 72% prevalence (Boden, Dean, Feagin, & Garrett, 2000).

Duration and quantity of physiotherapy treatment

Our results suggest New Zealanders are not receiving physiotherapy treatment for an appropriate duration following ACL injury or surgery. Post-ACLR rehabilitation lasting up to 12 months is associated with improved knee flexor/extensor strength (Ageberg, Thomeé, Neeter, Silbernagel, & Roos, 2008; Heijne & Werner, 2007; Risberg & Holm, 2009), greater performance during functional testing (Ebert, Edwards, et al., 2018), a greater rate of returning to pre-injury activities (Arderm et al., 2014; Della Villa et al., 2012; Edwards et al., 2018; Han et al., 2015; Rosso et al., 2018) and decreased re-injury risk (Grindem, Snyder-Mackler, Moksnes, Engebretsen, & Risberg, 2016). Traditional progressions through ACL rehabilitation have been time based, which may result in sub-optimal outcomes, as time after ACLR is not necessarily related to functional performance (Myer et al., 2012). Although post-surgical rehabilitation is recommended for nine to 12 months (van Melick et al., 2016), criterion-based measures of functional performance, incorporated within a biopsychosocial framework, are also recommended to determine rehabilitation progress (Dingenen & Gokeler, 2017; Larsen, Farup, Lind, & Dalgas, 2015; Myer et al., 2006).

Our results have highlighted a potential under-utilisation of physiotherapy treatment following ACL injury and surgery, and prior to ACLR in New Zealand. Physiotherapists consider pre-operative rehabilitation to have an important influence on post-operative outcomes (Ebert, Webster, Edwards, Joss, D'Alessandro, et al., 2018). A structured physiotherapy-led pre-ACLR rehabilitation programme of up to 27 sessions has been shown to be effective and safe, and to improve outcomes two years after ACLR (Alshewaiher, Yeowell, & Fatoye, 2017; Eitzen et al., 2010; Eitzen et al., 2009; Failla et al., 2016; Logerstedt et al., 2013). Our research found that 24% of people did not receive physiotherapy treatment prior to ACLR, which suggests the post-operative outcomes for almost a quarter of people in our sample may have been sub-optimal.

While many factors potentially influence outcomes after ACL injury and surgery, rehabilitation remains an important variable (Ebert, Webster, Edwards, Joss, D'Allesandro, et al., 2018) and is almost universally recommended (Adams et al., 2012; Ebert, Webster, Edwards, Joss, D'Alessandro, et al., 2018; Lobb, Tumilty, & Claydon, 2012; van Melick et al., 2016). Over 80% of Australian physiotherapists believe six to 12 treatments are required in the first six weeks after ACL surgery (Ebert, Webster, Edwards, Joss, D'Alessandro, et al., 2018), with a physiotherapist review recommended every two weeks (Filbay & Grindem, 2019). Therefore, rehabilitation lasting from nine to

12 months would equate to between 21 and 35 physiotherapy visits within 12 months following ACL surgery. It appears people in the current study received considerably less physiotherapy treatment than evidence-based guidelines suggest; the reasons for this require further evaluation.

There are multiple barriers to people engaging in a healthcare service, which includes physiotherapy following ACL injury/surgery (Carrillo et al., 2011). Patient-specific barriers include health literacy/understanding of the condition, cultural beliefs and socio-economic status; provider-specific barriers include clinician skills/knowledge and patient interactions; healthcare system barriers include cost, accessibility/waiting times, location of services and the involvement of multiple providers (Bath et al., 2016; Douthit, Kiv, Dwolatzky, & Biswas, 2015; Scheppers, Van Dongen, Dekker, Geertzen, & Dekker, 2006). In New Zealand, barriers to engaging with primary healthcare services include location, cost, suitability and awareness of services (Ministry of Health, 2001). Strategies to overcome these barriers include encouraging early, appropriate intervention within a patient's locale, ensuring cost-effective services within an accountable healthcare system and empowering people by improving health literacy through quality education (Ministry of Health, 2016).

The cost of private physiotherapy services may influence physiotherapy utilisation (Ebert, Webster, Edwards, Joss, D'Alessandro, et al., 2018). ACL rehabilitation in New Zealand is commonly supplied by private physiotherapy providers, who may charge a co-payment of up to \$50 per treatment. Although physiotherapy is available via the public health system at no cost, the vast majority of people seek physiotherapy from private providers (ACC, 2018a), who make up almost 70% of New Zealand's physiotherapy workforce (Physiotherapy New Zealand, 2018). Although there are a small number of private physiotherapists in New Zealand who do not charge a co-payment, unless the person is receiving VRS from ACC, it is likely they will have to contribute to the cost of physiotherapy treatment or rehabilitation services. As such, socio-economic status could be a barrier to utilisation of physiotherapy services.

A lack of endorsement of rehabilitation by orthopaedic surgeons may have influenced physiotherapy treatment numbers in this study. Almost 40% of orthopaedic surgeons in Australia do not consider pre-ACLR rehabilitation necessary, and a small percentage even consider post-ACLR rehabilitation unnecessary (Ebert, Webster, Edwards, Joss, D'Allesandro, et al., 2018). While the surgeon is responsible for the surgery, the physiotherapist should lead the decision-making in rehabilitation (van Melick et al., 2016). Good communication between the surgeon and physiotherapist is essential following ACL injury (Grindem et al., 2018) to overcome any potential disconnect between providers (von Aesch, Perry, & Sole, 2016).

ACL rehabilitation is described by some patients as time consuming and boring, and perceived as being unable to provide sufficient results within a reasonable timeframe (Thorstenson, Lohmander, Frobell, Roos, & Gooberman-Hill, 2009); this is likely to contribute to decreased compliance with rehabilitation exercises following ACLR (Risberg et al., 2016). Poor adherence to treatment recommendations may influence physiotherapy utilisation and have a significant impact on

clinical outcomes (Pizzari, McBurney, Taylor, & Feller, 2002; Vermeire, Hearnshaw, Van Royen, & Denekens, 2001). Early physiotherapeutic intervention after ACL injury, including education about the importance of rehabilitation, could positively influence the patient experience and may increase adherence to rehabilitation (Grindem, Risberg, & Eitzen, 2015; Risberg et al., 2016; Scott et al., 2018). Increased adherence to rehabilitation is positively associated with functional ability following ACLR (Brewer et al., 2000; Pizzari, Taylor, McBurney, & Feller, 2005; Rosso et al., 2018).

Patients may not be adequately informed about the rehabilitation requirements after ACL surgery (Cailliez et al., 2012). Limited understanding of the importance of rehabilitation can negatively influence patient motivation (Grindem, Risberg, et al., 2015) and patients may have high expectations regarding functional outcomes after primary ACLR (Webster & Feller, 2019). Although patient expectations align closely with the surgeons (Khair, Ghomrawi, Wilson, & Marx, 2018), the reality is these expectations are frequently not met (Ardern et al., 2014). A lack of patient education regarding the rehabilitation requirements may contribute to unrealistic patient expectations concerning the outcomes of ACLR (Feucht et al., 2016; Heijne, Axelsson, Werner, & Biguet, 2008). Therefore, an effective clinician-patient relationship incorporating education on the requirements and importance of rehabilitation may improve patient motivation and adherence, increasing physiotherapy utilisation and the likelihood of an optimal outcome (Scott et al., 2018).

Although the number of ACC-funded physiotherapy treatments under a claim may provide an indication of the amount of rehabilitation the individual received, it cannot be assumed this accurately reflects their total rehabilitation. Other potential sources of rehabilitation include orthopaedic surgeons or other allied health professionals (Ebert, Webster, Edwards, Joss, D'Alessandro, et al., 2018), ACC-funded rehabilitation under VRS, non-clinically led rehabilitation (e.g. fitness trainer or gym instructor), privately funded physiotherapy or self-directed rehabilitation. Our results showed that for claims with approved VRS in the 12 months following ACL injury or surgery, the average number of physiotherapy treatments was very similar to claims without approved VRS, which indicates VRS had a negligible impact on the number of physiotherapy treatments per claim.

There is no clear evidence that supervised rehabilitation after ACLR will result in superior outcomes compared to minimally supervised rehabilitation (Anderson, Browning, Urband, Kluczynski, & Bisson, 2016; Lobb et al., 2012), which may have contributed to low physiotherapy treatment numbers in the current study. Selected groups of patients, including young, athletic people, may achieve acceptable outcomes after ACLR with a minimally supervised rehabilitation programme involving fewer than 10 physiotherapy treatments over three to 12 months (Feller, Webster, Taylor, Payne, & Pizzari, 2004; Grant & Mohtadi, 2010; Hohmann, Tetsworth, & Bryant, 2011).

Our results showed that over 70% of New Zealanders engaged in physiotherapy treatment after ACL injury, and over 90% engaged in physiotherapy after ACLR. Ebert, Edwards et al.

(2018) reported that 91% of people engaged in supervised rehabilitation/physiotherapy after ACLR, but 45% of people reported that rehabilitation following surgery lasted three months or less. Therefore, while the majority of people initially receive physiotherapy treatment following ACL injury or surgery, our results suggest people do not remain engaged in rehabilitation for an appropriate duration.

Although our results suggest possible underutilisation of physiotherapy-led services in the 12 months following ACL injury, an absence of outcome data means the relationship between utility and outcome is currently unknown. The New Zealand ACL Registry records outcome data for people undergoing ACLR (New Zealand ACL Registry, 2018), but as details regarding the type, amount or duration of rehabilitation received prior to or following surgery are unknown, it is not possible to correlate these outcomes with rehabilitation parameters. Although outcomes following ACLR may appear to be influenced by post-operative rehabilitation (Ebert, Edwards, et al., 2018; Edwards et al., 2018), these data were collected retrospectively, with participants subjectively grading the amount, type and duration of rehabilitation they received. As details of the post-ACLR rehabilitation were not quantified prospectively, it is possible they do not accurately reflect the rehabilitation received.

Time to surgery

Almost half of the Surgery Group proceeded to ACLR within 90 days of injury, and 80% within 180 days of injury. There is no accepted definition for early or delayed ACLR (Beynon et al., 2005), with "early" defined as between two days and seven months of DOI, and "delayed" as between three weeks and 24 years (Anderson et al., 2016). There are equivocal differences in outcomes between patients undergoing early versus delayed ACLR (Anderson et al., 2016; Eriksson, von Essen, Jönhagen, & Barenius, 2018; Lee, Lee, Lee, & Hui, 2018; Smith, Postle, Penny, McNamara, & Mann, 2014; Wittenberg, Oxford, & Plafki, 1998), although early surgical intervention may reduce the risk of subsequent meniscal or chondral injury, both of which are associated with worse outcomes following ACLR (Cinque et al., 2018; Cox et al., 2014).

Early ACLR is common practice both domestically (New Zealand ACL Registry, 2018) and internationally (Delay, Smolinski, Wind, & Bowman, 2001; Sanders, Maradit Kremers, Bryan, Kremers, et al., 2016). However, it can take at least six months following ACL injury for the true functional disability to be defined (Noyes, Matthews, Moor, & Grood, 1983). A significant number of patients who may initially appear unable to cope with an ACL injury are able to cope following six months of rehabilitation (Moksnes, Snyder-Mackler, & Risberg, 2008). The time interval from ACL injury to ACLR may be less important as the condition of the knee at the time of surgery (Lattermann et al., 2018). Better pre-operative knee function is associated with fewer post-surgical complications and greater post-operative knee function (Beynon et al., 2005; Filbay et al., 2017; Risberg et al., 2016). Therefore, treatment following ACL injury should involve physical rehabilitation to optimise functional ability before any decisions regarding surgical intervention are made (Eitzen et al., 2010; Thoma et al., 2019).

Subsequent ACL injury

Across all three groups, 11% of people had suffered multiple ACL injuries, which is slightly less than the overall rate for all ages (Wiggins et al., 2016). Younger people have a significantly higher rate of subsequent ACL injury after ACLR (Webster & Feller, 2016). Five percent of all people had suffered a previous ACL injury, and 2% went on to suffer a subsequent contralateral ACL injury. Following ACLR, graft rupture occurred in 5% of people, which is consistent with previously reported graft rupture rates (Crawford et al., 2013; Lai et al., 2017; van Yperen, Reijman, van Es, Bierma-Zeinstra, & Meuffels, 2018; Wright et al., 2011).

Limitations

No outcomes measures were collected for any clients – as this was not the purpose of the study – which limits the conclusions regarding the adequacy of the physiotherapy treatment received. No attempt was made to make comparisons between the groups or to make associations between variables, as without outcome data, these analyses would not offer any additional insights.

CONCLUSION

ACL injuries are a common injury in New Zealand, with ACC the primary funder of treatment for the condition. Rehabilitation following ACL injury can influence short- and long-term outcomes. Our results indicate the number of ACC-funded physiotherapy sessions and duration over time following ACL injury is highly variable. Possible reasons for this variability include financial barriers, a lack of patient understanding, a lack of endorsement of rehabilitation by the surgeon and the structure of the New Zealand healthcare system. No clinical or functional outcome data were collected in the current study, which limits the conclusions that could be drawn. However, when compared with previous research, our results indicate New Zealanders may not be accessing sufficient physiotherapy treatment following ACL injury. Future research should utilise validated measures to clarify outcomes from ACL injury in New Zealand. The use of such measures will allow for investigation into associations between patient outcomes and multiple variables along the ACL injury management pathway.

KEY POINTS

1. The number of physiotherapy treatments after ACL injury in New Zealand is highly variable and does not appear to meet best practice guidelines.
2. The effectiveness of physiotherapy treatment for ACL injury in New Zealand is unclear as patient outcomes from ACL injury in New Zealand have not been quantified.
3. Clearly defined patient reported outcome data will allow the effectiveness of physiotherapy and rehabilitation interventions to be determined.

DISCLOSURES

No funding was obtained for this study. Although ACC provided the 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.

Wayne Fausett and Fraser Wilkins are employees of ACC, but this research was not undertaken in their capacity as ACC employees. Wayne Fausett is a doctoral student at the Auckland University of Technology, and this research was completed as part of his coursework. All other authors report no conflicts of interest.

PERMISSIONS

Ethical approval was sought retrospectively. However, as advised by the Auckland University of Technology Ethics Committee, this study did not meet the threshold to require ethical approval as all data remained de-identified during collection and analysis.

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Impacts of advanced physiotherapy: A narrative literature review

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ABSTRACT

Changes to healthcare design and delivery involving advanced physiotherapy roles may help health systems to meet challenges imposed by ageing populations, long-term conditions and unsustainable healthcare costs. This narrative literature review examined recent peer-reviewed literature (2010–2017), including primary studies and systematic reviews, that investigated the impact of advanced physiotherapy on healthcare efficacy, efficiency, service design or perceptions (consumers or health professionals) of these advanced roles. Thirty-five studies were included that investigated advanced physiotherapy roles in primary care, emergency department, orthopaedic outpatient and rheumatology clinic contexts. Implementation of these roles was found to reduce waiting times for appointments, reduce length of stay, improve access to care, reduce other clinicians' workload in primary care and emergency departments, streamline orthopaedic surgeons' caseload, and improve patient satisfaction. Some studies observed patient recovery outcomes following advanced practice physiotherapist care, but none compared these to existing models of care. In addition, few studies explored non-musculoskeletal physiotherapy fields or the New Zealand context, and no studies investigated the impact on consumer choice. More clearly defined and consistent use of advanced physiotherapy roles within the literature would enable a better understanding of the potential impact on health care. Overall, evidence suggested that advanced physiotherapy roles may provide benefits to the public and health system when implemented in innovative, interdisciplinary and non-traditional ways.

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Key Words: Delivery of Health Care, Health Workforce, Physical Therapy Specialty, Professional Role

INTRODUCTION

Ageing populations, increasing prevalence of long-term and co-morbid conditions, ongoing health inequity, growing healthcare costs, and workforce demands are driving international change in healthcare design and delivery. New models of service delivery are needed to achieve the best health outcomes for New Zealanders as the current health service is financially unsustainable (Ministry of Health, 2016). Advanced physiotherapy models and roles have been implemented in Australia (de Gruchy, Granger, & Gorelik, 2015), Canada (Bath, Grona, & Janzen, 2012) and the United Kingdom (Burn & Beeson, 2014) to meet these challenges, demonstrating the potential of physiotherapy to contribute to new models of service delivery.

In New Zealand in 2017, a Physiotherapy Board of New Zealand working group¹ explored the potential development of a regulated advanced scope of practice (Physiotherapy Board,

2017) to complement the existing general and specialist scopes of practice (Physiotherapy Board, n.d.). The Physiotherapy Board accepted the recommendations of the working group in 2018 and commenced developing a draft advanced/titled physiotherapist scope of practice (Physiotherapy Board, 2018).

The purpose of this narrative review was to investigate the impact of advanced physiotherapy on the public and the health system, and identify current gaps in the literature. A narrative review design enabled the exploration of diverse and heterogeneous studies related to this emerging area of physiotherapy practice (Greenhalgh, Thorne, & Malterud, 2018).

In this review, the term "advanced physiotherapy" is used generically and encompasses advanced practice, extended scope and expanded scope, and an "advanced practice physiotherapist" (APP) refers to a physiotherapist working under any of these titles.

¹ An early iteration of this review was written for the working group.

METHODS

Database searches were conducted for relevant peer-reviewed articles, using the search terms “physiotherap*” or “physical therap*”, and “advanced practice”, “expanded practice” or “extended practice”. Databases searched were CINAHL Plus with full text, Cochrane Library (Wiley), Directory of Open Access Journals, Google Scholar, Health Reference Centre Academic (Gale), Informa Healthcare Journals, Medline/PubMed, OneFile, PEDro, ProQuest variants, Rehabilitation and Sports Medicine, Science Direct (Elsevier), Scopus, SPORTDiscus with full text, SwePub, and Wiley (CrossRef). Other potentially relevant literature was identified through bibliography searches of included articles and expert recommendation.

Studies were considered from a variety of contexts (primary care, emergency departments, orthopaedic outpatients and specialist doctors). Findings relating to access to care, quality and timeliness of care, service and economic efficiencies, and stakeholder (health professional and consumer) perspectives regarding advanced physiotherapy were examined.

Studies were included if they reported research findings (primary studies and systematic reviews) investigating the impact of advanced physiotherapy on healthcare efficacy, efficiency, service design, patient outcomes or perceptions (public or health professionals) of APPs, and were published in English between January 2010 and September 2017. Studies set in military deployment contexts (e.g. Afghanistan) were excluded as these were considered to relate poorly to the general healthcare delivery.

Duplicate citations were removed from search results. Titles and abstracts of citations were then screened for relevance to

the inclusion criteria by one of two reviewers. For papers that appeared to meet the eligibility criteria, and those for which it was unclear from the title and abstract whether they met the criteria, full papers were retrieved and evaluated. A final decision about eligibility was then made by agreement between the reviewers. Data and themes were extracted from the selected papers by one reviewer with assistance from the other.

RESULTS

Through the literature searches, 103 titles were identified after duplicates had been removed. Seventy-one were excluded (two from military deployment contexts) based on title and abstract, 32 full-text articles were read, and 22 were included in the literature review (Figure 1). Also included were seven papers identified from bibliography searches and six from expert recommendation. In total, 35 eligible studies (five systematic reviews and 30 primary studies) were included in the review (Table 1). As indicated in Table 1, the included primary study by Kennedy, Robarts, and Woodhouse (2010) had been appraised within two of the included systematic reviews. The included primary study by Razmjou et al. (2013) had also been appraised in a different (also included) systematic review. Care was taken to ensure that the findings from these primary studies were not overemphasised due to their inclusion in the systematic reviews.

Impacts on the public and the health system

Overall, common themes emerged from the literature, including reduced wait times, expedited access to care and positive impact on other clinicians’ workloads. These were mainly in relation to musculoskeletal conditions. These themes will be discussed in relation to primary care, emergency department, orthopaedic outpatient and rheumatology clinic contexts.

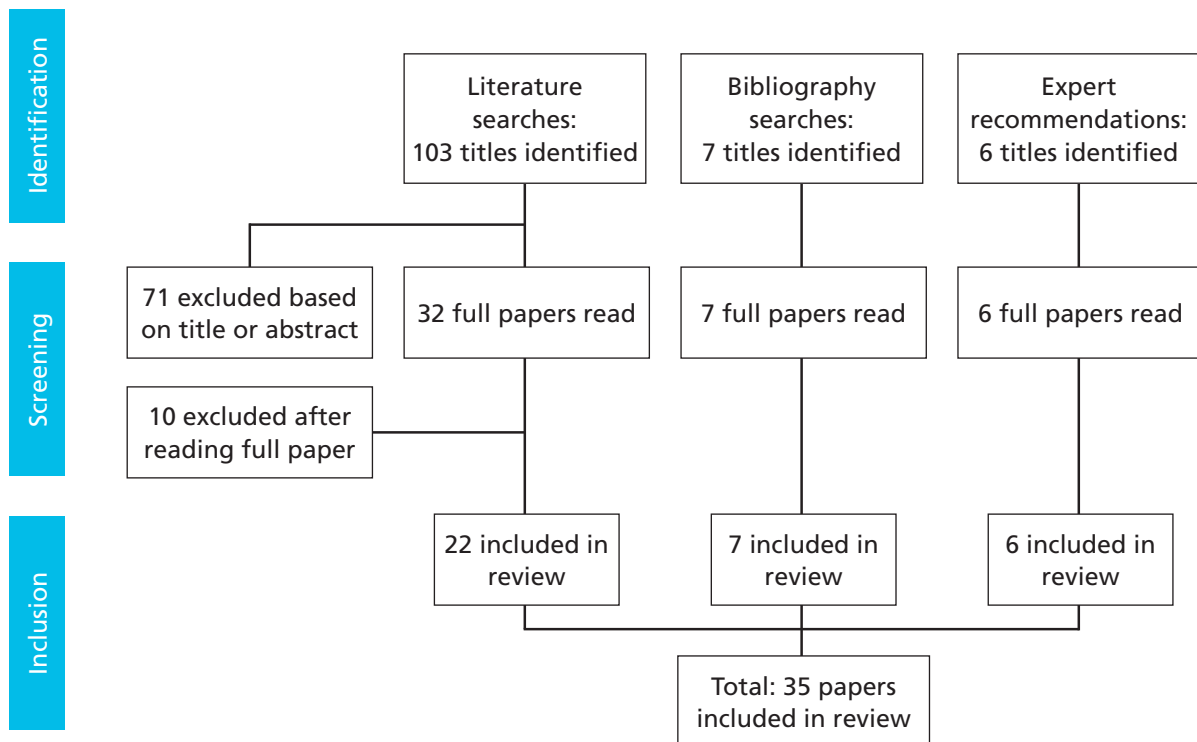


Figure 1: Literature identification, screening and inclusion-process results

Table 1: Literature included in this review

Reference	Country	Setting	Sample size ^a	Study design and description
Bath et al. (2012)	Canada	Orthopaedic, spinal triage	n (different variables) = 336-672 patients, with n (full data) = 299	Ex post facto observational study evaluating APPs' diagnoses of primary care referrals to surgeon
Burn & Beeson (2014)	UK	Orthopaedic, triage	n (screened referrals) = 1,395 patients; n (screened to APP) = 273	Quantitative evaluation of an APP's screening, diagnoses and management of primary care referrals to surgeon
de Gruchy et al. (2015)	Australia	Emergency department	n = 1017 patients	Single-site prospective observational study comparing APP management with physician management of categories 3-5 musculoskeletal presentations
Desjardins-Charbonneau et al. (2016)	Canada	Community	n = 513 consumers (university community)	Descriptive qualitative study exploring consumer perceptions about physiotherapists and APPs as primary care providers for treatment of musculoskeletal presentations
Desmeules et al. (2012)		Musculoskeletal	n (total) = 4,752 patients	Systematic literature review evaluating APP care and management of patients with musculoskeletal disorders (publication: 1980-2011; original qualitative research; 16 studies reviewed, comprising seven only appraised in this review, plus Kennedy et al., 2010, and eight appraised in other reviews: four in Oakley & Shacklady, 2015; two in Saxon et al., 2014; one in Oakley & Shacklady, 2015, and Saxon et al., 2014; one in Oakley & Shacklady, 2015, and Stanhope, Grimmer-Somers et al., 2012)
Desmeules et al. (2013)	Canada	Orthopaedic outpatients	n = 120 patients	Mixed methods evaluation comparing diagnosis and care recommendations by an APP with those of surgeons
Exton et al. (2014)	NZ	Emergency department	Not reported	Evaluation of six-month pilot project involving allied health practitioners, including APPs, within an interdisciplinary team
Goodwin & Hendrick (2016)	UK	General practice	n (total) = 600 patients, comprising n (APPs) = 500; n (GPs) = 100	Dual-site pragmatic prospective evaluation comparing APPs and GPs as primary care practitioner for musculoskeletal presentations
Harding et al. (2015)	Australia	Emergency department	n = 25 patients	Dual-site qualitative descriptive observational study evaluating patient experience and satisfaction with APP care for musculoskeletal presentations
Hawke et al. (2013)	Canada	Rheumatology, axial spondyloarthritis	n = 20 patients	Single-site evaluation comparing APP screening versus rheumatologist screening of inflammatory bowel disease patients
Jones et al. (2015)	Wales	Cross-sectoral	n = 67 healthcare professionals	Qualitative study exploring perceptions of various professional groups about advanced practitioner roles across different health professions
Kennedy et al. (2010) ^b	Canada	Orthopaedic, hip and knee replacement review clinic	n = 123 patients, comprising n (APP) = 63; n (surgeon) = 60	Qualitative study comparing patient satisfaction with APP-led versus orthopaedic surgeon-led follow-up care
Kerridge-Weeks & Langridge (2016)	UK	Orthopaedic, spinal triage	n = 100 patients	Service evaluation of an APP's diagnostic triage-to-care pathways

Reference	Country	Setting	Sample size ^a	Study design and description
Lefmann & Sheppard (2014)	Australia	Emergency department	n = 6 healthcare professionals	Single site qualitative study exploring perceptions of doctors, nurses and physiotherapists regarding advanced physiotherapy role
MacKay et al. (2012)	Canada	Orthopaedic outpatients, hip and knee arthritis	n = 73 patients	Single group pre- and post-intervention study investigating patients' use of self-management strategies, and comparing patients' exercise behaviour and self-efficacy from baseline to follow-up
Mallett et al. (2014)	UK	Referral to NHS musculoskeletal physiotherapy	n = 194 patients, comprising n (self) = 105; n (GP) = 89	Repeated measure prospective cohort study evaluating self-referral versus GP-referral pathways
McClellan et al. (2012)	UK	Emergency department	n = 372 patients, comprising n (APP) = 126, n (nurses) = 123, n (doctors) = 123	Single site randomised pragmatic trial of equivalence comparing clinical effectiveness of soft tissue injury management by APPs, emergency nurse practitioners and doctors
McClellan et al. (2013)	UK	Emergency department	n = 372 patients, as per McClellan et al. (2012)	Single site randomised pragmatic trial of equivalence comparing the cost-effectiveness of soft tissue injury management by APPs, emergency nurse practitioners and doctors
Morris et al. (2014)	Australia	Tertiary hospital	n = 8 stakeholders	Cross-sectional qualitative study exploring stakeholders' perspectives about a workforce redesign involving advanced physiotherapy roles
Morris et al. (2015)	Australia	Emergency department	Assessment/ management component: n = 13,495 patients (836 treated by APP); Perspective component: n (healthcare professionals) = 3, n (patients) = 11	Mixed methods, single site prospective observational longitudinal study comparing "fast track" assessment and management of categories 4 and 5 musculoskeletal presentations by an APP, advanced scope nurses, nurse practitioners and doctors
Naik (2016)	NZ	Orthopaedic, spinal screening	Not reported	Evaluation of APP screening of GP referrals to orthopaedic surgeon
Napier et al. (2013)	Canada	Orthopaedic, knee and shoulder triage	n = 45 patients	Prospective observational study comparing diagnostic agreement rate between an APP (triage) and surgeon, and surgical conversion rates between APP referrals and primary care provider referrals to surgeon
O Mir et al. (2016)	Republic of Ireland	Orthopaedic, paediatric triage	n = 2,650 patients	Prospective longitudinal cohort study evaluating efficacy of APP triage and care of non-surgical candidates
Oakley & Shacklady (2015)		Musculoskeletal	n (total) = 2,344 patients	Systematic literature review evaluating APPs in musculoskeletal triage (publication: 1989-2014; 14 studies reviewed, comprising five only appraised in this review, plus Razmjou et al., 2013, and eight appraised in other reviews: four in Desmeules et al., 2012; one in Saxon et al., 2014; one in Stanhope, Grimmer-Somers et al., 2012; one in Desmeules et al., 2012 and Saxon et al., 2014; one in Desmeules et al., 2012, and Stanhope, Grimmer-Somers et al., 2012)

Reference	Country	Setting	Sample size ^a	Study design and description
Passalent et al. (2015)	Canada	Rheumatology, axial spondyloarthritis	n = 57 patients	Study comparing APPs' and rheumatologists' clinical impressions and MRI recommendations
Phillips et al. (2012)	Wales	Occupational health services	n = 486 (baseline); n = 264 (treatment-end); n = 199 (follow-up)	Pragmatic cohort study evaluating cost-effectiveness and feasibility of three-tier self-referral pilot physiotherapy service
Razmjou et al. (2013) ^c	Canada	Orthopaedic, shoulder triage	n (total) = 494 patients, comprising n (1) = 100, n (2) = 200, n (3) = 194	Single site prospective study comparing an APP's and a surgeon's (1) diagnostic and management recommendation agreement, (2) wait times, and (3) patient satisfaction; separate samples for each component
Samsson et al. (2016)	Sweden	Orthopaedic triage	n = 163 patients: n (APP) = 83, n (surgeon) = 80	Randomised controlled trial comparing patient perceptions of quality of care of APP triage versus standard practice
Samsson & Larsson (2014)	Sweden	Orthopaedic screening	n = 203 patients: n (APP) = 102, n (surgeon) = 101	Randomised controlled trial comparing APP screening of initial referrals to orthopaedic consultation with standard practice
Saxon et al. (2014)		Extended scope roles across a range of contexts	n (total) = 2,453 (mix of health professionals and patients)	Systematic literature review of extended scope roles in physiotherapy, occupational therapy and speech pathology (publication: 2005-2013; 21 studies reviewed, comprising 15 only appraised in this review, plus Kennedy et al., 2010, and five appraised in other reviews: two in Desmeules et al., 2012; one in Oakley & Shacklady, 2015; one in Stanhope, Beaton et al., 2012; one in Desmeules et al., 2012, and Oakley & Shacklady, 2015)
Schulz et al. (2016)	Australia	Emergency department	n = 117 patients (limb: 88, back: 29)	Dual site prospective study comparing patient outcomes (lower limb soft tissue injuries or acute low back pain presentations) for APPs versus other health professionals
Stanhope, Beaton et al. (2012)		Inflammatory arthropathies	n (total) = undisclosed	Systematic literature review into APPs managing patients with inflammatory arthropathies (publication: 2002-2012; four studies reviewed, including one appraised by Saxon et al., 2014)
Stanhope, Grimmer-Somers et al. (2012)		Orthopaedic settings	n (total) = undisclosed	Systematic literature review into advanced physiotherapy roles in orthopaedic settings (publication: open-ended; 12 studies reviewed, comprising 10 only appraised in this review, plus one appraised by Oakley & Shacklady, 2015, and one by Desmeules et al., 2012, and Oakley & Shacklady, 2015)
Warmington et al. (2015)	Canada	Rheumatology, arthritis	n = 325 patients	Mixed method cross-sectional evaluation of patient satisfaction with APP and occupational therapist care
Wiles & Milanese (2016)	Australia	Health directorate	n = 6 health professionals	Qualitative study exploring perceptions of health professionals of advanced physiotherapy roles

Note: APP, advanced practice physiotherapist; GPs, general practitioners; MRI, magnetic resonance imaging; NHS, National Health Service; n, number; NZ, New Zealand; UK, United Kingdom

^a Sample size, participants in the study. ^b Included in reviews by Desmeules et al. (2012) and Saxon et al. (2014). ^c Included in review by Oakley and Shacklady (2015)

Primary care

Three primary studies evaluated advanced physiotherapy roles in primary care contexts (Goodwin & Hendrick, 2016; Mallett, Bakker, & Burton, 2014; Phillips et al., 2012). Goodwin and Hendrick (2016) found that APPs acting as first point of care for musculoskeletal complaints, instead of general practitioners (GPs), could provide safe and clinically effective care (in terms of self-reported improvements in Global Rating of Change and EQ-5D-5L measures) at a lower cost per episode of care (although a comparison of clinical efficacy between GPs and APPs was not conducted).

Mallett et al. (2014) compared a novel self-referral pathway involving an initial telephone triage appointment with an APP to publicly provided physiotherapy with the standard GP referral pathway. Self-referral provided an effective alternative with shorter wait times for treatment and with considerable cost savings (a mean saving of £36.42 per patient per episode of care) compared with the standard pathway. Cost savings were due to greater initial appointment attendance rates and fewer patient contacts. Reduction in wasted appointments projected annual savings of 0.75 to 1.23 full-time equivalents for the self-referral pathway (Mallett et al., 2014).

Phillips et al. (2012) evaluated the cost-effectiveness and feasibility of a self-referral pilot occupational health physiotherapy service led by APPs. Statistically significant improvements were seen in all target variables (clinical: pain intensity Visual Analogue Scale, General Health Questionnaire psychological distress, EQ-5D quality of life, Short Form Health Survey [SF12] mental and physical health subscales; psychosocial: pain catastrophising, work and physical activity fear and avoidance; work-related: sickness absence, work performance) from baseline to end of treatment, and to the three-month follow-up. They found that the cost of the self-referral service would need to increase by 160% before it fell outside the value-for-money range, suggesting that initiatives of this type may provide clinical, psychosocial and work-related cost-effective benefits.

Emergency departments

Six primary studies and one systematic review investigated advanced physiotherapy roles in emergency departments (de Gruchy et al., 2015; Desmeules et al., 2012; Exton et al., 2014; McClellan, Cramp, Powell, & Bengler, 2012; McClellan, Cramp, Powell, & Bengler, 2013; Morris, Vine, & Grimmer, 2015; Schulz et al., 2016). de Gruchy et al. (2015), Desmeules et al. (2012) and Morris et al. (2015) found that APPs' initial management of less serious musculoskeletal presentations assisted in meeting waiting-time and length-of-stay targets, expediting access to care for those patients. The advanced physiotherapy role was found to reduce the less serious musculoskeletal caseload for other clinicians in the emergency department medical team, enabling them to focus on medical and more serious musculoskeletal presentations (de Gruchy et al., 2015; Morris et al., 2015; Schulz et al., 2016). McClellan et al. (2012) found that APP management of peripheral soft tissue injuries achieved equivalent functional and time-off-work outcomes eight weeks following treatment when compared to other medical professionals in the team. Likewise, Schulz et al. (2016) found that APP management of musculoskeletal injuries and pain

resulted in similar functional outcomes (self-reported and delays in return to work or sport) and pain-related outcomes to those achieved by other health professionals, but with less imaging ordered or opioids administered.

Economic evaluations of advanced physiotherapy roles in emergency departments returned inconsistent results. Exton et al. (2014) found that identified cost savings resulting from prevented admissions outweighed the cost of employing APPs as primary contact practitioners. McClellan et al. (2013) concluded that APP care was equivalent in cost to doctor care when comparing soft tissue injury management cost-effectiveness across different members of the medical team. Similarly, in their systematic review, Desmuelles et al. (2012) reported no significant differences in cost between APP and standard care.

Orthopaedic outpatients

Ten primary studies examined APP involvement in orthopaedic outpatient contexts (Bath et al., 2012; Burn & Beeson, 2014; Desmeules et al., 2013; Kerridge-Weeks & Langridge, 2016; MacKay, Davis, Mahomed, & Badley, 2012; Naik, 2016; Napier, McCormack, Hunt, & Brooks-Hill, 2013; O Mir et al., 2016; Razmjou et al., 2013; Samsson & Larsson, 2014), as did four systematic reviews (Desmeules et al., 2012; Oakley & Shacklady, 2015; Saxon, Gray, & Oprescu, 2014; Stanhope, Grimmer-Somers, Milanese, Kumar, & Morris, 2012). Shorter wait times and expedited access to care were reported by multiple studies. In those evaluating APP-led screening of primary care referrals to orthopaedic surgeons, a high proportion (69%-90%) of initial referrals were found by APPs to be inappropriate or were managed independently by the APP (Bath et al., 2012; Burn & Beeson, 2014; Kerridge-Weeks & Langridge, 2016; Naik, 2016; O Mir et al., 2016). APP referrals for surgical consultation were likely to receive orthopaedic interventions (70-80%: Bath et al., 2012) and considerably more likely to receive such interventions than referrals by primary care providers referrals–Burn and Beeson (2014): 75% versus 57%; Napier et al. (2013): 90% versus 22%; Samsson and Larsson (2014): 55% versus 25%. The APP identification of inappropriate surgical referrals expedited access to non-surgical management. Significantly, shorter waiting times were found for APP-led screening than for standard practice (Naik, 2016; O Mir et al., 2016; Razmjou et al., 2013; Samsson & Larsson, 2014; Stanhope, Grimmer-Somers, et al., 2012).

Removing non-surgical candidates from surgeons' workloads also reduced the surgical consultation wait time for appropriate referrals (Bath et al., 2012; Naik, 2016; O Mir et al., 2016; Razmjou et al., 2013; Samsson & Larsson, 2014; Saxon et al., 2014). However, Burn and Beeson (2014) cautioned that the removal of candidates from waitlists might perversely stimulate GP referrals; without a reduction in waitlist capacity, GPs may refer more patients for surgical consultation as the length of waitlists decreased.

Diagnostic inter-rater agreement between APPs and orthopaedic surgeons was found to be high for knee and hip presentations by Desmeules et al. (2013): Kappa (κ)= 0.86; and by Razmjou et al. (2013): κ = 0.63–0.86 for major diagnostic categories of shoulder presentation. In three systematic reviews, APPs' diagnostic accuracy for musculoskeletal presentations (e.g. knee

or shoulder impairments) was comparable to that of surgeons', or high—as compared to subsequent arthroscopy or magnetic resonance imaging findings (Desmeules et al., 2012; Oakley & Shacklady, 2015; Stanhope, Grimmer-Somers et al., 2012).

High levels of agreement in surgical and non-surgical treatment recommendations between APPs and orthopaedic surgeons have been reported, further indicating that using APPs for orthopaedic screening does not reduce care quality—Desmeules et al. (2013) and Napier et al. (2013): $\kappa = 0.77$ for treatment approach; Razmjou et al. (2013): $\kappa = 0.75$ for indications for surgery. In their systematic review, Stanhope, Grimmer-Somers et al. (2012) reported a finding that the accuracy of identification of surgical candidates was higher for the APP (100%) than for the orthopaedic team doctors (79%).

Orthopaedic screening by APPs has been found to produce cost benefits (Burn & Beeson, 2014; Desmeules et al., 2012; Stanhope, Grimmer-Somers, et al., 2012). Although APP consultation adds cost for those referred on for surgical assessment, this is offset by savings created by high proportions of inappropriate referrals triaged directly to non-surgical management (Burn & Beeson, 2014). The systematic reviews of Desmeules et al. (2012) and Stanhope, Grimmer-Somers, et al. (2012) demonstrated evidence that the use of APPs in orthopaedic contexts resulted in cost savings.

Samsson and Larsson (2014) found significantly more non-surgical patients were referred to physiotherapy by the APP than by the surgeon, suggesting that the APP may be more aware of the potential benefits of physiotherapy treatment than the surgeon. These findings implied that APP screening could expedite access to both surgical and non-surgical management options.

MacKay et al. (2012) studied the results of multimodal management of non-surgical candidates six weeks post-APP screening. Patients reported spending more time stretching (50%) and more time walking or exercising (40%), and significant increases in self-efficacy (with a medium effect size). These findings suggest that APP management can enhance the use of active rehabilitation strategies for non-surgical candidates. One study reported improvements in chronic disease self-efficacy scores after APP management, although the findings were attenuated by a lack of comparison with other care pathways or patient groups (Saxon et al., 2014). No studies were found comparing patient outcomes of APP care with other care pathways.

Rheumatology clinics

In their systematic review, Stanhope, Beaton, Grimmer-Somers, & Morris (2012) appraised studies of APPs managing inflammatory arthropathy patients. However, all studies were deemed to be of low quality, and none reported measures of the effectiveness of APP management in terms of health outcomes or economic evaluations.

Hawke et al. (2013) evaluated an APP-led screening programme for patients with suspected axial spondyloarthritis and found that it may assist in reducing the wait time from referral to assessment. Passalent et al. (2015) found the agreement rates

between APPs and rheumatologists in their clinical impression of axial spondyloarthritis and magnetic resonance imaging recommendation to be comparable within and between the two professions (although inter-observer agreement rates were not high; inter-rater agreement for clinical impression was moderate: $\kappa = 0.52$; inter-rater agreement for recommendation of imaging was fair: $\kappa = 0.37$). Passalent et al. (2015) concluded that APPs could assist in improving rates of early detection and earlier access to care.

Stakeholder perspectives

Consumers

Sixteen studies explored consumer perspectives in a variety of contexts. Three of these studies examined patient perspectives of APPs in primary care and found high levels of patient satisfaction with and support for APPs in primary care roles (Desjardins-Charbonneau, Roy, Thibault, Ciccone, & Desmeules, 2016; Goodwin & Hendrick, 2016). Mallett et al. (2014) found that patients who self-referred to APPs reported greater satisfaction with wait times for a physiotherapy appointment and a significantly higher perception of active involvement than those referred to physiotherapy by their GP.

Six studies evaluated patient satisfaction in emergency departments. Desmeules et al. (2012) and Morris et al. (2015) found high levels of satisfaction with APP care of musculoskeletal presentations, and Saxon et al. (2014) reported higher patient satisfaction with APP care than that of other health professionals for soft tissue injuries. Harding, Prescott, Block, O'Flynn, & Burge (2015) found that patients were satisfied with the timing and efficiency of APP care and had confidence in the APPs' knowledge and skills. In one study, patient satisfaction on discharge was higher with APP care than for other health professionals, with the authors surmising that this may be due to the education and advice given (Schulz et al., 2016). Exton, Holmes, Scranney and Hollebon (2014) reported an "overwhelmingly positive" response from patients who were treated by the APP as primary contact practitioner.

Patient satisfaction with APP involvement in orthopaedic contexts was evaluated by nine studies. Four found levels of patient satisfaction with APP care to be high (Desmeules et al., 2012; Naik 2016; Napier et al., 2013; Oakley & Shacklady, 2015), and three reported that patients were more satisfied with APP care than that provided by surgeons (Desmeules et al., 2013; Razmjou et al., 2013; Samsson, Bernhardsson & Larsson, 2016). Kennedy et al. (2010) found that patient satisfaction with APP care post-orthopaedic surgery was comparable to that provided by surgeons. Other studies reported by Saxon et al. (2014) mirrored findings by Kennedy and colleagues.

In the context of arthritis care, Warmington et al. (2015) found that patient satisfaction with APP care was comparable to or greater than arthritis care previously received from other professionals.

Health professionals

The perspectives of health professionals regarding advanced physiotherapy roles were investigated by six studies (Exton et al., 2014; Lefmann & Sheppard, 2014; Morris et al., 2014; Morris

et al., 2015; Oakley & Shacklady, 2015; Wiles & Milanese, 2016). A seventh study (Jones, Powell, Watkins, & Kelly, 2015) explored health professionals' perspectives of advanced practice roles across diverse healthcare professions (including physiotherapy). Aspects considered important for advanced physiotherapy roles were clearly defined formal training and qualifications, common terminology, clear role definition, and negotiation of shifting professional boundaries (Jones et al., 2015; Lefmann & Sheppard, 2014; Morris et al., 2014; Wiles & Milanese, 2016). The need for legislative changes to enable or support the implementation of advanced physiotherapy roles was identified (Morris et al., 2014; Wiles & Milanese, 2016). Positive sentiments about contributions that APPs could make to meeting healthcare needs were also expressed (Jones et al., 2015; Wiles & Milanese, 2016), including in emergency departments (Exton et al., 2014; Lefmann & Sheppard, 2014; Morris et al., 2015). GPs were also satisfied with APP care (Oakley & Shacklady, 2015).

DISCUSSION

Use of APPs was found to create a number of benefits for health systems and consumers. These included reduced waiting times for appointments, reduced length of stay, improved access to care, improved onward referral, reduced musculoskeletal caseload for other clinicians in primary care and emergency departments, streamlined orthopaedic surgeon caseload, and improved patient satisfaction in a variety of contexts. Economic evaluations indicated that advanced physiotherapy roles were either cost saving or of equivalent cost compared to traditional models. Overall, these findings indicate that utilising APPs in innovative models of care has potential benefits of shorter patient pathways, better decisions regarding onward referral and efficiencies of service. Care provided by APPs was found to be safe and effective, and no evidence was found of harmful impacts of APP care or advanced physiotherapy roles to the public or health system.

Understanding the perspectives of different stakeholders is important when considering adjustments to traditional practice boundaries. The public (patients) would be directly impacted by the implementation of innovative models of care and the use of APPs in non-traditional roles. A number of studies found that patients consider APP involvement in various roles to be acceptable and were satisfied with APP care (e.g. Goodwin & Hendrick, 2016; Harding et al., 2015; Napier et al., 2013; Warmington et al., 2015). A recognised system denoting APPs (and indicating areas of APPs' expertise) would likely assist consumers to identify physiotherapists who best meet their health needs. This would be of particular relevance in jurisdictions (such as New Zealand) where consumers are able to self-refer to physiotherapy, often to the physiotherapist of their choice.

Other health professionals would also be impacted by the implementation of advanced physiotherapy roles. While other health professionals believed such roles could be beneficial, they perceived a need for clarity about the scope and focus of advanced physiotherapy roles. This is consistent with the

emphasis on role clarification that is included in established interprofessional practice frameworks. Role clarification is a key competency domain required for effective interprofessional collaboration and practice (Canadian Interprofessional Health Collaborative, 2010). Inconsistencies in advanced physiotherapy roles and changes to professional practice boundaries challenged such role implementation. Improved understanding, credibility and acceptance of APP roles between health professionals would be vital for effective enactment.

Results from economic analyses of APPs working in non-traditional roles were context dependent. Findings in primary care and orthopaedic contexts suggested that utilisation of APPs could provide economic efficiencies. For example, screening programmes in orthopaedic outpatients may offer sizable cost savings across the patient pathway (Burn & Beeson, 2014), although the economic benefits would likely be contingent on the quality of initial referrals. Presumably, such programmes would be most cost-effective in situations where the current surgical conversion rate was low. Economic analyses of advanced physiotherapy roles in emergency departments were inconclusive, and further robust evaluations are needed. With our search strategy, we were not able to find any examples of economic analyses of advanced physiotherapy roles in rheumatology contexts.

Limitations

A number of factors presented challenges for screening, interpreting findings, pooling results, drawing inferences and evaluating the generalisability of the research findings. These included potentially not identifying all relevant literature, and not having independent, dual screening of articles and extraction of findings. However, these are processes associated with systematic reviews and not with a narrative review. Inconsistencies were found in title (e.g. advanced practice physiotherapist, extended scope practitioner), terminology (including "advanced practice", "extended scope", and "expanded scope"), across the jurisdictions and clinical settings in which the reviewed studies were set, and a lack of clarity or consistency of role or qualifications, reflecting the challenges experienced by previous reviews (Desmeules et al., 2012; Saxon et al., 2014; Stanhope, Beaton, et al., 2012; Stanhope, Grimmer-Somers, et al., 2012). The advanced physiotherapy roles in different jurisdictions variously included triaging patients referred to medical specialists, ordering imaging, limited prescribing and administering injections.

Very little peer-reviewed literature was found from the New Zealand context. The differences between the New Zealand health system and the other systems within which most of these studies were conducted may alter the New Zealand relevance of findings. For example, many New Zealand physiotherapists already practice as first-contact primary care clinicians, so there may be little added benefit of using APPs to reduce GPs' musculoskeletal caseload (Goodwin & Hendrick, 2016; Mallett et al., 2014). In addition, most studies identified were in musculoskeletal physiotherapy, limiting the applicability of findings to other physiotherapy fields.

Research gaps identified

Little or no research was found in the following areas:

- Non-musculoskeletal physiotherapy fields.
- The impact of APP management or care on patient recovery outcomes compared to existing models of care.
- Peer-reviewed studies conducted in New Zealand, including in a private practice context.
- Consumer choice in relation to physiotherapy access in contexts where self-referral occurs.

Recommendations

Further research is required into health outcomes from advanced physiotherapy models of care and the impact of advanced physiotherapy roles in non-musculoskeletal fields of physiotherapy within the New Zealand context and relating to consumer choice for physiotherapy. Furthermore, consistent terminology and clear definitions need to be developed, along with delineation of healthcare roles within the different contexts.

CONCLUSION

Advanced physiotherapy roles have the potential to provide benefits to the public and health system, and to assist in new models of health delivery when implemented in innovative, interdisciplinary and non-traditional ways. No negative impacts of APPs working in non-traditional roles were identified. These findings should be interpreted within the context of a narrative review methodology.

KEY POINTS

1. Implementation of advanced physiotherapy roles in innovative interdisciplinary ways can benefit the public and health system, and assist in new models of health delivery.
2. Benefits found with implementing such roles include reduced wait times for appointments, reduced length of stay, improved access to care, reduced musculoskeletal workloads of other clinicians in primary care and emergency departments, streamlined caseloads of orthopaedic surgeons, and improved patient satisfaction.
3. Inconsistent terminology pertaining to the APP title and role was found across and within jurisdictions and contexts.

DISCLOSURES

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The Nijmegen Questionnaire: A valid measure for hyperventilation syndrome

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ABSTRACT

Hyperventilation syndrome is often undiagnosed due to its multi-systemic and apparently unrelated symptoms. The Nijmegen Questionnaire is used by clinicians to assess susceptible individuals, based on self-reporting symptoms attributed to hyperventilation syndrome. However, evidence of the psychometric properties of this questionnaire is lacking. This study investigated two types of validity using interviews and Rasch analysis. Data showed that the Nijmegen Questionnaire met criteria for content validity but not for structural validity. Content validity was supported by a high matching percentage between the symptoms identified within interview data and the current items on the Nijmegen Questionnaire (94%). Reported symptoms from study participants were conceptually congruent with most of the questionnaire items, with minor language inconsistencies between patients and clinicians. Rasch analysis indicated a poor fit of the Nijmegen Questionnaire to the Rasch model, demonstrating poor structural validity. This study also developed a revised 15-item version of the Nijmegen Questionnaire, which met criteria for structural validity. Subsequently, a conversion table was created for transforming raw total scores of the questionnaire in the clinical and research settings. Physiotherapists should use the revised 15-item Nijmegen Questionnaire for clinical and research purposes since it provides more accurate representation of the severity of patients' symptoms than the original scoring.

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Key Words: Hyperventilation, Nijmegen Questionnaire, Assessment, Validity, Rasch Analysis

INTRODUCTION

Dysfunctional breathing is an umbrella term describing breathing disorders where acute and/or chronic changes in breathing patterns result in dyspnoea and other symptoms in either the absence of or in excess of the magnitude of physiological, respiratory or cardiac disease (Boulding, Stacey, Niven, & Fowler, 2016). The following classification for dysfunctional breathing patterns was suggested in the literature review by Boulding and colleagues (2016): hyperventilation syndrome, periodic deep sighing, thoracic dominant breathing, forced abdominal expiration and thoraco-abdominal synchrony. Dysfunctional breathing is increasingly recognised as a costly health concern, given the involvement of various medical or surgical investigations prior to correctly identifying susceptible individuals (Chaitow, Morrison & Gilbert, 2014; Mooney & Candy, 2008). With the lack of population-based cohort studies in the literature, the prevalence of dysfunctional breathing is largely an estimate (Kiesel, Rhodes, Mueller, Waninger & Butler, 2017). Two cross-sectional studies based at a general practice of 7,033 clients in the United Kingdom showed that approximately 8% of adults without asthma who had visited a general practitioner, suffered from symptoms associated with dysfunctional breathing (Thomas, McKinley, Freeman, Foy, & Price, 2005). Dysfunctional breathing was more prevalent in women than men (35% versus

20% in those with asthma; 14% versus 2% in those without asthma) and in individuals diagnosed with asthma compared to those without (29% versus 8%) (Thomas, McKinley, Freeman, & Foy, 2001; Thomas et al., 2005). However, findings from these studies cannot be generalised to the general population, since the samples were relatively small and participants were recruited from one semi-rural practice – findings may be different in urban areas. In addition, clinical confirmation of dysfunctional breathing was not carried out.

The most common form of dysfunctional breathing is hyperventilation syndrome (Boulding et al., 2016), in which an individual presents with a range of apparently unrelated physiological symptoms associated with chemical changes (i.e. a reduction of carbon dioxide) in the cardiovascular/circulatory system. The reduced level of carbon dioxide within the bloodstream is the result of an acute or chronic increase in respiratory response (e.g. rate and/or volume) that exceeds the metabolic demands of the body (Lum, 1975). There is no gold standard objective assessment for the diagnosis of dysfunctional breathing/hyperventilation syndrome (Agache, Ciobanu, Paul, & Rogozea, 2012). The Nijmegen Questionnaire is used by clinicians for the assessment of symptoms attributed to hyperventilation syndrome as part of a holistic assessment. It does not provoke symptoms that could cause patient distress, in

contrast to the hyperventilation provocation test (Howell, 1997). The Nijmegen Questionnaire is a self-reported 16-symptom scale, with the response options: never (0), rarely (1), sometimes (2), often (3) and very often (4) (Appendix A). A score above 23 out of 64 is a positive screening of hyperventilation syndrome (Garssen et al., 1984; van Doorn, Colla, & Folgering, 1983). The questionnaire is also recommended for the assessment of other dysfunctional breathing patterns (Boulding et al., 2016). However, it has not been validated in these conditions.

An assessment tool needs to be conceptually sound, valid and reliable for application in various clinical and research settings. However, our previous literature review suggests evidence on the psychometric properties of the Nijmegen Questionnaire is limited (Li Ogilvie & Kersten, 2015). Indeed, only one study investigating structural validity was identified (van Doorn et al., 1983). Structural validity is *"the degree to which scores of a measurement instrument are an adequate reflection of the dimensionality of the construct to be measured"* (Mokkink et al. 2010b, p. 743). The second identified study had methodological limitations (e.g. the methodologies and procedures used to examine the content validity and reliability of the questionnaire were unclear (van Dixhoorn & Duivenvoorden, 1985)). Content validity can be defined as *"the degree to which the content of a measurement instrument is an adequate reflection of the construct to be measured"* (Mokkink et al. 2010b, p. 743). As such, there is more work needed to establish the content validity and structural validity of the Nijmegen Questionnaire. Without first establishing content validity, any other validation procedures are unlikely to yield meaningful results (Bond & Fox, 2015; McDowell, 2006). The purpose of this study, therefore, was to investigate the content and structural validity of the Nijmegen Questionnaire, with the research question: is the Nijmegen Questionnaire a valid outcome measure for individuals with hyperventilation syndrome? The research findings have the potential to increase confidence in the utilisation of the Nijmegen Questionnaire among clinicians and researchers, empowering users to make relevant inferences from the questionnaire scores and facilitating the process in identifying individuals with hyperventilation syndrome for early physiotherapy intervention.

METHODS

This study drew on guidelines for outcome measure development and testing, incorporating qualitative and quantitative research methods (Bowling, 2014; McDowell, 2006; Streiner, Norman, & Cairney, 2015). Content validity was investigated using qualitative descriptive methodology (Sandelowski, 2000), and structural validity was examined using Rasch analysis (Bond & Fox, 2015). The study was approved by the Auckland University of Technology Ethics Committee (reference number 15/197) and the research office at the participating government-funded hospital.

Content validity – qualitative descriptive study

Participants and sampling

Patient participants included people who were diagnosed by a clinician (based on their clinical diagnosis) with hyperventilation syndrome. Patients were eligible to take part if they were: a) 18 years or older; b) able to communicate in English (verbal and

written); and c) able to provide informed consent (verbal and written). Patients were excluded if they had a known organic cardiac, neurological and/or respiratory disease, given that the crossover of symptoms could pose a risk of contaminating the research findings. This was consistent with previously published studies associated with the development and validation of the Nijmegen Questionnaire (Garssen et al., 1984; van Dixhoorn & Duivenvoorden, 1985; van Doorn et al., 1983; van Doorn, Folgering, & Colla, 1982). Patient eligibility was determined by examination of their clinic records, which contained such details. Clinicians were included if they had experience working with patients with hyperventilation syndrome. Clinicians were from varied health disciplines (nursing, physiotherapy and medicine).

We intended to use purposeful sampling (Patton, 2002; Sandelowski, 2000) to select patients and clinicians, aiming to recruit individuals from different age, gender, ethnic groups and clinical disciplines. However, after three months, only one patient had consented to participate. Given this, other recruitment strategies (i.e. distribution of study flyers via specialist services mailing list, offering flyers to patients at clinic group sessions and snowballing sampling) were utilised (with additional ethical approval). Attempting to build on prior research (van Doorn et al., 1983) and to achieve sampling diversity, we aimed to recruit a minimum of six patients and three clinicians. Participants were identified and recruited from respiratory physiotherapy clinics in Auckland, New Zealand. A hospital administrator and physiotherapy colleague distributed or mailed the study flyers. All patient participants had knowledge of the Nijmegen Questionnaire as they had all completed this as part of previous or ongoing treatment. We did not record how many times they had completed the questionnaire previously.

Data collection

After providing consent, each participant took part in a semi-structured interview (approximately one hour) with the primary researcher (first author) who is a registered physiotherapist. An interview guide was used (Table 1) to explore the symptoms attributed to hyperventilation syndrome and content validity of the Nijmegen Questionnaire. Interviews were recorded and transcribed verbatim by the researcher.

Data analysis

Interview data were analysed using conventional content analysis, in which coding categories are derived directly from the text data, which allows the researcher to focus on the characteristics of language used to illuminate key concepts associated with the phenomenon (Hsieh & Shannon, 2005). The researcher identified data on symptoms attributed to hyperventilation syndrome and the Nijmegen Questionnaire. Symptoms/symptom clusters identified from the interviews that had conceptual congruency with the Nijmegen Questionnaire were grouped together to form categories and sub-categories, before being compared against the Nijmegen Questionnaire items. The primary researcher kept a reflexive journal, reviewed and revised coding strategies and outcomes with co-investigators (NK and PK) throughout the analytical process to stay close to the data as the categories and sub-categories were developed, and to minimise bias.

Table 1: Interview guide

Starting questions for patients

How would you describe what it feels like to have hyperventilation syndrome?

Can you tell me about the symptoms that you associate with this condition?

How would someone know that you were experiencing hyperventilation syndrome if they were watching you?

What would they miss?

Could you think of a specific incident where you were experiencing hyperventilation syndrome and tell me about those symptoms?

Starting questions for clinicians

How would you describe the signs and symptoms of hyperventilation syndrome?

How do you determine if someone is suffering from hyperventilation syndrome?

What other symptoms would a family member/friend/support person identify from an individual with hyperventilation syndrome?

Any cases that stand out to you that are different from what you told me already?

Questions relating to the Nijmegen Questionnaire for patients and clinicians

From your perspective, what are your views on the appropriateness of the questionnaire?

- Appropriateness of individual complaints

- Appropriateness of the response options

- Appropriateness of the language use

- Any important areas that are not currently included.

If you were to use this questionnaire, do you think it would give an accurate account of the symptoms associated with hyperventilation syndrome? Why?

Structural validity – Rasch analysis

Sampling

Nijmegen Questionnaires completed by eligible patients who attended the aforementioned clinic between 02/05/2013 and 30/04/2016 were extracted from patient clinical records. For Rasch analyses, reasonably well targeted samples of 108 are reported to have 99% confidence that the estimated item difficulty is within $\pm 1\frac{1}{2}$ logit of its stable value (Linacre, 1994). For poorly targeted samples, 243 are required for this level of confidence. Erring on the side of caution, we aimed to include 250 questionnaires (no upper limit was set for the number of questionnaires per patient). The individual item scores and total scores of the questionnaires made up the data set for analysis. Person characteristics (e.g. age, gender and ethnicity) were also collected.

Data collection

The individual item scores from the questionnaires were entered into a Microsoft Access database. Total item scores were calculated by a pre-entered formula and the total item scores could not be calculated if there were any missing items. Data entry was checked against the questionnaires. Rasch analysis was carried out using RUMM2030 software (Andrich, Sheridan, & Luo, 2009).

Data analysis

Descriptive statistics for the Nijmegen Questionnaire data set (including summary statistics for personal characteristics: age, gender, and ethnicity) were calculated using IBM SPSS Statistics for Windows (Version 22.0). Rasch analysis incorporated the relevant steps outlined below (Kersten & Kayes, 2011; Medvedev et al., 2017; Siegert, Tennant, & Turner-Stokes, 2010):

1. Testing of overall data fit to the Rasch model: The item-trait interaction chi-square probability should be non-significant.
2. Checking of person fit to the Rasch model: Fit residuals should be within the range of ± 2.5 , with a non-significant item fit chi-square probability; the mean fit residual should be close to zero with a standard deviation value close to one.
3. Checking of individual item fit to the Rasch model: Fit residuals should be within the range of ± 2.5 with a non-significant item fit chi-square probability; the mean fit residual should be close to zero with a standard deviation value close to one.
4. Identifying item(s) with poor fit to the Rasch model (using fit statistics outlined under 2.).

5. Identifying local dependency/dependencies between items from the residual correlation matrix: The residual correlation should be < 0.2 above the mean residual correlation.
6. Checking if the item response categories work as intended. The validity of the five response category structure of each item was assessed by examining if the response thresholds were ordered: Thresholds are the points on the scale where the probabilities of someone giving a response of either 0 or 1, and 1 or 2 (and so forth) are equally likely. When the response categories do not show a logical progression across the trait being measured, disordered thresholds are observed. In such instances, response categories can be collapsed to solve this problem.
7. Analysing differential item functioning (DIF) for personal characteristics (e.g. age, gender, ethnicity and assessment – time one, time two etc): Absence of DIF is shown if the analysis of variance (ANOVA) test is non-significant.
8. Testing of unidimensionality: Fewer than 5% of the independent *t*-test on estimates from testlets created from items with high positive and high negative loadings on the first principal component of the residuals should be significant (the 95% confidence interval (CI) should include 5%).
9. (Potentially) modifying the original scale by: deleting item(s) with poorest fit to the Rasch model combining items with local dependencies re-scoring item(s) with disordered threshold(s).
10. Re-testing individual item fit and overall fit to the Rasch model
11. Distribution analysis of the participant-item thresholds.

RESULTS

Participant characteristics

Six patients (all females) aged 26 to 64 years and four clinicians (three females) aged 54-58 were interviewed. Age was undisclosed for one clinician. Ethnic identities for patients included Chinese, Māori, New Zealand European and South African. Clinicians' ethnicities included Chinese, European and New Zealand European.

Symptoms of hyperventilation syndrome and content validity

Table 2 presents the symptoms/symptom clusters (total of 46), symptom categories (total of three) and sub-categories (total of 12) identified from interview data. Based on evaluation of conceptual congruency and language consistency, only one existing Nijmegen Questionnaire item (stiff fingers or arms) did not match with interview data. The other 15 items (94%) matched with interview data at a conceptual level, albeit with some inconsistencies in the language used to describe the symptoms. Table 3 contains excerpts from interview data as they relate to questionnaire items. Differences were noted between patients and clinicians in terms of the words or phrases used, for example, "You're not breathing in a good rhythm" (patient) versus "So the mechanics can include apical pattern of breathing, altered inspiratory expiratory ratio..." (clinician). Despite some minor discrepancies in language, these findings suggest the Nijmegen Questionnaire meets the criteria for content validity given that 94% of the items are representative of symptoms attributed to hyperventilation syndrome based on the perspectives of patients and clinicians with experience of the condition. There were symptoms identified from the interviews that were not addressed by the Nijmegen Questionnaire, 68% of which were in subcategories with other symptoms matched by questionnaire items.

Table 2: Symptom categories, sub-categories and symptoms

Sub-categories	Categories	Interview data match with NQ item number Item text
Category 1: Breathing Symptoms		
Altered capacity	1. Hyperventilating / Over breathing	NQ06 (P) Faster or deeper breathing
	2. Breathing more / Deep breathing	NQ06 (P) Faster or deeper breathing
	3. Breathing fast / Shallow breathing	NQ06 (P) Faster or deeper breathing
	4. Difficulty filling lungs / Taking deep breaths	NQ11 (P) Unable to breathe deeply
Altered pattern	1. Upper chest breathing	
	2. Noisy / Heavy breathing	
	3. Altered rhythm of breathing	
	4. Breath holding	
Global changes and difficulties	1. Gasp / Pant / Puff	
	2. Short of breath	NQ07 (F) Short of breath
	3. Air hunger	
	4. Sigh / Yawn	
	5. Difficulty breathing	

Sub-categories	Categories	Interview data match with NQ item number Item text
Category 2: Psychological Symptoms		
Feelings	1. Anxiety / Fear / Panic	NQ16 (F) Feeling of anxiety
	2. Aggravating / Agitated / Stressed / Rushed	
	3. Chaotic / Confused / Overwhelmed / Frustration	NO05 (P) Feeling confused
	4. Poor tolerance / Hypervigilance	
	5. Uneasy / Feeling different / Not feeling so good / Something is always at the back of your mind	
	6. Disconnected	
Thoughts	1. Out of control / Out of balance	
	2. Worry	
Category 3: Physical Symptoms		
Bodily regulations	1. Feeling hot / Feeling sweaty	
	2. Constipation / Irritable bowel	NQ09 (P) Bloating feeling in stomach
	3. Sleep disturbances	
Bodily sensations	1. Dizziness / Faintness / Light-headedness	
	2. Passing out / Physical collapse / Vision goes dark	NQ03 (P) Blurred vision; NQ04 (F) Dizzy spells
	3. Tiredness	
Head / face / mouth / throat	1. Headache	
	2. Pressure / Exploding feeling	
	3. Frowning / Facial expression	
	4. Pale	
	5. Tight feeling in the throat	NQ13 (P) Tight feelings around mouth
	6. Gritting teeth	NQ13 (P) Tight feelings around mouth
	7. Dry mouth	
	8. Clearing throat	
Heart / chest	1. Heart palpitations / Beats fast / Racing	NQ15 (F) Palpitations
	2. Chest restriction / Tightness	NQ08 (F) Tight feeling in chest
	3. Chest pain	NQ01 (F) Chest pain
Fingers / hands	1. Paraesthesia / Tingling	NQ10 (F) Tingling fingers
	2. Sweaty fingers / Palm	NQ14 (P) Cold hands or feet
Muscle / Posture	1. Tense muscles	NQ02 (P) Feeling tense
	2. Aches and pains	
	3. Postural changes	
Speech / Voice	1. Voice changes	
	2. Talking more / Talking faster	
	3. Poor breathing control	

Note: F, full match (consistent language, conceptually congruent); NQ, Nijmegen Questionnaire item; P, part match (some discrepancy in language or not entirely conceptually congruent)

Table 3: Comparison between Nijmegen Questionnaire items and excerpts from interview data

Items	Excerpts
Chest pain	"The chest pain kind of group of symptoms." (Leena ^c)
Feeling tense	"Your muscles would tense up." (Cathy ^p)
Blurred vision	"You feel like you're going to pass out." (Dora ^p)
Dizzy spells	"Sometimes the dizziness just lasts despite me trying different things to calm my breathing down." (Eva ^p)
Feeling confused	"...their world feels...chaotic or confused..." (Jessica ^c)
Faster or deeper breathing	"They're breathing fast." (Kelvin ^c)
Short of breath	"I do feel like short of breath like I'm not getting enough oxygen." (Eva ^p)
Tight feelings in chest	"It's just kind of...tight, more at the bottom." (Becky ^p)
Bloated feeling in stomach	"The feeling of constipation or irritable bowel." (Jessica ^c)
Tingling fingers	"Some people have sort of tingling in their hands." (Margo ^c)
Unable to breathe deeply	"I can't take a deep breath in and I can't completely fill up my lungs." (Abby ^p)
Stiff fingers or arms	Nil ^a
Tight feelings round mouth	"Tightening around...your throat." (Cathy ^p)
Cold hands or feet	"I've always got...sweaty palms/fingers." (Eva ^p)
Palpitations	"...[patients] come in...saying they have palpitations." (Kelvin ^c)
Feeling of anxiety	"A general sort of sense of anxiety." (Margo ^c)

Note: ^a No match; ^c clinician; P patient

Questionnaire characteristics

Data from 239 questionnaires completed by 159 patients (one to five questionnaires per patient) were extracted for the Rasch analysis. Of the 239 questionnaires, 73% were completed by females. The ethnic characteristics of the patients included New Zealand European (41%), Asian (28%), Pacific Islander (11%), Māori (8%) and other (12%). Age characteristics were divided into three groups: 15-46 years (40%), 47-57 years (28%) and >57 years (32%). Of the 159 patients, 72% were females. The mean age was 51 years with a standard deviation of 16 (range 15-90) years.

Rasch analysis and structural validity

Table 4 shows the distribution of response frequencies of the 239 questionnaires, including information on missing data. Twelve items showed a floor effect (i.e. >25% of patients scoring 0 = never). The data did not fit the Rasch model with mean item fit residual of 0.410 and standard deviation of 1.499 (Table 5). The item-trait interaction chi-square was significant with probability of <0.001, demonstrating the lack of fit (Table 5, Analysis 1). One misfitting item (NQ14 *cold hands or feet*) was identified with an item fit residual of 4.58 (acceptable range = +/- 2.5). This item was under discriminating and shown to have uniform DIF by gender (Figure 1).

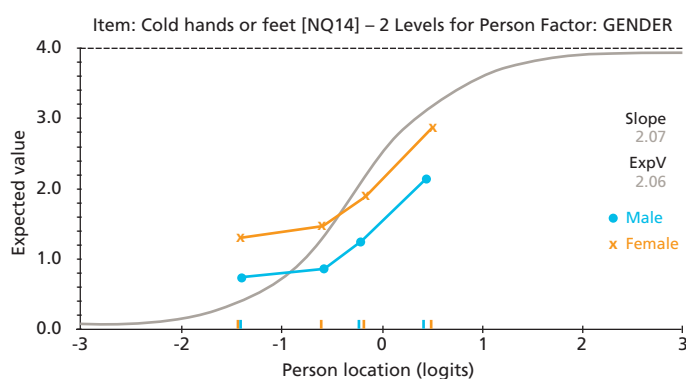


Figure 1: Differential item functioning for item NQ14 cold hands or feet

Residual correlations should be smaller than 0.2 above the average residual correlation (in this instance $-0.063 + 0.2 = 0.137$). High correlations between the residuals indicated local dependency between six sets of items (Table 6), suggesting that item responses of the Nijmegen Questionnaire depend not only on the severity of the symptoms of hyperventilation syndrome being measured, but on responses to other questionnaire items. The Nijmegen Questionnaire is unidimensional, given that 5.1% of *t*-tests were significant (95% CI 2.3% to 7.8%, Table 5, Analysis 1). Examination of the category probability curves indicated disordered thresholds for all 16 items.

Table 4: Distribution of response frequencies of the Nijmegen Questionnaire

Item	Description	Description Frequency (%)					Missing
		Never (0)	Rare (1)	Sometimes (2)	Often (3)	Very often (4)	
NQ1	Chest pain	79 (33.1)	47 (19.7)	65 (27.2)	27 (11.3)	20 (8.4)	1 (0.4)
NQ2	Feeling tense	29 (12.1)	24 (10.0)	87 (36.4)	60 (25.1)	37 (15.5)	2 (0.8)
NQ3	Blurred vision	96 (40.2)	39 (16.3)	57 (23.8)	32 (13.4)	15 (6.3)	-
NQ4	Dizzy spells	65 (27.2)	40 (16.7)	76 (31.8)	40 (16.7)	17 (7.1)	1 (0.4)
NQ5	Feeling confused	94 (39.3)	51 (21.3)	52 (21.8)	24 (10.0)	18 (7.5)	-
NQ6	Faster or deeper breathing	40 (16.7)	41 (17.2)	77 (32.2)	48 (20.1)	32 (13.4)	1 (0.4)
NQ7	Short of breath	45 (18.8)	33 (13.8)	78 (32.6)	49 (20.5)	33 (13.8)	1 (0.4)
NQ8	Tight feelings in chest	62 (25.9)	40 (16.7)	67 (28.0)	38 (15.9)	31 (13.0)	1 (0.4)
NQ9	Bloated feeling in stomach	67 (28.0)	35 (14.6)	65 (27.2)	36 (15.1)	36 (15.1)	-
NQ10	Tingling fingers	94 (39.3)	42 (17.6)	55 (23.0)	24 (10.0)	22 (9.2)	2 (0.8)
NQ11	Unable to breathe deeply	80 (33.5)	42 (17.6)	55 (23.0)	34 (14.2)	26 (10.9)	2 (0.8)
NQ12	Stiff fingers or arms	99 (41.4)	40 (16.7)	47 (19.7)	27 (11.3)	26 (10.9)	-
NQ13	Tight feelings around mouth	153 (64.0)	38 (15.9)	25 (10.5)	11 (4.6)	11 (4.6)	1 (0.4)
NQ14	Cold hands or feet	81 (33.9)	32 (13.4)	46 (19.2)	33 (13.8)	47 (19.7)	-
NQ15	Palpitations	63 (26.4)	44 (18.4)	82 (34.3)	30 (12.6)	20 (8.4)	-
NQ16	Feeling of anxiety	35 (14.6)	38 (15.9)	72 (30.1)	51 (21.3)	43 (18.0)	-

Note: NQ, Nijmegen Questionnaire

Table 5. Summary of fit statistics of the Nijmegen Questionnaire to the Rasch Model

Analysis number	Item fit residual	Person fit residual	Chi-square interaction	Chi-square probability	PSI (without extremes)	α (without extremes)	Tests of unidimensionality
	Mean (SD)	Mean (SD)	Value (df)	<i>p</i>			Significant <i>t</i> -test (95% confidence interval)
One ^a	0.41 (1.50)	-0.27 (1.61)	109.4 (48)	0.000	0.880	0.890	5.1% (2.3 to 7.8)
Two ^b	0.39 (1.15)	-0.31 (1.58)	67.8 (45)	0.016	0.879	0.891	5.5% (2.7 to 8.3)
Three ^c	0.06 (0.97)	-0.22 (1.20)	41.9 (45)	0.604	0.826	0.869	5.8% (2.9 to 8.6)
Four ^d	0.06 (0.86)	-0.21 (1.02)	36.1 (45)	0.205	0.789	0.809	1.8% (1.1 to 4.6)

Note: α , Cronbach's alpha; df, degrees of freedom; SD, standard deviation; *p*, probability; PSI, person separation index;

^a Fit to the Rasch model of all 16 items. ^b Fit to the Rasch model after deleting item NQ14. ^c Fit to the Rasch model after rescaling response categories for items with disordered thresholds. ^d Fit to Rasch model after merging of items

Table 6: Summary of local dependencies of the Nijmegen Questionnaire

Analysis number	Item		Locally dependent with:	
	Item	Description	Item	Description
One ^a and Two ^b	1.	Chest pain	8.	Tight feelings in chest
	2.	Feeling tense	5., 16.	Feeling confused / Feeling of anxiety
	3.	Blurred vision	4.	Dizzy spells
	6.	Faster or deeper breathing	7.	Short of breath
	7.	Short of breath	11.	Unable to breathe deeply
	10.	Tingling fingers	12.	Stiff fingers or arms
Three ^c	1.	Chest pain	8.	Tight feelings in chest
	2.	Feeling tense	5., 16.	Feeling confused / Feeling of anxiety
	6.	Faster or deeper breathing	7.	Short of breath
	10.	Tingling fingers	11., 12.	Unable to breathe deeply / Stiff fingers or arms
Four ^d	No local dependency			

Note: ^a Fit to the Rasch model of all 16 items. ^b Fit to the Rasch model after deleting item NQ14. ^c Fit to the Rasch model after rescoring response categories for items with disordered thresholds. ^d Fit to the Rasch model after merging of items

The misfitting item NQ14 was deleted and the analysis repeated with the remaining data (Table 5, Analysis 2). The mean item fit residual was 0.39 with a standard deviation of 1.15. The item-trait interaction chi-square was not significant with probability of 0.016 (greater than the Bonferroni adjusted *p* value of 0.0033), indicating fit to the Rasch model. Item NQ9 (*bloated feeling in stomach*) had an item fit residual of 2.76 – just outside the acceptable range. This item was also under discriminating, though not to the extent NQ14 was. The remaining 14 items demonstrated good fit to the Rasch model. All 15 items were invariant (i.e. unbiased, no DIF) across different age, gender and ethnic groups at initial and repeated assessment(s). Local dependency was found between the same clusters of items identified previously. The 15-item Nijmegen Questionnaire was found to remain unidimensional. However, as with the 16-item scale, all items had disordered thresholds. After

collapsing response options (Table 5, Analysis 3) using strategies outlined in Table 7, the number of disordered thresholds were reduced over three rescoring stages. Ordered thresholds were achieved for all 15 items by combining the response categories *sometimes* and *often*. Locally dependent items were combined into new super items (testlets), removing the influence of local dependencies (Table 5, Analysis 4). Following this, the average fit residual statistics had a mean of 0.06 and standard deviation of 0.86. The item-trait interaction chi-square probability was not significant at 0.205. With only 1.8% of significant *t*-tests, the scale remained unidimensional. A conversion table (Table 8) was created, allowing the conversion of ordinal to interval data for parametric analyses and clinical use. This works by calculating the total score on a completed questionnaire, excluding item 14, and then using the table to convert the raw (ordinal) score in column 1 to the new equivalent interval score in column 3.

Table 7: Rescore strategy for response categories of the Nijmegen Questionnaire

Strategy	Response options				
	Never (0)	Rare (1)	Sometimes (2)	Often (3)	Very often (4)
1st rescore	0	1	1	2	3
2nd rescore	0	0	1	2	3
3rd rescore	0	0	1	1	2

Table 8: Conversion table for the Nijmegen Questionnaire

Raw total score	Logit	Interval score
0	-3.438	0.00
1	-2.710	4.62
2	-2.234	7.64
3	-1.923	9.62
4	-1.690	11.10
5	-1.502	12.29
6	-1.344	13.30
7	-1.207	14.17
8	-1.085	14.94
9	-0.975	15.64
10	-0.875	16.27
11	-0.782	16.86
12	-0.696	17.41
13	-0.616	17.92
14	-0.540	18.40
15	-0.469	18.85
16	-0.400	19.29
17	-0.334	19.71
18	-0.270	20.11
19	-0.208	20.51
20	-0.148	20.89
21	-0.088	21.27

DISCUSSION

Our study evaluated the content and structural validity of the Nijmegen Questionnaire. To our knowledge, this is the first study to involve patients in a content validity investigation for the questionnaire. It is also the first time that Rasch analysis has been utilised in the evaluation of structural validity of the Nijmegen Questionnaire. Our study results demonstrated that 94% of the questionnaire items matched partly or fully with the interview data, representing both patients' and clinicians' view on symptoms of hyperventilation syndrome in relation to questionnaire content, though perhaps not fully. Stiff fingers or arms was the only item (from 16) that did not map onto interview data. A total of 46 symptoms/symptom clusters were identified in our study, compared to a total of 45 symptoms reported by patients in the first study by van Doorn and colleagues (1982). However, we were unable to compare our additional symptoms/symptom clusters with that study as it only reported the content of the final 16 symptoms that now make

up the Nijmegen Questionnaire.

This study provides a point of reference for symptoms of hyperventilation syndrome as perceived by patients who experience hyperventilation syndrome first-hand, and clinicians working with this population. It is worth noting that while the items were conceptually congruent with interview data, there were some language inconsistencies between the existing items and the symptoms/symptom clusters identified. This has also been observed in the literature (Grossman & de Swart, 1984; de Ruiter, Garssen, Rijken, & Kraaimaat, 1989; van Doorn et al., 1982). Future research might involve refining the wording of items so that it resonates with the language patients would use to describe their symptoms; any refinements would need to be tested against the Rasch model.

The Rasch analysis findings showed that the current Nijmegen Questionnaire did not fit the Rasch model and therefore did not meet criteria for structural validity. The questionnaire was not unidimensional and all 16 items demonstrated disordered thresholds. *Cold hands or feet* (NQ14) was identified as an item with poor fit illustrating bias in its function when assessing hyperventilation syndrome between male and female patients. After deleting NQ14, *bloated feeling in stomach* (NQ9) was another item identified as a poor fit and under discriminating. However, it was retained due to the absence of bias in terms of item function in person variables. This suggested that *bloated feeling in stomach* was valid in assessing hyperventilation syndrome. The systematic rescoring of response options and the merging of items with congruent meanings into testlets resulted in the revised 15-item version of the Nijmegen Questionnaire, meeting straight criteria for structural validity. A previous study (van Dixhoorn & Duivenvoorden, 1985) utilised non-metric principal components analysis (a parametric statistical technique) to evaluate structural validity of the Nijmegen Questionnaire. However, those results cannot be compared directly with the current study results because that study used parametric statistical techniques, which are not suited to ordinal data (Bond & Fox, 2015; Streiner et al., 2015). However, prior results concerning construct validity can be extrapolated and interpreted with these study results. Van Dixhoorn and Duivenvoorden (1985) identified three questionnaire components: shortness of breath, peripheral tetany and central tetany. The identification of this underlying relationship between variables was consistent with the discovery of local dependencies among the current items of the Nijmegen Questionnaire in this study. Some of the local dependencies identified were noted within the shortness of breath and central tetany components. This suggests that the symptoms represented by these items were scored not just based on the severity of hyperventilation syndrome related symptoms, but on the score for another item on the scale also. The locally dependent items were representing symptoms of similar nature. One item (NQ16 *feeling of anxiety*) was omitted from van Doorn et al.'s (1982) validation study. This item was found to be locally dependent with *feeling tense* (NQ2) and *feeling confused* (NQ5). Van Dixhoorn and Duivenvoorden's (1985) decision to omit *feeling of anxiety* (NQ16) was not supported by our study results. *Stiff fingers or arms* (NQ12) did not match with any participant-identified symptoms. However, it was found to

be locally dependent with *tingling fingers* (NQ10), which was fully conceptually and linguistically congruent with symptom identified by participants. Regardless of the lack of reporting by study participants, the fact that NQ12 was locally dependent suggests it measures something very similar to NQ10. Item NQ14 (*cold hands or feet*) was only partly congruent with interview findings. In addition, it was a misfitting item, as highlighted by the Rasch analysis, which resulted in it being deleted. Thus, both the interview and Rasch analysis findings from this study supported a 15-item version of the Nijmegen Questionnaire as a valid screening tool for hyperventilation syndrome.

Research and clinical implications

Interview findings revealed one existing item that appeared to be a poor match to the symptoms of hyperventilation syndrome. Additionally, a number of symptoms identified by participants are not captured by existing items of the Nijmegen Questionnaire. The reason for the mismatch between items and symptoms could be multifaceted. On the one hand, the interpretation and description of these symptoms varied between patients and clinicians. This could cause symptoms to be missed or misinterpreted by both parties in the clinical encounter. The Nijmegen Questionnaire does contain a majority of items that reflect symptoms of hyperventilation syndrome. While the questionnaire is structurally valid for repeat assessment (as there was no bias over time points in this study), no validation process to date has proved the ability of this questionnaire in measuring change (e.g. treatment effectiveness on hyperventilation syndrome). It is important to be aware of this when interpreting results from more than one assessment for individual patients. The same caution needs to be applied when using the Nijmegen Questionnaire as an outcome measure in research.

Strengths and limitations

By involving both patients and clinicians, this study met the

criteria for the evaluation of content validity as described by the Scientific Advisory Committee of the Medical Outcomes Trust (Aaronson et al., 2002). Studies employing the qualitative descriptive methodology are able to produce findings that are transferable to populations with similar characteristics as the study participants (Sandelowski, 1995, 2000). The COSMIN checklist identifies several criteria to assess the methodological quality of measurement studies (Mokkink et al., 2010a; Terwee et al., 2012). A self-assessment of the current study suggested that it meets all the criteria identified as critical to content validity, achieving an *excellent* rating (Table 9).

The interview data may be limited by the small sample size, and despite the various adjustments made in the effort to recruit male participants, there was also a lack of male patient interview participants and only one in the clinician group. Although more women than men suffer from hyperventilation syndrome and more women are treated at the recruitment locality, the study findings regarding content validity have limited transferability to a male population. The Nijmegen Questionnaire is a suggested screening tool for hyperventilation syndrome, based on reported symptoms. However, these symptoms are not exclusive to individuals with hyperventilation syndrome. It was not feasible to exclude patients with psychiatric and/or psychological disorders due to either personal preferences or public health policies around disclosure. The mental health background of patients from the study was unexplored and could have affected their symptom reporting.

CONCLUSION

The revised 15-item Nijmegen Questionnaire is an outcome measure that is suitable for its purpose in screening for hyperventilation syndrome in clinical and research settings with standards for application in place. The utilisation of the conversion table is recommended for converting ordinal raw scores to interval data when using the Nijmegen Questionnaire, especially when parametric testing is indicated. It should be used

Table 9: COSMIN checklist for content validity

Questions to determine if a study meets the standards for methodological quality	Excellent	Good	Fair	Poor
1. Was there an assessment of whether all items refer to the relevant aspects of the construct to be measured?	✓			
2. Was there an assessment of whether all items are relevant for the study population?	✓			
3. Was there an assessment of whether all items are relevant for the purpose of the measurement instrument?	✓			
4. Was there an assessment of whether all items together comprehensively reflect the construct to be measured?	✓			
5. Were there any important flaws in the design or methods of the study?	✓			

COSMIN, COnsensus-based Standards for the selection of health status Measurement INstruments.

Note: The definition of *excellent* for different questions are: 1 = assessed if all items refer to relevant aspects of the construct to be measured. 2 = assessed if all items are relevant for the study population in adequate sample size (≥ 10). 3 = assessed if all items are relevant for the purpose of the application. 4 = assessed if all items together comprehensively reflect the construct to be measured. 5 = no other important methodological flaws in the design or execution of the study.

in conjunction with other subjective and objective measures when assessing for hyperventilation syndrome.

KEY POINTS

1. This paper demonstrates content validity of the Nijmegen Questionnaire for hyperventilation syndrome, involving patients (in addition to clinicians) in the validation process for the first time.
2. The structural validity of the Nijmegen Questionnaire was explored using Rasch analysis (first in the literature), in line with the principles of outcome measure development and testing for ordinal questionnaire data.
3. This paper includes a revised 15-item Nijmegen Questionnaire and a conversion table for transforming raw (ordinal) total questionnaire scores to interval scores.
4. Physiotherapists should use the revised 15-item Nijmegen Questionnaire for clinical and research purposes.

DISCLOSURES

Funding for this study was obtained from the Cardiothoracic Special Interest Group, Physiotherapy New Zealand and Counties Manukau Health. There are no conflicts of interest which may be perceived to interfere with or bias this study.

PERMISSIONS

Ethical approval was obtained from the Auckland University of Technology Ethics Committee (15/197). Consent was obtained from all participants who took part in interviews.

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Appendix A

NIJMEGEN QUESTIONNAIRE ^a

	Never (0)	Rarely (1)	Sometimes (2)	Often (3)	Very often (4)
1. Chest pain					
2. Feeling tense					
3. Blurred vision					
4. Dizzy spells					
5. Feeling confused					
6. Faster/deeper breathing					
7. Short of breath					
8. Tight feelings in the chest					
9. Bloating feeling in the stomach					
10. Tingling fingers					
11. Unable to breathe deeply					
12. Stiff fingers or arms					
13. Tight feelings around the mouth					
14. Cold hands or feet					
15. Palpitations					
16. Feelings of anxiety					

^a van Dixhoorn and Duivenvoorden (1985)

Physiotherapy student experience of a mindful movement and a mindful stress-reduction intervention: A qualitative study

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ABSTRACT

Increasing levels of psychological distress in university student populations are a growing concern. Mindfulness training provides a potential intervention to improve well-being outcomes. This paper uses a thematic analysis approach to explore the experiences of pre-clinic physiotherapy students participating in a six-week mindfulness programme based on either sitting meditation or mindful movement. Semi-structured interviews were conducted with 12 students immediately post-intervention and six students at a six-week follow-up. Interviews were transcribed and coded, and the data analysed and interpreted. One main theme (increased self-awareness) and five sub-themes (mental health, self-care, communication, study engagement, and awareness of movement) were identified. Participants were more aware of their own stress response and the mental processes, such as rumination, that gave rise to these experiences. Participants reported making healthier lifestyle choices, including increased exercise and improved diet. They reported improved listening and communication, and study time was more focused and productive. Participants in the mindful movement group also reported increased awareness of their own physical movement and that of others. Participants engaged well with both the six-week mindful stress-reduction intervention and six-week mindful movement intervention, reporting improvements in well-being, communication and academic engagement.

McConville, J., Lewis, D., Chambers, R., & Hassed, C. (2019). Physiotherapy student experience of a mindful movement and a mindful stress-reduction intervention: A qualitative study. *New Zealand Journal of Physiotherapy*, 47(3), 172-182. <https://doi.org/10.15619/NZJP/47.3.05>

Key Words: Mindful Movement, Mindfulness, Physiotherapy Student, Stress, Study Engagement, Qualitative

INTRODUCTION

University students report higher levels of psychological distress across diverse areas of study compared to the general population (Larcombe, Finch, & Sore, 2015). The academic and clinical requirements of health professional training in particular can lead to increased levels of stress, poor mental health and unhealthy lifestyle behaviours in students (Dyrbye, Thomas, & Shanafelt, 2006). Persistent stress may lead to high allostatic load with adverse effects on physical health and atrophy of neurons in brain regions, important for learning, memory and executive functioning (McEwen, 2004). Strategies that equip students to manage psychological distress will, therefore, be a valuable addition to any professional training programme since they may enhance student well-being and learning. There is also some evidence that mindfulness training for healthcare professionals (HCPs) not only enhances well-being but also leads to better patient care in terms of greater empathy and improved communication (Epstein, Siegel, & Silberman, 2008; Fahrenkopf et al., 2008).

Mindfulness training is one approach which has been utilised to decrease stress and anxiety for students in health profession programmes (Slonim, Kienhuis, Di Benedetto, & Reece, 2015).

A recent meta-analysis of 38 studies on the effectiveness of mindfulness-based interventions for distress, well-being, physical health, and performance in HCPs and HCPs-in-training showed that these interventions had a significant moderate effect on anxiety, depression, psychological distress, and stress, and small to moderate effects were found for burnout and well-being at post-intervention. Larger intervention effects were observed with mindfulness-based stress reduction (Spinelli, Wisener, & Houry, 2019).

It is beyond the scope of this paper to discuss the definition and operationalisation of mindfulness in detail, but briefly, the most widely used definition of mindfulness is "the awareness that emerges through paying attention on purpose, in the present moment, and non-judgmentally to the unfolding experience moment by moment" (Kabat-Zinn, 2003, p.145). Mindfulness as a term, however, can refer to many different things. For example, it can be seen as a *trait* in terms of being an everyday experience, in that we all have moments throughout the day where we are fully present and engaged with the task at hand. Mindfulness can also be described as a *state* in terms of being mindful or unmindful in a given moment in time. Mindfulness can also be seen as a *practice* where a person intentionally cultivates state or trait mindfulness through formal (meditation)

and informal practices (daily life) (Grossman, Niemann, Schmidt, & Walach, 2004; Shapiro, Carlson, Astin, & Freedman, 2006).

Mindfulness-based interventions such as mindfulness-based stress reduction (Kabat-Zinn, 2003) and mindfulness-based cognitive therapy (Segal, Williams, & Teasdale, 2002) have proven effective in increasing mindfulness, self-efficacy and empathy, and decreasing stress, anxiety, and depression in groups of medical, psychology, nursing, and other health profession students (McConville, McAleer, & Hahne, 2017). Qualitative studies with psychology (Hopkins & Proeve, 2013), occupational therapy (Stew, 2011), and nursing (van der Riet, Rossiter, Kirby, Dluzewska, & Harmon, 2015) students report better ability to cope with stress, improved self-awareness and better patient/client care following such programmes.

Mindfulness-based interventions generally include formal meditation practices like body scan and breath meditation, and informal practices and applications where participants are taught how to use mindfulness practice during everyday activities or for specific challenges, such as study or stress reduction. These sitting, formal practices of mindfulness commonly use the body and senses as an anchor for the present moment, and, as a result, lead to increased bodily awareness and interoception, which are very helpful for various psychological disorders (Price, Merrill, McCarty, Pike, & Tsui, 2019; Khoury, Lutz, & Schuman-Olivier). Some interventions include mindful movement practices, for example, the mindful yoga component of mindfulness-based stress reduction. There is a growing interest in the use of mindful movement (MMov) to increase awareness of mental reactions, mental states and body awareness, and decrease stress and anxiety (Kinser, Braun, Deeb, Carrico & Dow, 2016). MMov cultivates a present-moment focused state of mind and attention by paying attention to body sensations, proprioception, and breathing, and some people, particularly those with anxiety and attentional problems, may find body-oriented therapies and MMov much easier to practise than sitting meditation (Price & Hooven 2018). MMov includes traditional forms like Tai Chi, yoga and Qigong, but other potential forms of MMov are the Feldenkrais Method, Alexander Technique, and dance. The Feldenkrais Method, also known as Awareness Through Movement, has been found to decrease state anxiety in physiotherapy students (Kolt & McConville, 2000). However, a review of the outcomes of MMov on reducing stress and anxiety was unable to draw definitive conclusions (Payne & Crane-Godreau, 2015). Qualitative studies indicate a possible benefit of MMov. Medical students participating in a yoga programme reported an improved ability to cope with stress, perceived reconnection of mind and body, and confidence with using mind-body skills with patients (Bond et al., 2013).

Given the limited research into MMov interventions, there is a need for further research in this area. One potential barrier to implementing MMov as core curriculum, rather than an elective programme, could be the perceived cultural barriers of practices like yoga, Qigong and Tai Chi. Just as interventions such as mindfulness-based stress reduction and mindfulness-based cognitive therapy secularise mindfulness (that is, decontextualise it from its Buddhist/spiritual roots), it is vital to similarly decontextualise MMov and assess the effectiveness and

acceptability of these programmes by health science students, who are more likely to accept interventions that are both secular and scientific.

We are not aware of any studies that have specifically investigated mindfulness-based interventions for physiotherapy students. Lo, Francis-Cracknel, and Hassed (2017) evaluated a mindfulness-based lifestyle programme (Health Enhancement Program) for physiotherapy students at Monash University, where mindfulness has been incorporated as part of the core curriculum. However, due to the multiple elements, it is not possible to determine the relative contributions of the mindfulness and lifestyle components to the outcomes of this programme. Interestingly, participants reported enjoying the mindfulness activities and adoption of healthier lifestyle behaviours. While stress was found to increase in this cohort, this could be explained by a variety of factors. For example, it could be a reflection of the fact that the post-course measures were taken during a major assessment period or the increased reporting of stress was a sign of growing interoception with the intervention not continuing for long enough to help students go to the next stage of being able to minimise stress. There was also no control group. A study of Monash medical students receiving a more extensive form of the Health Enhancement Program found pre-post improvements in mental health despite the post-course evaluation taking place during the high-stress assessment pre-exam period (Hassed, de Lisle, Sullivan, & Pier, 2009). Providing different options for learning mindfulness may improve engagement and make the programmes more relevant and adaptable to specific tertiary education contexts (Dobkin & Hassed, 2016). MMov may be particularly useful for physiotherapy students with their assumed natural proclivity for exercise and physical interventions.

To address some of the issues highlighted above, in this study we developed two mindfulness interventions tailored to address the specific challenges faced by physiotherapy students, designed to be compatible with their science education and resonate with their interest in physical movement. The aim of the study was to explore the lived experience of third-year physiotherapy students who participated in a six-week mindful stress-reduction (MSR) intervention or MMov intervention during their pre-clinic semester.

METHODS

A qualitative analytic method using semi-structured interviews was employed. The aim was to identify themes that richly described the lived experience of the students during these programmes.

Design

The thematic analysis method described by Braun and Clarke (2006) was used to identify, analyse and report patterns of meaning (themes) within the data set. Themes were induced from the data rather than being analysed using a pre-existing theoretical framework. In doing this, reference to the concept of the theme was sought across all participants. The explicit meaning of the data was used to identify and describe themes, as it was assumed that the participants' descriptions accurately described their experience and reality (Braun & Clarke, 2006). Ethical approval was obtained from the Human Research Ethics

Committee of La Trobe University (reference FHEC1413). All participants gave written informed consent.

Participants

A cohort of 123 third-year pre-clinic physiotherapy students attended a two-hour core curricular Introduction to Mindfulness lecture, which included instruction on how to apply mindfulness practice in personal and professional settings. Following a subsequent invitation, 17 students agreed to participate in this research and were randomly allocated to either an MSR or MMov group. Both groups participated in six one-hour sessions, timetabled over the first six weeks of the 12-week semester.

Interventions

Mindful stress reduction (MSR)

The MSR intervention consisted of six one-hour weekly sessions. Each session introduced a different application of mindfulness and associated sitting meditation and informal practices, mainly focused around stress reduction. Participants were encouraged to practice these meditations and apply the informal practices in their everyday lives. Time was devoted in each session to discussing insights gained and challenges faced in attempting and achieving meditations and informal practices.

Mindful movement (MMov)

The MMov intervention also consisted of six one-hour weekly sessions. Each session covered the same basic topic/application as the MSR intervention, although the meditations and informal practices were based on mindful movement. Again, participants were encouraged to practise the mindful movement exercises each day and were coached in applying mindful movement to their everyday life, with a focus on reducing stress. Both interventions were led by a clinical psychologist and experienced

mindfulness facilitator, who was also one of the researchers (RC).

The focus of each session and the weekly homework practices are summarised in Table 1.

Data collection

Interviews were conducted following the completion of the programme (week six or seven of the semester) and at a six-week follow-up (pre-exam, end-of-semester). Audio recorded interviews were conducted on campus and lasted for an average length of 46 minutes. Experience of mindfulness was investigated post-intervention by asking questions in relation to the effect of mindfulness on aspects of life, awareness of attention, awareness of thoughts, relationship to self, and relevance of mindfulness to the trainee physiotherapists. At the six-week follow-up, questions covered the topics of becoming mindful, the perceived benefits of mindfulness, and factors helping or hindering practice as well as individual follow-up. An opening statement introduced the participant to each topic area. This was followed by a question, and then further questioning if required. The schedule was flexible, enabling the students to talk about, reflect on, and learn from their own unique experience.

All interviews were conducted by a student enrolled in an Honours degree psychology programme who was not involved in the mindfulness programme or in student teaching (GE). (See Appendix A for post-intervention interview and follow-up questions).

Table 1: Focus of each session and weekly at-home practices

Week	Mindful stress reduction	Mindful movement
1	Introducing mindfulness Body scan 5 min twice a day Notice how much (1) paying attention and (2) in "default mode" (distracted/daydreaming) and effect of each	Introducing mindfulness Body scan 5 min twice a day Notice how much (1) paying attention and (2) in "default mode" (distracted/daydreaming) and effect of each
2	Reducing stress Breath meditation 5 min twice a day Noticing when fight/flight (stress) response triggered and using mindfulness to disconnect from it	Releasing tension Tensing and relaxing 5 min twice a day Noticing and releasing physical / mental tension throughout day
3	Compassion Mindful listening meditation 10 min twice a day Recognising self-criticism and practising self-compassion	Moving mindfully Mindful walking 10 min twice a day Moving/commuting mindfully
4	Acceptance/letting go Mindfulness of thoughts 10 min twice a day Noticing conflict/tension and letting go	Efficient/compassionate movement Compassionate body scan/mindful yoga 10 min twice a day Using minimal effort throughout daily activities
5	Improving productivity Choiceless awareness 15 min twice a day Unitasking (instead of multitasking)	Joyful movement Free movement / dance 15 min twice a day Awareness of joyful movement throughout day
6	Course review and maintaining the practice	Course review and maintaining the practice

Data analysis

All students were assigned an ID number, and audio recordings were de-identified. All interviews were transcribed verbatim by one of the researchers (DL). Transcripts were checked against the audio recordings for accuracy.

Two researchers (DL and JM) independently analysed the data. All transcripts were first read in their entirety to get an overall sense of the students' experience. The transcripts were then read line by line and codes were assigned in a systematic way across the data set. These codes were then collated into themes. The two researchers then came together, and through consensus and discussion, formulated final themes, further refining these through checking that they were consistent with the codes and data set. Data analysis was therefore an iterative process that involved multiple readings of the transcripts. Extracts from the data set were then selected. Themes were analysed in relation to the research topic and the literature (Braun & Clarke, 2006).

RESULTS

Of the 17 students who participated in the research, 12 agreed to be interviewed. Twelve were interviewed at the completion of the programme (five from MSR and seven from MMov). Due to attrition, only six students completed follow-up interviews (four MSR and two MMov). The mean age of the participants was 24.7 years, with an even distribution of women and men. The median number of sessions attended was 5.5. There was low attendance at the six-week follow-up, as the interviews were conducted in the week prior to end-of-semester exams, and students reported they could not afford the time. Participant characteristics are presented in Table 2.

A total of 18 interviews were analysed. The six-week and 12-week individual interviews from the MSR and MMov groups were analysed as one data set as the researchers sought to understand the lived experience following participation in a mindfulness-based intervention. Each participant had a different narrative about the effect of mindfulness training in their life. However, four themes were identified as being common across the participants. An additional theme of movement awareness was identified across participants in the MMov group. Information relating to "barriers to practice" from the week-12 interviews has also been included.

Main theme

The main theme from both groups was increased self-awareness (i.e. being more aware of their physical, mental and emotional states). This is the meta skill which makes all the other abilities possible.

Sub-themes

The five sub-themes identified were: (1) mental health, (2) self-care, (3) communication, (4) study engagement and (5) movement awareness. Subthemes with supporting quotes are described below, with additional supporting quotes in Appendix B.

Mental health

Semester one for third year students is a "high-stakes" semester, with potential for high levels of stress. Participants reported recognising the stress response in themselves – such as increased muscle tension and heart rate – enabling them to use strategies from the training to decrease the physical symptoms and feelings of stress and anxiety:

Table 2: Participant characteristics

Participant number	Sex	Age	Group allocation	Number of sessions attended
1	F	22	MMov	5
2	F	20	MMov	5
3 ^a	F	26	MMov	6
4 ^a	M	27	MSR	6
5 ^a	M	40	MSR	6
6 ^a	F	23	MMov	5
7 ^a	F	28	MSR	6
8	F	21	MMov	4
9	M	20	MMov	4
10 ^a	M	20	MSR	5
11	M	25	MSR	6
12	M	25	MMov	6

Note: F, female; M, male; MMov, mindful movement, MSR, mindful stress reduction

^a Participant attended both interviews

Over the last few weeks with assessments... I can really feel my heart rate increasing... I didn't sit there and panic, as I maybe used to, I was able to recognise there were physiological signs of stress and take action. (Participant 3)

There appeared to be an awareness of rumination, self-created perceptions of threat, excessive thinking, excessive judgement, catastrophising and reactivity. Through increased self-awareness, students shifted into a less stressed, more accepting space of presence, including self-acceptance, acknowledgement and kindness: "A lot of things that I'm stressed about, it is just me making them bigger than they are. ... I want everything to be perfect and to the highest possible standard, but the pressure is only coming from me" (Participant 2); "I haven't got as down on myself. I have tried to focus myself back into the moment, so I haven't had as many bad thoughts like "you're going to fail this, you're not going to do well" (Participant 8).

Self-care

Participants reported bringing increased attention and kindness to self when engaging in everyday activities, improving the experience of these activities. Participants reported prioritising exercise and making better food choices: "Leisure time has become actual guilt-free leisure time...I've accepted that me getting up and exercising for half an hour isn't a waste of time" (Participant 3); "Every meal, everything I eat, I slow down, kind of enjoy it more, and I guess I eat less of what I know I shouldn't eat" (Participant 11).

Participants reported improved sleep linking this to a variety of practices, including meditation, progressive muscle relaxation, body scan, mindful movement and dancing: "Now if I do a 10- to 15-minute mindful movement activity, I fall asleep so much quicker than I used to, which is having a huge effect on my general well-being" (Participant 6).

Communication

When communicating with others, participants reported being more aware of when they were trying to multitask or when their attention wandered. In noticing their attention wandering, they were able to bring it back to the other person: "I noticed that when I listen to someone, I kind of lose my concentration ... This programme has helped me to be aware of myself, then bring myself back to the current situation and what is being said" (Participant 4); "I've stopped multitasking and texting and stuff when I speak to people...not being distracted while speaking to them [people] helps [me] to communicate better" (Participant 11).

A reported implication was more holistic and effective patient interaction: "[Being] more present in the moment and listening to what they [the patients] are saying, you are actually going to understand more about them, then you are going to give them a better treatment" (Participant 2).

Study engagement

Participants engaged more in their learning by bringing mindful awareness to academic activities. One of the consistent experiences reported was an increased ability to recognise default mode (where the attention has wandered) and the ability to bring attention back to the task at hand: "When I go to lectures, rather than get halfway through a lecture and realise

I haven't heard any of the previous part, I pick up a lot quicker [when I'm not tuned in] and I can kind of refocus" (Participant 7).

This led to more effective use of time and a reported increase in productivity: "I used to sit down for four or five hours and probably achieve the same as now, if I give myself two hours and be really mindful, not be as much in default mode" (Participant 2).

Participants reported being more accepting of themselves and less reactive, enabling them to stay focused on a task: "When I reflect on what I've done wrong, I take a gentler tone, and it's easier to stay focused, and not just be kind of down on yourself; making mistakes is more productive" (Participant 11).

Participant 5 noted:

... When writing a difficult essay and you're grappling with a concept or how to describe something, often that can induce a stress reaction, and it's an uncomfortable feeling to sit with ... I guess using mindfulness ... I have been able to sit with that difficult feeling a bit longer.

Movement awareness

All participants in the MMOV group reported increased movement awareness, including the few participants who felt personally challenged by some of the activities, specifically the free-dance session. The extent of this awareness was not apparent in the MSR group.

Participants reported the increased awareness of movement in themselves led to a better appreciation of movement in others: "The better you understand your body, the better you're going to be able to understand someone else's body" (Participant 2).

Participants reconceptualised movement re-education for their future patients: "When you're trying to teach a patient a movement ... being able to help them to create a better mindfulness of their body and their movements ... will then allow them to learn new movements a lot better" (Participant 6).

Participants reported that the mindful movement facilitated awareness of the body and the potential to change: "With the mindful movement activities, [it] was a lot easier to identify where I was holding tension in my body, and then by acknowledging that, being able to find a way to rid myself of that" (Participant 6); "I've been feeling my posture a lot more and able to correct it" (Participant 9).

Negative experiences and challenges

Participants identified barriers to formal mindfulness practice. These included lethargy, inconsistent routines, and a perceived lack of time to practise.

During the six weeks of the programme, participants informally applied mindfulness practice in their daily lives. They were motivated by peer support, the face-to-face contact with the facilitator, and weekly follow-up emails with MP3 files of mindfulness practices. However, once the programme finished, the majority did not maintain their practice at the same level. Ongoing mindfulness support is likely to be required for these participants to implement their newly gained mindfulness practice on an ongoing basis during their university studies and

in the clinical context as healthcare students and professionals: *"I was much more vigilant [with practice] when I had a weekly commitment"* (Participant 6).

On an individual basis, participants found some practices more useful than others. A feeling of benefit did not necessarily predict practise of the technique: *"I didn't find dance useful. I like being told what to do – structure – I am not creative. I am uncoordinated. I liked the walking, tense-relax, and body scan, but I still only practised once or twice a week"* (Participant 8).

DISCUSSION

This study explored the lived experience of physiotherapy students participating in a mindfulness intervention consisting of a two-hour lecture outlining the science of mindfulness, and then either a six-week programme based on sitting meditation (MSR) or mindful movement (MMov). Participants in both programmes reported increased self-awareness and improvement in mental health, self-care, communication and study engagement. The MMov programme participants also reported applying the experiential learning from the movement awareness activities into their practice as trainee physiotherapists.

Participants in both programmes reported greater physical self-awareness through explicitly focusing on body awareness. Noticing signs of the fight/flight/freeze (stress) response, such as muscle tension and increased heart rate, allowed participants to recognise the onset of this response earlier, resulting in lower overall levels of tension.

Being mindfully aware of the stress response – that is, without judgement – also meant that they may have been less caught up in secondary reactions, such as anxiety and panic. This reduced reactivity is a characteristic element of mindfulness-based interventions. As they became more aware of the physiological correlates of the stress response, participants in both the MSR and MMov programmes also reported being able to recognise the triggers and mental processes that gave rise to their experience of stress, such as perfectionism and catastrophising. This is important for a student in a high-pressure programme like physiotherapy, as it results in the locus of control for stress transitioning from external to internal, providing them with an effective strategy to reduce perfectionism, and concomitant stress and anxiety.

Such metacognition and meta-emotion, and concomitantly reduced reactivity are central parts of mindfulness-based interventions. The observed decrease in reactivity would, therefore, be expected as both programmes focused on recognising the stress response and using mindfulness to reduce it. However, as the intervention in the MMov programme primarily focused on developing body awareness, in contrast to the explicit focus on mental processes in the MSR programme, the increased metacognition and decreased perfectionism reported by participants in the MMov group are noteworthy since these appear to have emerged spontaneously from the training. This is consistent with the findings of Chrisman, Christopher, and Lichtenstein (2009), who reported that students participating in mindful movement practices experienced emotional, physical and mental changes. This

finding also concurs with research showing that increased physical self-awareness (awareness of bodily sensations and the reciprocal relationship these sensations have with emotion) may be a key mechanism in mindfulness-based interventions such as mindfulness-based cognitive therapy (Michalak, Burg, & Heidenreich, 2012). This non-judgemental attitude may also have arisen through modelling by the course facilitator – a recognised key aspect of successful mindfulness teaching (Segal et al., 2002).

In this study, increased mindful awareness appeared to be associated with healthier choices, such as regular exercise and improved diet and sleep. This concurs with previous research that has shown mindfulness meditation only (Black, O'Reilly, Olmstead, Breen, & Irwin, 2015), mindful movement (Caldwell, Harrison, Adams, Quin, & Greeson, 2010), and mindfulness-based stress reduction are all associated with improved sleep (Winbush, Gross, & Kreitzer, 2007). Despite several methodological issues in these studies, overall, it appears to be increased trait mindfulness that most predicts improved sleep (Howell, Digdon, & Buro, 2010). Furthermore, given that poor sleep predisposes individuals to poor mental and physical health, improved sleep quality might at least partially mediate the relationship between increased mindfulness and improved well-being (Howell, Digdon, Buro, & Sheptycki, 2008). Given the increased prevalence of sleep issues in tertiary students (Lund, Reider, Whiting, & Prichard, 2010), these findings add support for including mindfulness training in higher education.

Participants in both programmes reported improved listening when communicating with others. Reported implications for participants in dealings with patients included a more holistic understanding of the patient. Training healthcare workers in mindful communication has been shown to lead to improved empathy (Krasner et al., 2009) and better patient care (Beckman et al., 2012) as well as improved personal well-being and reduced burnout (Goodman & Schorling, 2012). Although the MMov programme did not explicitly teach mindful communication, the facilitator intentionally modelled mindful communication in the group sessions in both programmes, which may explain the improvement reported by the participants. Alternatively, it is possible that increased trait mindfulness resulting from the MMov training may have intrinsically led to more mindful communication.

Participants also reported improved study engagement and greater productivity. Participants in both the MSR and MMov programmes reported reduced distractedness due to greater awareness of when they were distracted and being able to re-engage attention more easily. Consequently, participants also reported increased concentration and increased study efficiency. Previous research has found that mindfulness may reduce distractedness and "default mode" activity (Brewer et al., 2011), and improve concentration (Lazar, 2005). These factors are likely to lead to better academic performance (Zenner, Herrnleben-Kurz, & Walach, 2014).

Although research shows that mindfulness leads to increased work engagement (Malinowski & Lim, 2015), there is a paucity of literature on mindfulness and study engagement, with research focusing more on the effects of mindfulness on

cognitive performance and academic achievement. Given the findings of the present study that mindfulness appears to boost study engagement, this area warrants further investigation. It is possible that mindfulness enhances work/study engagement during work/study times, but also the ability to volitionally shift attention fully to other activities that are not work or study related once the task is complete. From our data, it may be that mindfulness facilitates healthy work and study engagement by promoting attention switching, metacognition and focus.

Participants in the MMov group reported an increased awareness of body posture and movement. Increased awareness of their own movement appeared to lead to a greater appreciation of movement in others. This resulted in strategies to teach others new, corrective ways to move, therefore improving treatment efficacy. Participants reported being able to organise themselves more effectively and sustainably when working with each other and with simulated patients in practical classes. These findings suggest that mindful movement offers a unique dimension of benefit which may be well suited to and useful for physiotherapy students.

The present research had several limitations. It would be interesting for future researchers to combine qualitative interviews with validated self-report scales, stress biomarkers, academic performance and observer-rated scales of outcome variables such as patient care.

Students in this study self-selected by volunteering to participate. It is unknown whether the programme would have been as successful or well-received by a whole cohort of physiotherapy students who did not self-select. Future research should seek to deliver such programmes to entire cohorts in order to address this. Research conducted in students in similar university settings who receive mindfulness training as part of their core curriculum has shown that once students understand the rationale and background science, 90.5% report personally engaging with meditation and/or other applications of mindfulness (Hassed et al., 2009). It is likely to be similar in physiotherapy students, and this is something that future researchers should explore. The present study randomised participants into the MSR and MMov programmes. Both the meditation-based and movement-based interventions used in this study included common elements, such as an explicit stress reduction focus and an emphasis on informal mindfulness practice as well as meditation/movement practices. It might be advisable for future researchers to design interventions comparing only meditation and movement practices without these other elements. This would allow for a clearer understanding of the relative contribution of sitting meditation and mindful movement practices to various outcomes of interest.

Finally, it would have been interesting to include a control group who did not receive mindfulness training and was given some other active (non-mindfulness) intervention to account for the possible effects of simply participating in a programme or increasing social connectedness.

Notwithstanding these limitations, this was the first study we are aware of that investigates via qualitative interviews the

acceptability of and benefits resulting from a mindfulness intervention based on sitting meditation and mindful movement designed specifically for physiotherapy students.

CONCLUSION

Overall, the students appeared to engage well with both forms of mindfulness training and reported a range of benefits to their well-being, study engagement, communication and clinical effectiveness as trainee physiotherapists. The MMov programme appeared to have an additional benefit, given its alignment with participants' existing interests as physiotherapists and the application of the increased movement awareness in client management. Given this, there is a case for including such mindfulness training in physiotherapy (and allied health) training programmes. Designing interventions that meet the specific needs of different cohorts may enhance engagement and is a recommendation of some researchers (e.g. Spinelli et al., 2019).

These findings provide a rationale for including mindfulness in physiotherapy courses, with the ready availability of online apps providing ongoing support of mindfulness practice. Further studies are required to replicate and extend these initial findings.

KEY POINTS

1. Both the meditation-based and movement-based interventions were acceptable to physiotherapy students with the mindful movement programme providing additional benefit as students applied their experiential awareness of movement into their practice as trainee physiotherapists.
2. Increased mindfulness led to healthier choices including improved diet, regular exercise and improved sleep which may have partially mediated improved well-being.
3. Participants reported improved listening and communication, which have been linked to improved empathy, better patient care and reduced practitioner burnout.
4. Participants reported awareness of the stress response, improved attention switching, metacognition and focus, and improve overall study engagement.

DISCLOSURES

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

PERMISSIONS

Ethical approval was obtained from the Human Resources Ethics Committee of La Trobe University (FHEC1413). All participants gave written informed consent.

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Appendix A

POST-INTERVENTION INTERVIEW AND FOLLOW-UP QUESTIONS

Post-intervention interview questions (week 6 and 7)

Opening statement 1: You have now completed the six-week mindfulness programme.

Opening question 1: What is different for you since completing the programme? Example of sub-question: What is different in each aspect of your life from mindfulness?

Opening statement 2: We are interested in evaluations and your unique experiences of mindfulness.

Opening question 2: Describe your experience of the programme.

Opening statement 3: Initial mindfulness training often makes people more aware of the regular habits of their attention in meditation and/or daily life.

Opening question 3: Have you been more aware of “default mode” (times where you were not engaged in what you were doing)?

Opening statement 4: One of the things mindfulness aims to do is to make people more aware of their thoughts.

Opening question 4: Describe a recent situation where you have had greater awareness and/or less reactivity.

Opening statement 5: Another aspect of mindfulness is that people become more aware of their body.

Opening question 5: Describe a situation where you have become more mindful of your body recently.

Opening statement 6: Mindfulness can change the way people relate to themselves and how one identifies with aspects of themselves.

Opening question 6: Describe the ways your relationship with your thoughts, feelings and body sensations changed as you progressed through the course.

Opening statement 7: We are interested in the relevance of mindfulness to physiotherapy students.

Opening question 7: What are the ways you think learning mindfulness will help you in your work as a physiotherapist?

Opening statement 8: This brings us to the last question.

Opening question 8: Is there anything else that you would like to add about your experience?

Follow-up interview questions (week 12)

Opening statement 1: Last time we discussed several experiences, thoughts and opinions relating to mindfulness.

Opening question 1: What can you tell me about how you view mindfulness now? Example of sub-question: Can you please describe what the experience of a mindful moment is like for you?

Opening statement 2: I am interested in how people become more mindful.

Opening question 2: At any stage, has there been a process of becoming more mindful in your daily life that you can describe to me?

Opening statement 3: Research suggests our emotions can be embodied.

Opening question 3: Can you describe an instance where your emotions have manifested in your body?

Opening statement 4: Regardless of whether you have been practising mindfulness recently, I am interested in how all the mindfulness you have done may still be affecting you now.

Opening question 4: Can you describe the benefits you currently feel from mindfulness?

Opening statement 5: I am interested in what has lasted from mindfulness.

Opening question 5: What are the main things from the programme that have stayed with you?

Opening statement 6: I am interested in how mindfulness gets used at different times.

Opening question 6: Can you describe how mindfulness has influenced your studies over the semester?

Opening statement 7: Different things help or hinder people in starting and maintaining a regular practice of mindfulness.

Opening questions 7: What things have supported you in building a mindfulness practice? What have been obstacles to mindfulness practice for you?

Opening statement 8: I am interested in the role of others in an individual's practice of mindfulness. You have now had about six weeks with weekly group support and about six weeks where you could have continued to practise individually.

Opening Question 8: What was the effect of having the group and then not having the group?

Opening statement 9: Research shows that mindfulness is associated with changes in authentic functioning.

Opening question 9: Do you feel more in touch with yourself?

Opening statement 10: Last time we spoke, you talked about which seemed prominent to you.

Opening question 10: How has that been going?

Individual follow-up: Are there any other experiences or benefits of mindfulness you see that you would like to share? Is there anything else that you would like to contribute to this research?

Appendix B

ADDITIONAL QUOTES FROM PARTICIPANTS

Mental Health

"Maybe the biggest advantage of mindfulness is to be aware of myself. Knowing myself" (Participant 4).

"I have become a lot more aware of tension and where I carry tension, and the sort of things that trigger when I get tense" (Participant 7).

"I am quite hard on myself usually, especially with assignments coming back. If I am not happy with it, I tend to get angry at myself and very self-critical. Knowing now how to be gentler with myself and reminding myself about that, I have managed to not be so reactive" (Participant 7).

"I don't feel as overwhelmed with things with regards to uni. Things seem more achievable. I suppose just taking everything step by step" (Participant 7).

"Being aware of over-emotional or angry responses has helped to just let them be and I feel a bit calmer rather than up and down, and flight and fight" (Participant 5).

"My attitudes to my thoughts and my feelings are less judgmental and more accepting. They are there and they are what they are" (Participant 3).

"I've noticed when I'm being more reactive ... and I can sort of take a step back from it or I can at least make a decision whether I am going to continue to react or step away" (Participant 10).

"In relationships with family and friends, how I feel towards others, the sort of emotions that sometimes come up with different people, I have noticed a lot more. If I feel negative towards someone, I can pick that up, and I realise that's me, that's my feelings, that's not them that is causing anything, that's my attitude towards people. This motivates me to have a more positive attitude towards people. I can change that and often that changes the way I interact with them, and maybe it's not such a negative experience with them after all" (Participant 7).

Self-care

"Dancing, just moving in a way that my body wanted to, helped me forget about stressors and other things that are distracting" (Participant 3).

"Enjoyed most the feeling of being kind of present during my everyday tasks, so even walking from class to class, class to lunch, going home and going to work I would find myself tuning back into what I was actually doing, and I really enjoyed slowing down to eat" (Participant 11).

"I like to exercise, and I am a ballet dancer. I am now more able to focus on them rather than just being there and not actually mentally being there. While I know they are my hobbies, they used to stress me out as I would be thinking about what (I perceived) I was supposed to be doing rather than my hobbies. Now they are more enjoyable" (Participant 2).

Communication

"I have got a wife and two kids. I am now more aware of trying to divide my attention between two things, and it is not really working. So, if my kids need attention, I am now more likely to stop whatever else I was doing and give them all the attention and then when that's done, go back to whatever and give all my attention to that, rather than trying to do two things at once" (Participant 5).

Study engagement

"I find that I spend less time kind of zoning out, just looking at the screen, [and am] less tempted to come and go and look at YouTube or Facebook during my study" (Participant 11).

"Definitely more assured, or more willing to be wrong ... now I am a bit happier to be a bit more assertive and ask questions" (Participant 6).

"When I'm studying, and catch [myself] procrastinate [sic] a bit, usually I get angry, now I'm just, 'It's ok, it happens', and bring myself back and refocus" (Participant 7).

Movement awareness

"Experiencing mindful movement allows you to see different ways to help your patient, like understanding how each of the body's parts are all connected together" (Participant 3).

"I've been feeling my posture a lot more and able to correct it." (Participant 9).

"Hands-on practical work, I can actually feel what's going on, not just doing it" (Participant 2).

Negative experiences and challenges

"I still view it as being very critical. Having said that, I am not practicing it as much as I was then [during the intervention], too many other things at the forefront of my mind" (Participant 6).

Quality indicators for hip and knee osteoarthritis management in New Zealand: A patient survey

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ABSTRACT

Osteoarthritis is a prevalent and costly condition. Knowledge of the quality of care being offered to people with hip and knee osteoarthritis in New Zealand is limited. The aim of this study was to investigate the quality of care being offered to people with hip and knee osteoarthritis in New Zealand, and to investigate common pathways of care. The OsteoArthritis Quality Indicator (osteoarthritis) questionnaire was administered to adults with hip and/or knee osteoarthritis, and participants were also asked to list the healthcare professionals they had consulted. Descriptive statistics with 95% confidence intervals were calculated. The study included 106 participants (87% female, $n=92$; 94% European, $n=100$). The mean OsteoArthritis Quality Indicator achievement rate was 50.2% (95% confidence intervals 41.0–59.7%). OsteoArthritis Quality Indicator achievement rates were lowest for weight reduction referral (8.6%; 3.7–17.8%) and daily activity aids assessment (18.5%; 10.2–31.0%), and highest for physical activity education (80.8%; 72.1–87.3%) and offering of paracetamol (80.0%; 71.3–86.6%). Following consultation with a general practitioner, 22% ($n=24$) consulted orthopaedic surgeons while 15% ($n=17$) consulted physiotherapists. The results suggest that implementation of evidence-informed conservative treatments for osteoarthritis in primary care is suboptimal, although evidence from a larger representative sample is needed.

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Key Words: Osteoarthritis, New Zealand, Treatment, Hip, Knee

INTRODUCTION

Osteoarthritis (OA) of the hip and knee is currently ranked the eleventh highest contributor to disability globally (Cross et al., 2014). People with OA often experience pain, joint stiffness and weakness, which can affect their mobility, function, mental well-being and independence (Hall et al., 2008; Hermans et al., 2012). The prevalence of OA in New Zealand has increased from 9% of adults in 2011/2012 to 10.6% in 2017/2018 and is expected to continue rising with the ageing population, which will increase the burden and reliance on healthcare resources (Baldwin, Briggs, Bagg, & Larmer, 2017; Hooper, Lee, Rothwell, & Frampton, 2014; Ministry of Health, 2019). In 2018, the estimated total cost of arthritis in New Zealand, of which OA is the most common form, was \$12.2 billion dollars (Access Economics, 2018). Hospital costs, which are dominated by osteoarthritic knee and hip surgeries, totalled \$423.7 million (Access Economics, 2018).

International evidence-based OA treatment guidelines

commonly place interventions into three categories: non-pharmacological, pharmacological or surgical (Department of Veterans Affairs, & Department of Defense, 2014; Jevsevar et al., 2013; National Institute for Health and Care Excellence, 2015; Rillo et al., 2016; Zhang et al., 2008). These guidelines suggest that interventions be staged and progress from conservative non-pharmacological interventions, such as education and exercise, to more invasive interventions, such as surgery (Brosseau et al., 2016; Department of Veterans Affairs, & Department of Defense, 2014; Hochberg et al., 2012; Loew et al., 2012; National Institute for Health and Care Excellence, 2015; Zhang et al., 2008). Furthermore, surgical intervention should only be recommended for those people who have failed to respond to non-pharmacological and pharmacological treatments, and whose quality of life is acutely impacted (Department of Veterans Affairs, & Department of Defense, 2014; National Institute for Health and Care Excellence, 2015; Zhang et al., 2008). However, evidence from Australia and France demonstrates implementation of these guidelines

into clinical practice is limited and that non-pharmacological treatments are commonly underutilised (Brand et al., 2014; Chevalier, Marre, de Butler, & Hercek, 2004; Hunter, 2011; Hunter & Lo, 2009; Poitras et al., 2010). In New Zealand, many people with OA who are referred for joint replacement surgery are either not appropriate for surgery or face a lengthy waiting list (Hooper, 2016). This is especially problematic given that the number of New Zealanders who will require a total hip or knee joint replacement is expected to rise by 84% and 183% respectively by 2026 (Hooper et al., 2014).

The OsteoArthritis Quality Indicator (OA-QI) questionnaire is a patient-reported outcome measure that investigates the quality of care, in terms of adherence to clinical guidelines, being offered to people with OA (Østerås et al., 2013). The questionnaire is in English and consists of 17 items ("quality indicators"), 16 of which address patient education, exercise, weight loss, and mobility interventions and pharmacological management or non-surgical interventions that are supported by international clinical guidelines (Østerås et al., 2013). The OA-QI questionnaire has demonstrated acceptable content validity, construct validity, and test-retest reliability in a Norwegian sample of people with hip, knee, and hand OA (Grønhaug, Hagfors, Borch, Østerås, & Hagen, 2015; Grønhaug, Østerås, & Hagen, 2014; Østerås et al., 2015; Østerås et al., 2013).

A recent qualitative study that explored treatments offered to New Zealanders ($n = 23$) with lower limb OA found that the first clinician most commonly consulted by participants was a general practitioner (GP) (Jolly, Bassett, O'Brien, Parkinson, & Larmer, 2017). Participants indicated that they were not aware of a distinct treatment pathway for their OA, and many reported receiving inconsistent information from different healthcare providers, although the findings of the study are difficult to generalise because of the qualitative methodology. There is limited knowledge of the quality of care being offered to people with hip and knee OA in New Zealand and whether the care being offered is in line with international clinical guidelines. Therefore, this study had two aims, to:

1. Investigate the quality of care being offered for people with hip and knee OA in New Zealand compared to international guidelines.
2. Investigate clinical pathways of OA management in New Zealand in terms of healthcare professionals consulted.

METHODS

A cross-sectional observational study involving administration of an online survey at a single time point was conducted. Ethical approval was granted by the Auckland University of Technology Ethics Committee (reference number 16/407).

Participants

People were eligible to participate in the study if they were aged 18 years or older, had been diagnosed with hip and/or knee OA by their GP and had received treatment for it, and if they could comprehend written English. Participants were recruited via social media (Facebook), Arthritis New Zealand newsletters (n =approximately 2,800 subscribers at time of study), flyers placed on community noticeboards as well as through snowballing techniques. The advertisements included

a link to the online survey. People who chose to follow the link to the survey were first directed to the participant information sheet and the informed consent question, and those who consented to participate were next directed to the survey. Participants could choose to stop answering the questionnaire at any point or skip a question within the survey. The questionnaire was administered through SurveyMonkey (SurveyMonkey Inc., San Mateo, California, United States) and was available online between December 2016 and May 2017.

Data collection

The questionnaire consisted of three sections (see Appendix A). The first section collected data regarding sociodemographic characteristics: age, gender, ethnicity, occupational status, education, physical activity level, comorbidities, and any medications or supplements that participants were taking at the time of survey completion. Ethnicity was self-reported and re-coded to the following ethnic groups used by the Ministry of Health: European, Māori, Pacific Island, Asian or Middle Eastern/Latin American/African (Ministry of Health, 2010). Ethnicity was coded using the hierarchical method, in which each individual was assigned one ethnic group using a priority order, with Māori prioritised first followed by Pacific, Asian, Middle Eastern/Latin American/African and European/Other (Statistics New Zealand, 2013).

The second section collected data regarding participants' OA characteristics: hip and/or knee joint/s affected, duration of symptoms, time since diagnosis and average pain intensity in the past week (rated on a numerical rating scale from 0–10 where 0 is no pain and 10 is the worst pain imaginable). Participants were also asked to list in chronological order all healthcare professionals they had consulted for their OA.

OA-QI questionnaire

The third section of the survey consisted of the 17-item OA-QI questionnaire (Østerås et al., 2013). Individual items in the survey each referred to a specific intervention for OA recommended by international clinical guidelines (e.g. the National Institute for Health and Clinical Excellence [NICE] guidelines) (National Institute for Health and Care Excellence, 2015). Participants were asked to respond "Yes", "No", or "Not applicable" indicating whether they had been offered that intervention. Six items related to education regarding OA: disease progression, treatment alternatives, self-management, lifestyle change and physical activity. Two items asked participants about weight-loss interventions, three items about mobility interventions, and five items about pharmacological management (including offering paracetamol, stronger pain killers, and non-steroidal anti-inflammatory drugs [NSAIDs]). The final item asked whether participants have been referred for surgical assessment. An additional question was included in this study asking participants whether they had undergone surgery for their OA. Minor wording changes were made to the OA-QI for the New Zealand context, e.g. the drug name acetaminophen was replaced with paracetamol.

Data analysis

Data were analysed using SPSS Windows 22.0 software package (IBM SPSS Inc, Chicago, IL, United States). Continuous data were analysed as means, standard deviations, and ranges. Categorical

data were analysed using frequencies and percentages of total responses. OA-QI achievement rates were calculated for each individual quality indicator and for the study sample as a whole, whereby the numerator represented the number of “Yes” responses and the denominator represented the number of eligible responses (that is, the total number of “Yes” and “No” responses) (Østerås et al., 2013). Confidence intervals were calculated using the Adjusted Wald Method (2005).

RESULTS

A total of 118 people were recruited to the study, of which five participants completed informed consent but did not continue with the questionnaire, and a further seven partially completed the survey. Hence, analysis was undertaken on 106 complete surveys.

Demographic and disease characteristics

The mean (standard deviation [SD]) age of participants was 62.4 (11.9) years. The majority of participants were female (87%, $n=92$) and of European ethnicity (94%, $n=100$) (Table 1). Approximately half were employed (52%, $n=55$), three-quarters had attained tertiary qualifications (75%, $n=79$) and half reported engaging in physical activity almost every day (50%, $n=53$). Over three-quarters (75%, $n=80$) reported knee OA while 63% ($n=67$) reported hip OA. Almost all participants had experienced pain or stiffness in the past month (98%, $n=104$) with a mean (SD) pain intensity of 5.5 (2.1) out of 10.

Table 1: Demographic and osteoarthritis characteristics of participants (n = 106)

Characteristic		<i>n</i> (%) ^a
Age (years)	Mean (SD), range	62.4 (11.9), 18–86
Sex	Female	92 (87)
	Male	14 (13)
Ethnicity	Māori	3 (3)
	Pacific Islander	0
	Asian	2 (2)
	Middle Eastern/Latin American/African	1 (1)
	European	100 (94)
Occupational status	Working full time/part time	55 (52)
	Retired	42 (40)
	Unemployed/student/disability beneficiary	9 (8)
Highest education level	Secondary	27 (26)
	Tertiary	79 (75)
Physical activity level	Never	1 (1)
	Less than once a week	6 (6)
	Once a week	11 (10)
	2–3 times per week	35 (33)
	Almost every day	53 (50)
Comorbidities	Other rheumatic diseases	14 (13)
	Other chronic non-rheumatic diseases	30 (28)
OA site	Hip	67 (63)
	Knee	80 (75)
Pain or stiffness in the last month	Yes	104 (98)
Time since OA symptom onset	<5 years	33 (31)
	5–10 years	31 (29)

Characteristic		n (%) ^a
	> 10 years	42 (40)
Time since OA diagnosis	<5 years	51 (48)
	5–10 years	27 (25)
	>10 years	23 (22)
	Not reported	5 (5)
Pain level, mean (SD) ^b	Mean (SD), range	5.5 (2.1), 1–9

Note: OA, osteoarthritis; SD, standard deviation

^a Some percentages add up to more than 100% as participants could select more than one category. ^b Pain in the last week rated on a numerical rating scale from 0 (no pain) to 10 (worst pain imaginable).

OA quality indicator achievement rates

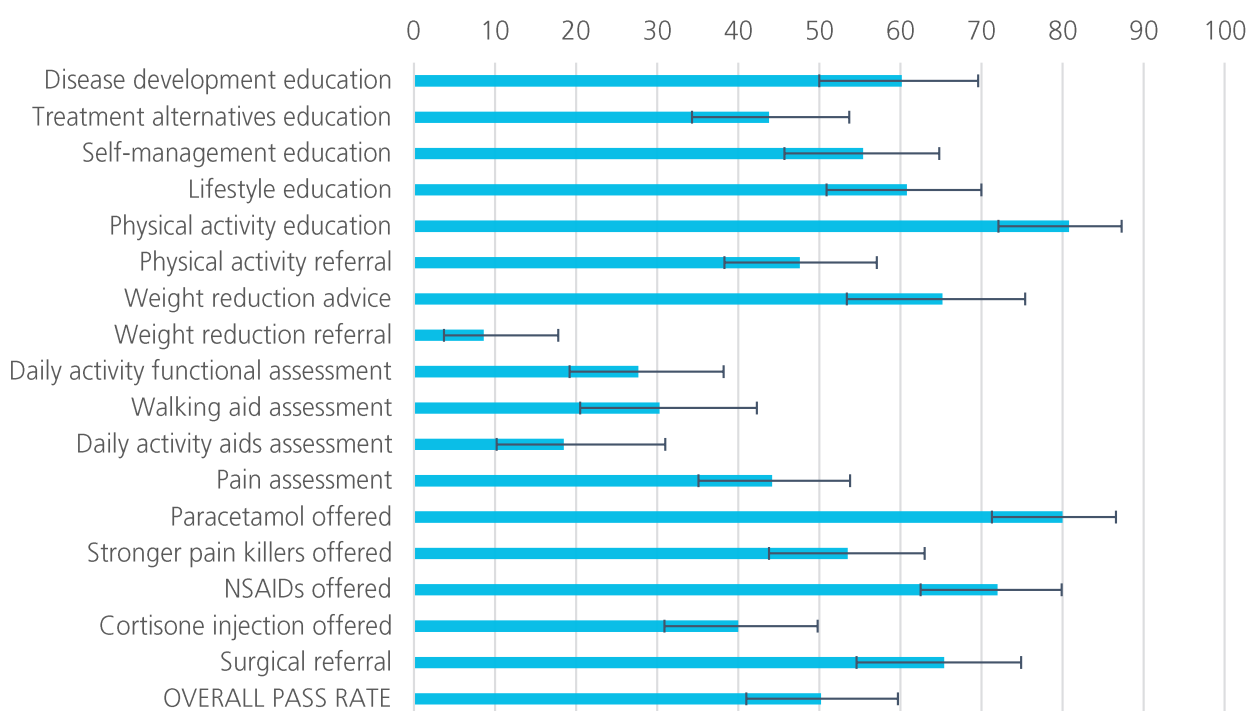
Achievement rates were calculated for each OA quality indicator, representing the proportion of participants in the sample who had reported receiving that intervention during the course of their OA management. There was wide variation in achievement rates across the 17 OA quality indicators. The average achievement rate for OA quality indicators was 50.2% (95% CI 41.0–59.7%) (Figure 1). Achievement rates were lowest for weight reduction referral (8.6%; 3.7–17.8%), daily activity aids assessment (18.5%; 10.2–31.0%), daily activity functional assessment (27.7%; 19.2–38.2%) and walking aid assessment

(30.3%; 20.5–42.3%). Achievement rates were highest for physical activity education (80.8%; 72.1–87.3%), offering of paracetamol for pain relief (80.0%; 71.3–86.6%), offering of NSAIDs (72.0%; 62.5–79.9%), and referral for surgical assessment (65.4%; 54.6–74.9%).

Eligible responses exclude those stating not applicable/do not remember and those who did not respond. Overall pass rate calculated as mean (95% CI) of pass rates for all indicators.

Clinical pathway for people with OA

Table 2 shows the clinical pathways followed by participants



Note: CI, confidence interval; OA, osteoarthritis

Figure 1: Achievement rates for OA quality indicators, represented as percentage (95% CI) of eligible respondents

in terms of the chronological order in which they consulted with healthcare professionals. The GP was the first professional consulted for 92.4% ($n=98$) of participants. Almost one-third (30.0%, $n=24$) of participants saw an orthopaedic surgeon as their second healthcare professional, while 21.3% ($n=17$) saw a physiotherapist and 13.8% ($n=11$) saw another health professional.

DISCUSSION

This study aimed to investigate the quality of care being offered to people with hip and knee OA in New Zealand using a validated patient-reported outcome measure – the OA-QI (Østerås et al., 2013). On average, half of the 17 clinical indicators were met, although there was wide variation in achievement rates. Physical activity education, pharmacological management and surgical referral represented areas of strength in quality of care, while weight reduction and daily activity assessment were identified as areas for improvement. While almost all participants reported consulting their GP for their OA, there was a great deal of variation in subsequent clinical pathways in terms of other clinicians consulted. Generalisation of these findings to the broader population of New Zealanders with OA is limited on account of the small, non-representative sample.

Strengths and limitations

The two primary strengths of this study were that it collected data about treatments from the patient's perspective and that it employed a validated patient-reported outcome measure, which allowed direct comparison of the findings with previous research conducted elsewhere. The study had four important limitations. Firstly, the small sample size and lack of heterogeneity limits

generalisability of the findings. Specifically, our sample comprised mostly females (87%), and had a higher proportion of participants of European ethnicity (94% compared to 74% in the national population) and participants reporting tertiary qualifications (75% compared to 51% of New Zealanders), although self-reported physical activity rates were comparable (50% reported engaging in physical activity almost every day compared to 51% of New Zealanders) (Ministry of Education, 2017; Sport New Zealand, 2015; Statistics New Zealand, 2013). Secondly, the use of self-reported data on treatments received may have introduced bias that may not reflect actual behaviour. Thirdly, the survey was conducted online, eliciting an undefined sample, an unknown response rate and no ability to follow up with non-responders. Fourthly, as we only included people who had been told by their GP that they had OA, our sample did not include people who have OA but have not been diagnosed by a GP. As such, generalisability of these findings to the broader OA population, particularly Māori, Pacific Islanders and other non-European ethnicities, is limited.

OA quality indicator achievement rates

The mean achievement rate of 50% for the OA quality indicators was higher than previous studies, which ranged from 31 to 47% (Grønhaug et al., 2015, 2014; Østerås et al., 2015; Østerås et al., 2013). This difference may be due to discrepancies between the inclusion criteria of the studies, with two including participants with hand, hip and knee OA (Grønhaug et al., 2015; Østerås et al., 2013); and one with knee OA only (Østerås et al., 2015). Nonetheless, the mean achievement rate of 50% is still less than optimal, as not all treatments outlined in clinical guidelines are being implemented. Encouragingly, over 80% of participants reported receiving

Table 2: Clinical pathways for people with hip and/or knee osteoarthritis in terms of order of health professionals consulted

	Visit order <i>n</i> (%)				Visited at least once <i>n</i> (%)
	First	Second	Third	Fourth	
General practitioner	98 (92)	4 (5)	2 (4)	1 (4)	105 (99)
Orthopaedic surgeon	-	24 (30)	13 (28)	4 (16)	42 (40)
Physiotherapist	4 (4)	17 (21)	8 (17)	6 (24)	30 (28)
Medical specialist (e.g. rheumatologist, sports medicine specialist)	-	9 (11)	5 (11)	2 (8)	15 (14)
Pharmacist	2 (2)	7 (9)	3 (6)	3 (12)	15 (14)
Other health professional (e.g. chiropractor, acupuncture, osteopath, laser therapist, massage therapist, personal trainer)	2 (2)	11 (14)	11 (23)	9 (36)	31 (29)
Arthritis educator	-	8 (10)	5 (11)	-	13 (12)

Note: Visit order for first four reported health professionals only. For second, third and fourth visits, percentages calculated using the total number of participants in each column as the denominator

education about physical activity, which is similar to the OA-QI achievement rate in previous studies (Grønhaug et al., 2015, 2014; Østerås et al., 2015; Østerås et al., 2013). This is in keeping with clinical guidelines that advocate for the promotion of physical activity for all people with hip and knee OA (Department of Veterans Affairs, & Department of Defense, 2014; Loew et al., 2012; National Institute for Health and Care Excellence, 2015; Zhang et al., 2008). However, in our study, less than half of participants surveyed had been provided with a referral for physical activity management, supporting the need for improved multi-disciplinary management in New Zealand. The achievement rates for pharmacological interventions (recommended Paracetamol as first medication [80%] and information about anti-inflammatory side-effects [72%]) were higher than identified in previous research, suggesting that pharmacological interventions for OA may be more popular in New Zealand than in other countries (Grønhaug et al., 2014; Østerås et al., 2015; Østerås et al., 2013).

The lowest OA-QI achievement rate was for referral to services for losing weight. While 65% of participants received advice about weight loss, less than one in 10 participants (9%) were provided with a referral for weight-loss services, a pattern that matches previous research (Grønhaug et al., 2015; Østerås et al., 2015; Østerås et al., 2013). A reduction in body weight of between 5 and 10% can significantly reduce pain for people with lower limb OA, and as such, current treatment guidelines recommend weight loss for anyone with OA who is overweight (Brosseau et al., 2016, 2011; Hochberg et al., 2012). However, weight loss is particularly challenging for people with OA when physical activity is limited by joint pain (Bliddal, Leeds, & Christensen, 2014; Carmona-Terés et al., 2017). As such, providing support for people with OA who are overweight or obese is important. The low achievement rate for referral to weight-loss services in this study could be explained by the limited funding of dietetic services in New Zealand and a lack of support for GPs to provide these referrals.

Clinical pathway for OA

The current study adds to existing evidence indicating that the majority of New Zealanders consult their GP about hip and/or knee OA symptoms, and for most people, the GP is the first health professional consulted (Jolly et al., 2017). The high variation among the types of health professionals subsequently consulted highlights that there is at present no clear clinical pathway for people with OA. The introduction of an OA model of care could help provide a clearer clinical pathway, support linkages between health professionals and improve the uptake of evidence-informed clinical guidelines (Baldwin et al., 2017).

The percentage of participants (40%) who reported consulting an orthopaedic surgeon seems high, especially as guidelines indicate that conservative treatment options should be exhausted before surgery is considered and many people with OA do not require surgical intervention (Brand et al., 2014; Brosseau et al., 2016; Department of Veterans Affairs, & Department of Defense, 2014; Hochberg et al., 2012; Loew et al., 2012; National Institute for Health and Care Excellence, 2015; Zhang et al., 2008). This finding may reflect the participants' relatively long mean time since diagnosis (69%

were diagnosed at least five years ago). However, the relatively high rate of referrals may also reflect the absence of a clear clinical pathway for primary care management of OA following best practice guidelines that emphasise conservative treatments.

Less than one-third of all participants reported consulting with a physiotherapist about their OA, which is lower than previously reported (Grønhaug et al., 2014). Exercise therapy and physical activity form part of the core treatments for OA outlined in the NICE clinical guidelines (National Institute for Health and Care Excellence, 2015). In New Zealand, these treatments are often the domain of physiotherapists. There are two possible explanations for the lower than expected rates of physiotherapy consultations: (i) the cost of therapy may have been a barrier, as there is currently limited public funding available in New Zealand for the conservative treatment of people with hip and/or knee OA; and (ii) the participants surveyed reported high habitual physical activity rates (over 80% undertook physical activity at least twice weekly) and thus might not have felt the need to consult a physiotherapist, although the type of physical activity was not collected.

Nonetheless, NICE clinical guidelines recommend both local muscle strengthening (e.g. comprising specific exercises prescribed by a physiotherapist) as well as general aerobic fitness (National Institute for Health and Care Excellence, 2015), and physiotherapists possess specialist expertise in both of these areas.

CONCLUSION

On average, quality indicators for OA were achieved for half of this small sample of New Zealanders surveyed with hip and knee OA. Weight reduction referral and daily activity aids assessment were least frequently reported as being treatments received by people with OA, and these represent treatments which lie within the expertise and scope of physiotherapists. While GPs are consulted for the majority of patients with OA, the follow-up care pathway is varied and inconsistent. Quality improvement for management of OA is indicated, and physiotherapists could be involved together with GPs as key primary care providers. Findings from this study must be interpreted with caution on account of the small, non-representative sample of participants surveyed.

KEY POINTS

1. On average, half of all quality indicators for osteoarthritis are being met in New Zealand.
2. Lowest achievement rates for osteoarthritis are for weight reduction and daily activity aids assessment.
3. There is no clear clinical pathway for osteoarthritis.
4. Physiotherapists could work together with GPs as key healthcare providers for osteoarthritis treatment.

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DISCLOSURES

This study was supported by a grant from Arthritis New Zealand. The authors declare no conflicts of interest.

PERMISSIONS

Ethical approval for this study was granted by the Auckland University of Technology Ethics Committee (reference number 16/407).

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Appendix A

QUESTIONNAIRE

Consent to participate in the survey

1. I wish to take part in this study, I have read the participant information sheet on the previous page and have been given adequate time to make this decision.

Demographic data

2. What was your age in years at your last birthday?
3. What is your gender?
 Male
 Female
4. What is your ethnicity? (Please select all that apply)
 New Zealand European
 Māori
 Pacific Islander
 Asian
 Indian
 Middle Eastern
 Latin American African
 Other (please specify)
5. What is your current occupational status?
 Working full time
 Working part time
 Unemployed
 Retired
 Disability beneficiary
 Other (please specify)
6. What is the highest level of school you have completed or the highest degree you have received?
 None
 Primary
 Secondary
 Tertiary
7. In a typical week, how many times do you engage in physical activity?
 Never
 Less than once a week
 Once a week
 2-3 times per week
 Almost every day

8. Other health problems: Has your doctor told you that you have any of the following? (Tick all those that apply to you)
 Other rheumatic diseases
 Other chronic non-rheumatic diseases
 No other rheumatic or chronic diseases
9. Please list the medications that you are currently taking for your osteoarthritis.
10. Please list any dietary supplements that you are currently taking for your osteoarthritis.

Disease characteristics

11. Which of your joints are affected by osteoarthritis?
 One hip joint
 Both hips joint
 One knee joint
 Both knee joints
12. How long have you experienced symptoms from osteoarthritis?
13. How long ago were you diagnosed with osteoarthritis by your GP?
14. Have you suffered from joint pain or stiffness in the last month?
 Yes No
15. Please rate your pain in the last week on a scale from 0 to 10 (0=no pain to 10=unbearable pain).

Number of healthcare visits in the past year

16. In the past year, how many times have you consulted with your GP?
17. In the past year, how many times have you consulted with a medical specialist, e.g. rheumatologist?
18. In the past year, how many times have you consulted with an orthopaedic surgeon?
19. In the past year, how many times have you consulted with a physiotherapist?
20. In the past year, how many times have you consulted with an alternative health practitioner?
21. In the past year, how many times have you consulted with a health educator or peer support group?
22. Please list any other healthcare practitioners that you may have consulted in the past year, as well as the number of times you consulted with them.

Information

There are several different treatment alternatives for osteoarthritis. We would like to know what treatment, information or advice that you have been given for your osteoarthritis. For each question, please select one of the boxes provided.

23. Have you been given information about how the disease usually develops over time?
 Yes No
 Don't remember
24. Have you been given information about different treatment alternatives?
 Yes No
 Don't remember
25. Have you been given information about how you can live with the disease?
 Yes No
 Don't remember
26. Have you been given information about how you can change your lifestyle?
 Yes No
 Don't remember
27. Have you been given information about the importance of physical activity and exercise?
 Yes No
 Don't remember
28. Have you been referred to someone who can advise you about physical activity and exercise? (e.g. a physiotherapist)
 Yes No
 Don't remember

Weight

29. If you are overweight, have you been advised to lose weight?
 Yes No
 Not overweight
30. If you are overweight, have you been referred to someone who can help you to lose weight?
 Yes No
 Not overweight

Activities of daily living and mobility

31. If you have had problems related to daily activities, have these problems been assessed by health personnel in the past year?
 Yes No
 No such problems
32. If you have problems with walking, has your need for a walking aid been assessed? (e.g. stick, crutch or walker)
 Yes No
 No such problems
33. If you have problems related to other daily activities, has your need for different appliances and aids been assessed? (e.g. splints, assistive technology for cooking or personal hygiene, or a special chair)

- Yes No
 No such problems

Pain and medication

34. If you have pain, has it been assessed in the past year?
 Yes No
 No pain/discomfort
35. If you have pain, was Paracetamol or Panadol the first medicine that was recommended for your osteoarthritic pain?
 Yes No
 No pain/discomfort
36. If you have prolonged severe pain which is not relieved sufficiently by paracetamol, have you been offered stronger pain killers? (e.g. coproxamol, co-dydramol, tramadol, co-codamol, dihydrocodeine or codeine).
 Yes No
 No pain/discomfort
37. If you are taking anti-inflammatory drugs, have you been given information about the effects and possible side effects of this medicine? (e.g. Ibuprofen, Nurofen, Brufen, Diclofenac, Voltarol, Naproxen, Naprosyn or Celebrex).
 Yes No
 No pain/discomfort
38. If you have experienced an acute deterioration of your symptoms, has a corticosteroid injection been considered?
 Yes No
 No pain/discomfort

Surgery

39. If you are severely troubled by your osteoarthritis, and exercise and medicine have not helped, have you been referred and assessed for an operation? (e.g. joint replacement)
 Yes No
 I am not severely troubled by my osteoarthritis
40. If you answered yes to the question above, have you had surgery as a result of your osteoarthritis?
 Yes No
 If yes, please specify. If no, do you anticipate that you will have surgery for your osteoarthritis?

The order in which you sought treatment

41. Name the healthcare providers and list them in the order in which you have sought help from them for your osteoarthritis. (e.g. if your GP was the first healthcare provider you sought help for your OA, then you write 1. GP. If you went to the pharmacist next independent of the GP (not to collect your prescription from the GP), then they are 2. Pharmacist. If the third source of help was a health food shop, then they are 3. Health food shop.

