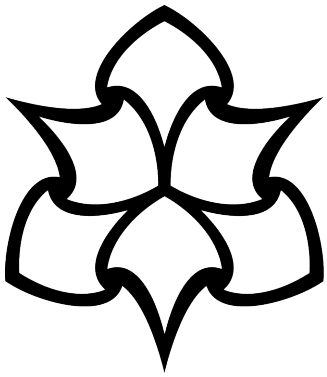

## INTRODUCTION

Shoulder pain has an estimated prevalence of 15-30% of the population[1], rotator cuff tendinopathy implicated as the cause in approximately a third of these patients [2]. Evidence highlights that the associated pain and functional limitations from rotator cuff tendinopathy have a profound impact on daily life and can lead to substantial societal burden via work absenteeism and utilisation of healthcare resources [3]. Up to 50% of those affected experience ongoing pain and disability beyond 12 months and many eventually have surgical intervention [4].

Conservative management including advice, activity modification and clinician guided exercise is recommended as the first-line treatment for 6-12 weeks prior to considering imaging, injection or surgical referral [5, 6]. Although consensus among guidelines recommends exercise for rotator cuff tendinopathy [5-9], the optimal type of exercise and exercise parameters are unknown [10, 11].

Bury and Littlewood [12], performing a similar survey to Littlewood et al. [13], found that physiotherapy practice in the United Kingdom (UK) was in line with guideline recommendations in rotator cuff tendinopathy. A similar survey design by Pieters et al [14] found this was also true for Belgian and Dutch physiotherapists. Australian physiotherapist adherence to recommended care is currently unknown, but a survey of Australian general practitioners and rheumatologists demonstrated practice that was contrary to recommended practice guidelines [15, 16]. Specifically, imaging, injection

and surgical referrals were recommended prior to appropriate conservative treatment [15].

Physiotherapists are key care providers for people with shoulder pain [12] and therefore may significantly impact quality of care. However, physiotherapist management of rotator cuff tendinopathy has not been explored in Australia. It is important to identify how consistent physiotherapists are in delivering recommended management to identify practice gaps if they exist. They can then be addressed to ultimately reduce unnecessary procedures and improve patient outcomes. The aims of this study were to: 1.) investigate physiotherapists' management of rotator cuff tendinopathy; 2.) compare this to recommended practice and; 3.) identify any gaps in practice.

## MATERIALS AND METHODS:

### Study design

A cross-sectional survey exploring physiotherapists' management of rotator cuff tendinopathy was performed. The design was adapted from a similar survey used in a prior study by Bury and Littlewood[12]. The research was approved by Monash University Human Research Ethics Committee (project ID: 12800).

### Recruitment and sampling method

This study used a cross-sectional survey design to gather information from physiotherapists located within Australia. The survey was advertised in the Australian Physiotherapy Association's online newsletter on two occasions and participants were

47 provided a link to the online survey. The survey was available online for a 6-month
48 period from February 2018 to August 2018. Physiotherapists were excluded if they
49 were not from Australia.
50
51 Survey instrument
52 The survey instrument (see Appendix 1) was constructed using Qualtrics software
53 (Qualtrics, Provo, Utah) and consisted of 27 questions. The survey was initially
54 designed by a sub-group of the investigators and subsequently pilot-tested with a
55 convenience sample of 5 rotator cuff tendinopathy experts, to test for clarity and
56 potential online operational issues. Minor subsequent amendments were made
57 following feedback from the pilot test.
58
59 In the final instrument, participant characteristics collected were: age range, years of
60 clinical experience, gender, highest level of qualification and whether they had a
61 special interest in shoulder pain. A clinical vignette was provided to assess participant
62 clinical reasoning (see figure 1), design encapsulating a common initial presentation of
63 rotator cuff tendinopathy modified from the work of Bury and Littlewood [12]. Clinical
64 vignettes have been shown to be valid tools for reflecting on clinical practice and
65 clinical reasoned decision making [17] . Subsequent questions incorporated: (1) multiple
66 choice questions exploring the frequency of treatment in and expected length of
67 treatment for patients with rotator cuff tendinopathy in regards to the vignette and;
68 (2) open ended questions exploring practitioner beliefs and clinical reasoning
69 regarding the vignette. The survey also incorporated five open questions exploring

understanding of values and specific practice of clinicians in regards to exercise parameters (e.g. load-intensity, sets, repetitions) and education (e.g. about exercise progression and regression) they provide patients with rotator cuff tendinopathy.

A 57-year-old man, an accountant, presents with a 6-month history of discomfort in his right antero-lateral shoulder region. The pain came on gradually and there is no history of trauma. The pain is intermittent, made worse by reaching overhead and sleeping on his affected side. He has no pain with rest. Passive range of motion is normal. Cervical spine assessment is normal. No imaging studies have been undertaken. He has no other medical conditions, is not taking any medication and there are no indications of red flags. He has not had any treatment, aside from advice from the GP to rest from aggravating activities.

For the purposes of this survey we define a presentation like this as rotator cuff tendinopathy, but please note it has many synonyms in the literature including supraspinatus, infraspinatus or subscapularis tendinopathy, rotator cuff related pain, rotator cuff tendinitis, rotator cuff tears, subacromial bursitis and subacromial impingement syndrome.

Figure 1. Clinical Vignette

Determination of recommended care

To establish whether participant responses were consistent with current recommended management we compared their answers to relevant guidelines. A

summary of evidence from these guidelines and reviews in reference to questions arising from the vignette is shown in Appendix 2.

Statistical analysis

All survey data was exported from Qualtrics to SPSS version 25 (IBM Corp., Armonk, NY, USA) data analysis software. The prevalence of demographic information including experience, post-graduate training, work setting, work location and special interest in shoulder pain was reported. In relation to the clinical vignette, the frequency of referrals for imaging, injections and surgical opinion, as well as exercise, adjunct and education interventions were reported for the entire cohort. The relationship education, special interest, work setting and work location and referral decisions (i.e. referral for imaging, injection and surgical opinion) were investigated (Chi-square). The relationship between frequency of review and work context was also investigated (Chi-square). The alpha level for all analyses was set at 0.05.

Each open ended question response was transcribed verbatim with identifying data removed. Microsoft Excel (Microsoft excel, 2016) was used to manage the survey data and compare the responses. A qualitative content analysis approach was employed. This analysis approach allows for large amounts of data to be reduced to concepts that describe the research [18]. Two researchers collaboratively identified units of meaning by reading each response, and manually developing initial codes. The codes were deductively derived into initial categories inspired by the focus of the open questions, topics which are often addressed during physiotherapy management. Following regular

meetings and discussion, codes were further refined into categories and a descriptive column was inserted into the Excel spreadsheet. In addition, we undertook a frequency count of the content to aid interpretation. We negotiated any researcher-perspective differences; and, if necessary, regrouped and recoded until reaching consensus. Our final step examined relationships between categories to form themes.

## RESULTS

Five hundred and two physiotherapists completed the survey, with 70.2% (353/502) registering complete responses. A flow diagram of recruitment is shown in figure 2.

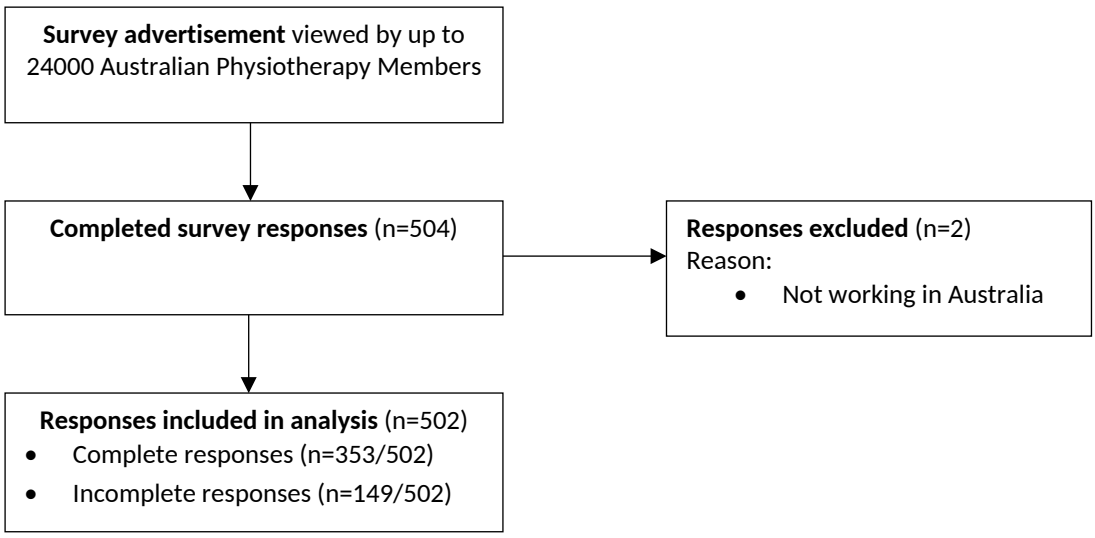


Figure 2. Recruitment flowchart

The demographic characteristics of the cohort are shown in Table 1. Most respondents worked in private practice (344/480; 71.7%) and a metropolitan locations (340/483; 69.0%). Similar proportions reported that they did or did not have a special interest in managing shoulder pain and post graduate clinical training (e.g. masters or post

graduate diploma). Respondents had been treating shoulder pain for an average of 14.8 years (SD=11.7, range 1 to 51 years).

| | Frequency | % |
|---|---|---|
| Age | | |
| 18-24 | 36 | 7.3% |
| 25-34 | 150 | 30.4% |
| 35-44 | 113 | 22.9% |
| 45-54 | 105 | 21.1% |
| 55-64 | 80 | 16.2% |
| >64 | 10 | 2% |
| Location | | |
| Rural | 143 | 29.6% |
| Metropolitan | 340 | 70.4% |
| Clinical setting | | |
| Private practice | 344 | 71.7% |
| Non-private practice | 136 | 28.3% |
| Level of education | | |
| Postgraduate | 235 | 48% |
| No postgraduate | 255 | 52% |
| Special interest in shoulder pain or rotator cuff related pain | | |
| Yes | 220 | 45.9% |
| No | 259 | 54.1% |
| Average number of shoulder pain cases treated per month | | |
| <5 | 96 | 20.4% |
| 6-10 | 164 | 34.9% |
| 11-20 | 137 | 29.2% |
| >20 | 73 | 15.5% |

Table 1. Respondent demographic information

Recommended care for the clinical vignette

*Referrals*

Most respondents did not recommend imaging (441/471; 93.6%). Among the minority that recommended imaging, the most commonly recommended imaging modality was ultrasound (26/30, 86.7%), followed by MRI (9/30; 30.0%) and X-ray (7/30; 23.3%) (respondents able to pick multiple modalities). Physiotherapists with a special interest

in shoulder pain (19/214; 8.9%) recommended imaging significantly more than those without a special interest (11/245; 4.3%) (Chi-squared=4.095, p=.043). Work setting, location and level of training were not associated with imaging decision.

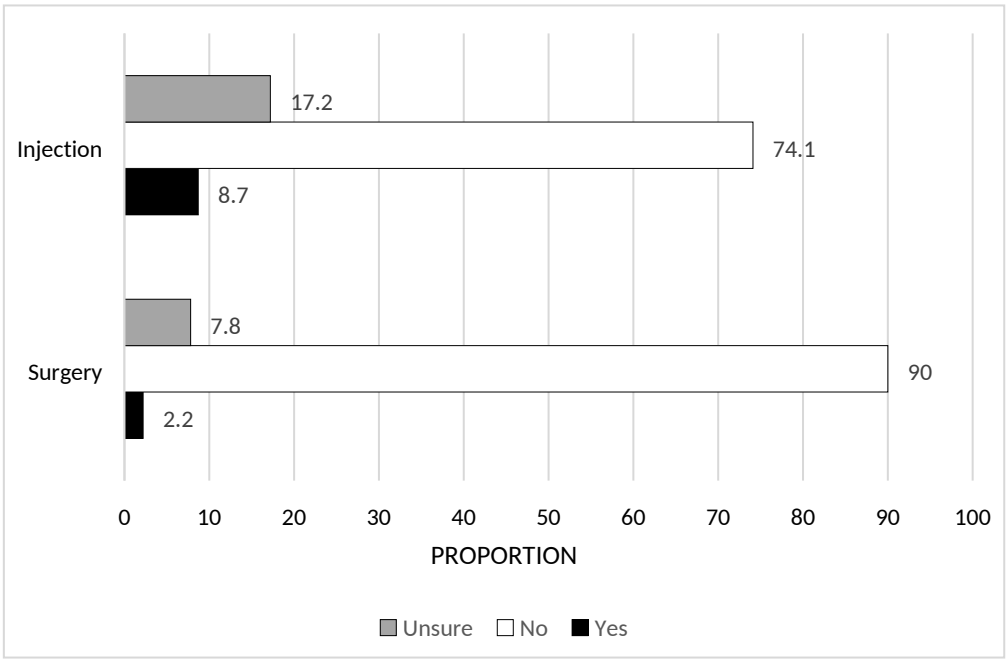


Figure 3. Proportion of physiotherapists recommending referral for clinical vignette

Referral for injection (figure 3). was not recommended by most physiotherapists for the case presented (340/459; 74.1%) shown in figure 3. The remaining 25.9% (119/459) were either unsure or would recommend injection. Physiotherapists working in non-private practice environments were significantly more uncertain (answering 'unsure') about referral for injection (34/128; 26.6%) than those working in private practice 13.6% (45/331) (Chi-squared=11.063, p=.004). Special interest, location and training were not significantly associated with referral decision.

A small proportion of physiotherapists would refer for surgical opinion (10/459; 2.2%) or were unsure whether to refer (36/459; 7.8%) in reference to the clinical vignette (figure 3). Surgical referral was not significantly associated with special interest, training, location or work setting.

*Management*

Figure 4 shows that various strategies are recommended by physiotherapists for rotator cuff tendinopathy. Consistent with recommended care, 99.8% (501/502) prescribed some form of exercise. The most popular exercise included scapular exercise (366/502; 72.9%), rotator cuff exercise (358/502; 71.3%) and isometric exercise (302/502; 60.2%). Less than 30.0% of participants recommended proprioceptive (147/502; 29.3%) or stretching exercise (135/502; 26.9%).

Considering adjunctive management, shown in figure 5, most physiotherapists would provide massage (314/502; 62.5%) and taping (267/502; 53.2%). Almost half (240/502; 47.8%,) would recommend treatment directed towards the thoracic or cervical spine, 47% (236/502) recommended mobilisation, 43.2% (217/502) recommend use of paracetamol and oral anti-inflammatories and 30.3% (152/502) perform acupuncture or dry needling. The least common treatments were hot or cold therapy (144/502; 28.7%), electrotherapy (56/502; 11.2%), rest (53/502; 10.6%) and manipulation (15/502; 3%). In the 'other' category further comments were made with recommendations including yoga, postural re-education, trigger point and myofascial therapy.

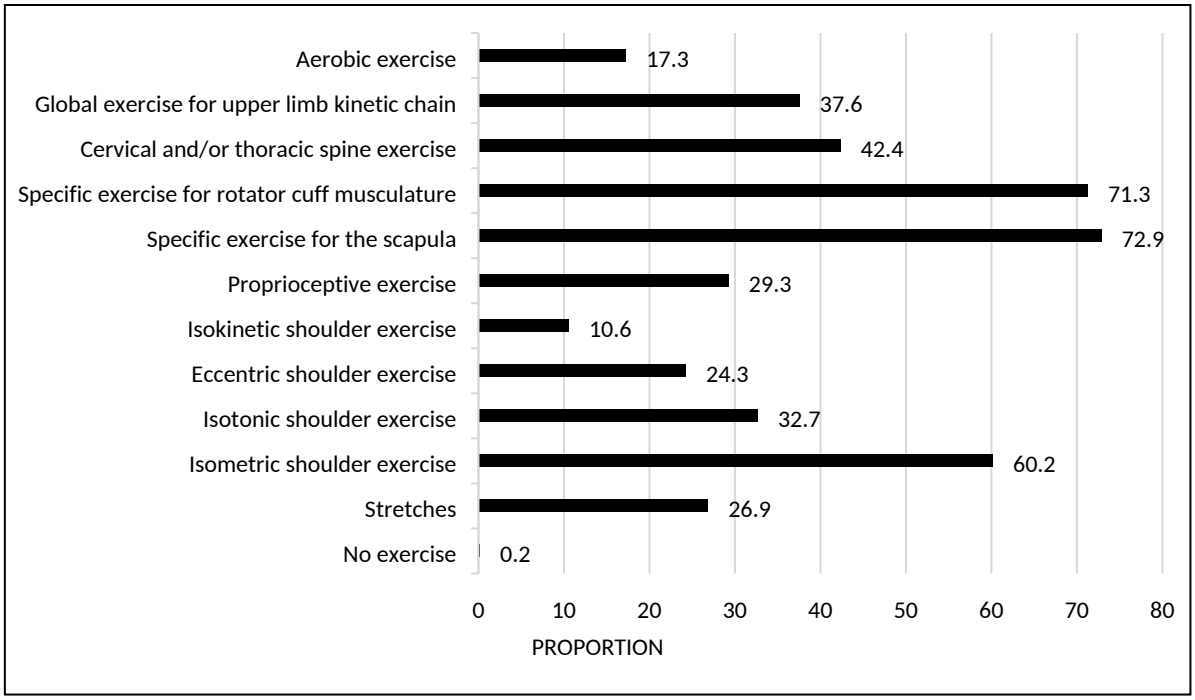


Figure 4. Proportion of recommended exercise strategies

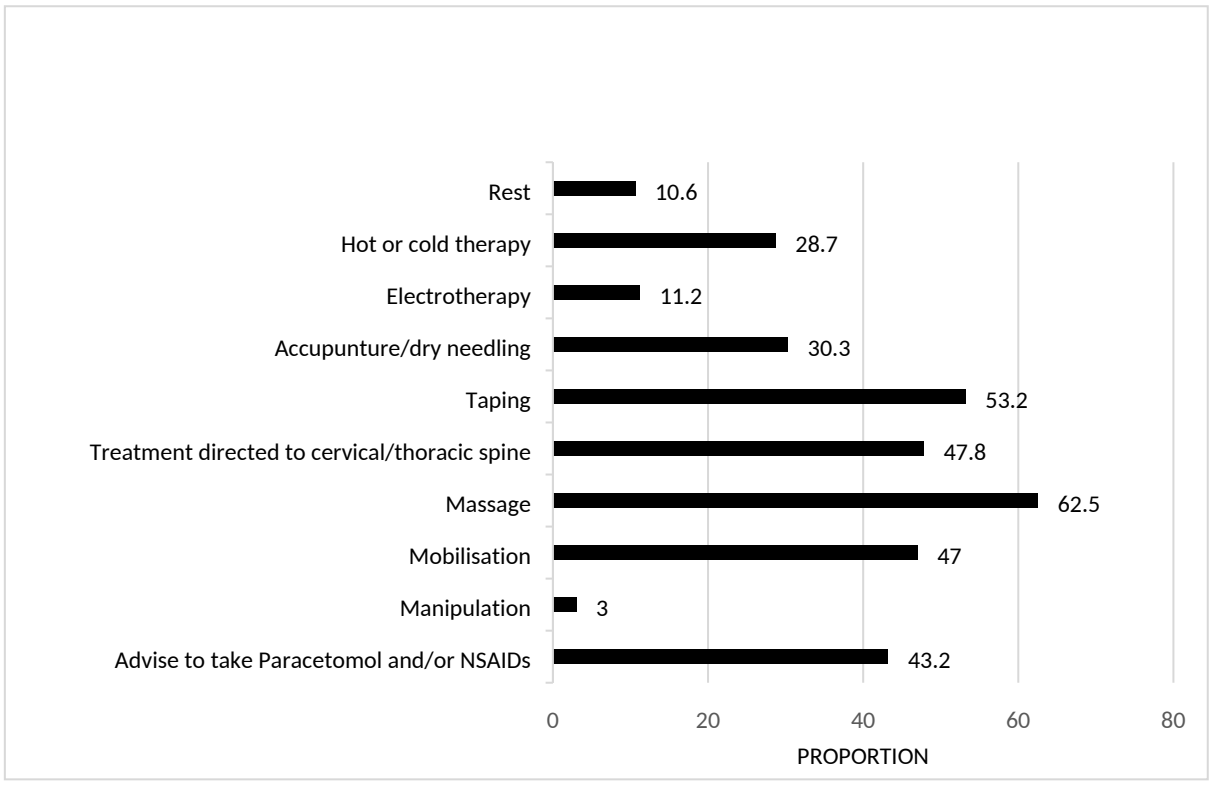

Figure 5. Proportion of recommended adjunctive treatment

Figure 6 shows the proportion of physiotherapists that would deliver various forms of education. Most physiotherapists (442/502; 88%) would provide education regarding recommended physiotherapy management, discuss activity modification in response to pain (428/502; 85.3%), educate about risk factors (374/502; 74.5%) and explore the relationship between pathology and pain (317/502; 63.1%). About half of the physiotherapists surveyed would provide education on factors that modify pain (258/502; 51.4%) and educate patients on the role of imaging (253/502; 50.4%). A minority of physiotherapists reported discussing the role of injections (179/502; 35.7%) and surgery (126/502; 25.1%). Open responses related to education included education on posture and scapula positioning, prognosis and the anatomy of the shoulder.

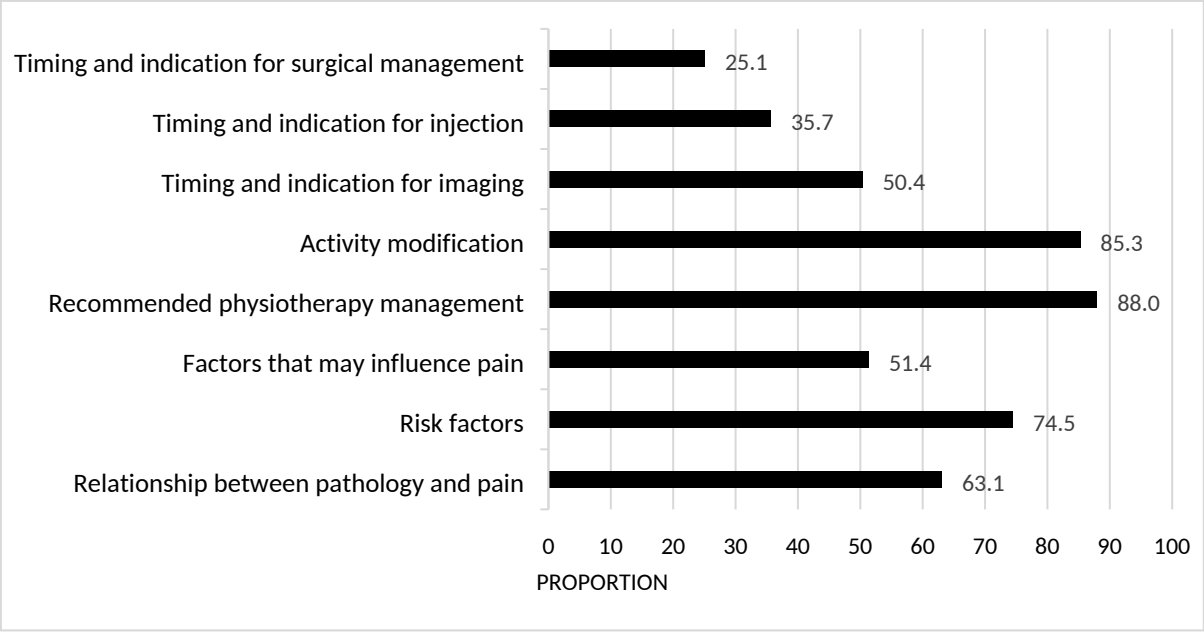

Figure 6. Proportion of recommended education topics

*Information formats*

Most physiotherapists would provide written or printed information (396/502; 78.9%), followed by verbal information (384/502; 76.5%) whilst a minority would provide website links (85/502; 16.9%) or recorded videos (162/502; 32.3%).

*Management frequency and duration*

Almost all physiotherapists would review rotator cuff tendinopathy patients either weekly (176/353; 49.8%) or fortnightly (161/353; 45.6%) to progress or modify exercises. The majority (176/353; 49.8%) are consistent with expert recommendations of weekly review for at least 12 weeks [19]. Respondents in private practice (141/320; 44.1%) were more likely to review frequently (weekly) compared with public sector physiotherapists (35/121; 28.9%) (Chi square = 4.50, p=0.025). Metropolitan physiotherapists (135/230; 58.7%) were also more likely to review patients weekly compared to their rural counterparts (41/105; 39.1%) (Chi square=11.161, p=0.001). Special interest and training did not influence frequency of reviews. Some physiotherapists reported in the open response field that patient review would depend on patient factors such as stage of recovery, independence and coping ability. Others reported that appointment availability and patient finances would influence attendance frequency.

Over half of the respondents (240/399; 60.2%) would expect to see rotator cuff tendinopathy patients for 3 months or longer, whereas 35.8% (158/399) would expect a timeframe of 6-8 weeks (figure 7). Some physiotherapists reported (in open response) that timeframes are dependent on patient recovery and factors that may alter response to treatment such as yellow flags or non-modifiable risk factors. Special interest, training, work setting, and location were not associated with expectation of treatment duration.

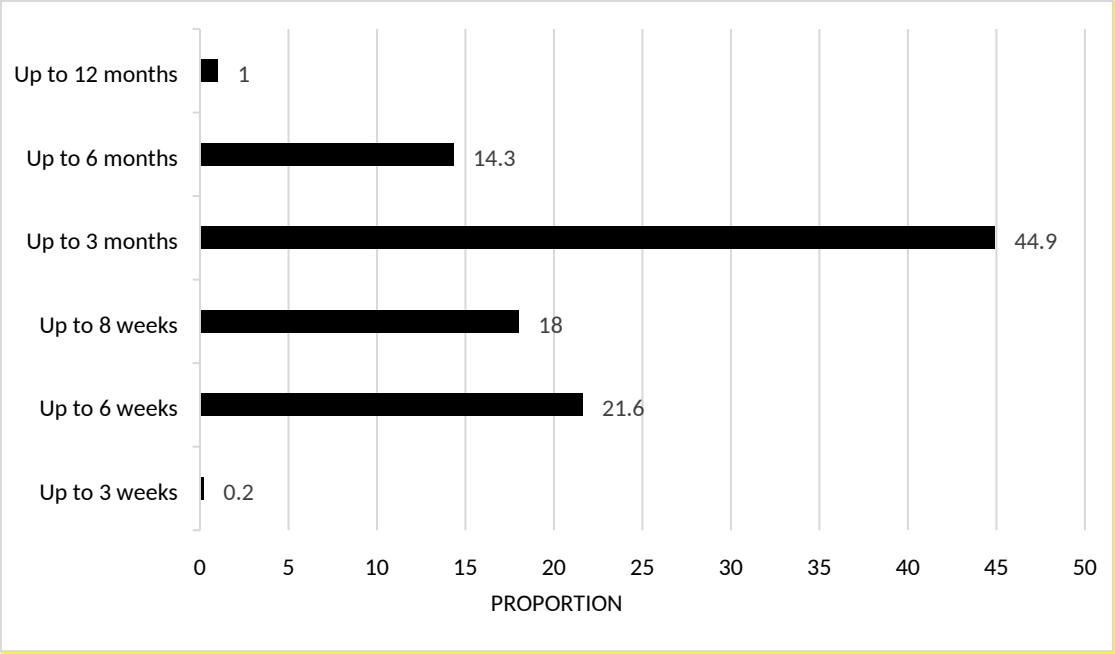


Figure 7. Proportion of expected treatment duration

*Qualitative findings*

Content analysis of the open questions yielded 5 categories with frequency counts giving an indication of content inclusion.

1. *When prescribing exercise, what instructions do you generally give the patient in regards to pain during exercise?*

The extent to which respondents allowed for the experience of pain during rehabilitation exercise ranged from no pain during exercise (139/418; 33.3%) to pain being allowed during exercise (279/418; 66.7%). When educating patients that pain is allowed during exercise, approximately half of the respondents reportedly used a numeric rating scale to assist to quantify the appropriate level of pain that may be experienced (142/279; 50.9%). Acceptable parameters reported ranged from "No greater than 1-2 out of 10" (Participant (P) 24) up to "No more than 6 out of 10" (P 346). The remainder of respondents allowed pain during exercise (137/279; 49.1%) according to subjective descriptions, ranging from "Mild pain that eases shortly after exercise is ok" (P210) to higher levels, "Any pain is fine during exercise so long as it settles after 24 hours" (P 38).

2. *When prescribing exercise, what instructions do you generally give the patient in regards to load/resistance?*

Exercise prescription parameters and the reasoning behind these reportedly varied among respondents. Over half of respondents (196/380; 51.6%) reported graduated intensity with no reasoning to justify their discussion, such as "Start with low load, 1-2kg" (P238) or "Exercises start at 60-70% of Repetition Maximum" (P 280). Load intensity was described as symptom dependent (e.g. "Whatever load results in an initial 4-5/10 in pain but doesn't worsen "; P 35) or fatigue dependent (e.g. "Enough load so that fatigued at the end of 12-15 reps"; P155) by 24.7% (94/380) of respondents. Of the remaining responses 11.1% (42/380) described load as dependent

on technique such as the “maximum that the patient can perform maintaining good form/technique” (P 57), 5.0% (19/380) described load as dependent on goal of exercise (strength, endurance, proprioception etc.), 4.7% (18/380) discussed load dependent on outcome of clinical assessment and 2.9% (11/380) stated that load was dependent on exercise type (isometric, isotonic, stretches etc.).

3. *When prescribing exercise, what instructions do you generally give the patient in regards to progression and regression?*

Ideas and reasoning behind progression and regression were closely aligned among respondents and were centered on two key concepts; (1) how to progress or regress and (2) why progress or regress. Participants indicated it was necessary to increase exercise dose to progress exercise. There were various descriptions of how this could be achieved, including: increasing weight or resistance by (58.2%; 113/194), increasing repetitions or sets (36.1%; 70/194); and increase in range of motion (5.7%; 11/194). To regress exercises 72.1% (88/122) would reduce repetitions and sets, 24.6% (30/122) would reduce resistance or weight while 3.3% would reduce range of motion of the exercise (4/122).

Responses describing why they would progress exercises fell into three categories: (1) patient’s ability to correctly perform the exercise without worsening symptoms (97/158; 61.4%); (2) progression based on timelines (e.g. “every 3-4 weeks”; P 1) (25/158; 15.8%) and (3) individual performance during clinical assessment (36/158; 22.8%). Similar categories were reported when respondents discussed when they

would regress exercises. Most (189/207; 91.3%) cited they would regress exercises and "reduce repetitions or resistance if the exercise "was too difficult or painful" (P 354) or if the exercise was performed incorrectly. The remainder (18/207; 8.7%) indicated they would regress exercises if required following clinical patient examination but were non-specific as to why.

4. *When prescribing exercise, what instructions do you generally give the patient in regards to reps and sets?*

Substantial variability was expressed by respondents concerning the clinical reasoning behind the prescription of exercise repetitions and sets. Most participants (254/396; 64.1%) cited the prescription of a specific number of repetitions and sets without providing reasoning. The number of repetitions and sets was highly variable ranging in number from "1 set of 15" (P 104) to, "An easy approach to remember: 8-12 repetitions, 3-5 sets" (P 343). Where a reason was given, this commonly related to ensuring appropriate pain and tolerance to exercise (43/396; 10.9%). For example, one respondent indicated, "it depends on their pain and [symptom] irritability. Often more endurance based, 2-3 sets 15-20, but more irritable patients do smaller doses more frequently" (P 391). Other respondent reported that prescribed repetitions and sets were dependent on the type of exercise (34/396; 8.6%) (e.g. "3x45sec holds [isometric], 3x12 [isotonic])" (P 12), the ability to "generate fatigue" (P 472) (5.3%: 21/396), the patient's goals (22/396; 5.6%) or clinical reassessment (22/396; 5.6%)

5. *When prescribing exercise, what instructions do you generally give the patient in regards to how often?*

Respondents typically suggested daily exercise performance or exercise performance several times weekly. The majority of respondents (340/424; 80.2%) recommended exercises be at least once daily ranging from “once per day” (P 27) to “3-5 times daily” (P207). The next most frequent response was exercise performance several times weekly (36/424; 8.5%). There were varied responses among the remaining respondents (48/424; 11.3%), that could be categorised as dependent on: (1) the type of exercise performed “ (2) fatiguability and (3) patient factors such as “pain tolerance and quality of movement” (participant 118) during in room assessment.

## DISCUSSION

Results of the survey study identified that most physiotherapists provide care in accordance with current practice recommendations in rotator cuff tendinopathy. This includes providing recommended exercise and advice [5-9]. Importantly, few reported that they would recommend immediate referral for imaging or surgical opinion prior to conservative treatment, consistent with recommendations [5, 6, 9]. However disparity is shown in specific approaches within exercise, education and adjunctive management; and many physiotherapists engage in out of scope care recommending medication use.

### *Exercise treatment*

We found that almost all (99.8%) of physiotherapists surveyed provide some form of exercise for rotator cuff tendinopathy, however, there was substantial variability regarding exercise type. This is unsurprising when considering the number of exercise trials and the non-uniformity of exercise interventions in the literature [10, 11, 20]. The most recent Cochrane systematic review on exercise interventions for rotator cuff tendinopathy included 60 exercise trials varied in regards to exercise type and parameters [10]. From the survey, most physiotherapists direct exercise treatment towards the scapula (72.9%) and rotator cuff musculature (71.3%), consistent with current literature and guideline suggestions [6, 8]. Isometric exercise is the most popular exercise type used by 60.2% of physiotherapists in the survey, despite limited evidence on this approach[10]. Isotonic exercise, more commonly described in the literature is only used by 32.7% of physiotherapists. However, it is possible that they used both isometric and isotonic exercise types in parallel, as has been recommended by narrative reviews in other tendinopathies [21].

*Physiotherapists' views about exercise parameters*

Overall, there was substantial variability in recommended exercise parameters which is consistent with the diversity of approaches in the current literature [10, 11]. Pain was consistently a major factor in determining exercise parameters. Most physiotherapists surveyed allow pain during exercise, the amount of pain allowed highly variable. A recent consensus of shoulder clinical experts recommend mild to moderate pain (less than 4/10 pain on a numeric rating scale) during exercises, as long as pain subsides to baseline level within 12 hours [19]. However, the authors note that some experts in this

consensus group believed that no pain should be allowed during shoulder exercise [8]. In contrast, a recent systematic review assessing the effect of painful and pain-free exercise on musculoskeletal pain concluded that painful exercise results in improved patient outcomes in the short term and equivalent outcomes in the longer term [22]. Future studies should assess whether painful exercise leads to superior outcomes and the optimal level of pain during exercise.

Recommendations for exercise parameters were highly variable, once again reflecting the lack of consensus in the literature [10, 11, 20]. We identified a substantial diversity in recommendations for the amount of load, sets, repetitions and frequency of exercise, as well as the method of introducing load (weights, resistance bands, body weight etc.). The principle of gradually increasing the difficulty of exercise by adding load or other dose parameters (e.g. sets, reps) featured strongly in the views of the physiotherapists and this is consistent with current evidence and guidelines [5, 6].

The rationale for recommended exercise parameters was predominately based on patient-reported symptoms. Fewer responses cited parameters dependent on other factors including quality of movement, generation of fatigue or goal dependent. It is well recognized that musculoskeletal conditions such as rotator cuff tendinopathy have various clinical phases with differing symptom levels [23]. It follows, that in more symptomatic phases pain may be a key driver of exercise decisions and this may switch to other factors such as functional capacity in more symptomatic phases. More

research is required to understand the key criteria that we should use to guide dosage prescription for people with different clinical stages of rotator cuff tendinopathy.

The lack of consensus on exercise treatment for rotator cuff tendinopathy may also be a reflection of a heterogeneous population that requires a diverse and adaptable approach to treatment [24]. People with rotator cuff tendinopathy present with differing levels of pain and dysfunction and clinicians may accordingly adjust exercise approach based on these and other presenting characteristics [25]. Further research is required to determine whether this explains heterogeneity in respondent exercise recommendation and based on what parameters. Consequently, trial designs can be developed to test the efficacy of novel exercise approaches informed by the current evidence and clinicians beliefs.

*Adjunctive treatment*

Adjunctive care was also highly varied, but most physiotherapists recommended some form of manual therapy (massage, mobilization) in line with current guideline recommendations [5-7]. Surprisingly almost half (43.2%) of the respondents discussed the use of paracetamol and oral anti-inflammatories for pain despite clear guidelines about over-the-counter drugs in physiotherapy's scope of practice [26]. Physiotherapists may engage in this because they view it as low risk for potential benefit and because these pain medications are recommended as first line management for general practitioners [5, 6, 8]. Given the proportion of physiotherapists engaging in out of scope practice, training in appropriate strategies and referral pathways to provide advice

388 about medication is warranted. Alternatively, education pathways could be introduced
389 allowing physiotherapists to extend their scope of practice to advice and prescription
390 of basic medication [27].
391
392 A notable finding of this survey was that low value or unknown value adjunctive care is
393 evident with one in ten (11.2%) physiotherapists surveyed using electrotherapy.
394 Multiple studies have concluded that electrotherapy provides no benefit in rotator cuff
395 tendinopathy [6, 28]. At best these practices waste valuable patient time and health-care
396 resources and at worse they may result in failure of conservative treatment, extend
397 patient morbidity and even result in unnecessary second line interventions (e.g.
398 injections and surgery) [29].
399
400 *Education*
401 Variable education is provided as outlined by survey responses. Education about
402 activity modification and risk factors is recommended in clinical guidelines [5, 6, 9] and
403 was recommended by most physiotherapists (85.3% and 74.5% respectively). It is
404 concerning that 15% of physiotherapists in this sample do not provide advice about
405 activity modification. Continuing activities that aggravate symptoms may result in
406 failure of conservative management [6]. The most concerning gap in education provided
407 related to treatments and referrals. As part of evidence based medicine it is important
408 for clinicians to provide patients with an overview of treatments available and the role
409 and efficacy for these treatments [30]. This includes out of scope treatments such as
410 injections and surgery. If patient's are not educated on these different options, they

411 are unable to make informed choices, engaging instead in limited shared decision
412 making conversations, and ethically flawed practice [31]. Greater emphasis needs to be
413 placed on education of various diagnostic and treatment options, allowing the patient
414 to make informed choices in the shared decision making process.
415
416 *Imaging, injections and surgery*
417 Regarding recommendations for surgical referral and imaging, physiotherapists were
418 generally consistent with the current evidence, suggesting neither is required for our
419 clinical vignette. Some uncertainty was evident regarding whether referral for injection
420 was indicated, expressed by 17.2% of respondents, those working in non-private
421 practice environments were more likely to be uncertain. This uncertainty is reflected in
422 the literature with some guidelines recommending corticosteroid injection as part of
423 initial treatment [8, 32] as opposed to recommending injection only after no
424 improvement with conservative management [6]. This warrants further research into
425 injection treatments to reach consensus on specific indications in rotator cuff
426 tendinopathy and education of Australian physiotherapists.
427
428 *Environmental impacts*
429 Physiotherapists in non-private practice environments and those in rural areas were
430 more likely to review patients less frequently. Expert consensus recommends weekly
431 reviews of rotator cuff tendinopathy patients over a period of at least 12 weeks [19, 33]
432 .Limited physiotherapy capacity in rural areas is a likely explanation for less frequent
433 reviews in rural areas. Decreased community access and scarcity of services have been

shown to increase the burden on rural physiotherapy services, impeding their ability to provide frequent reviews [34]. Whether weekly physiotherapy services are required for rotator cuff tendinopathy and whether they can be partly replaced by remote care in rural areas or even online resources requires further investigation.

*Comparison to other nationalities*

Since this study is similar to those of Bury and Littlewood [12] and Pieters et al. [14] some comparisons can be made between the current physiotherapy practice of Australia, the UK, Belgium and the Netherlands. Frequency of imaging referral for Australian physiotherapists (6.4%) was similar to that in the UK (9%) whereas a higher proportion (31%) of Belgian and Dutch physiotherapists would recommend imaging [12, 14]. Similar to the Dutch and Belgians (37.8%), Australian physiotherapists (47%) would often recommend mobilisation as part of treatment, compared to only 21% of those in the UK [12, 14]. Exercise and education were highly recommended, a staple of management by all nationalities, however differences within this practice are evident by region. Isotonic exercise was recommended less commonly by Australian physiotherapists (32.7%) compared to their counterparts in the UK (67%) and the Netherlands and Belgium (59.8%) [12, 14]. The rates of recommending exercise into some discomfort were comparable between regions, as were the low use of electrotherapy and recommendations for injection or surgical opinion.

Overall, physiotherapists are relatively consistent in applying recommended practice through delivery of exercise and education and avoiding inappropriate referrals for

imaging and surgical opinion. Heterogeneity exists in the methods and parameters of treatment delivery. The limitations of the evidence base provide general practice guidelines only, leading to heterogeneity in the application of individual treatment regimes.

## LIMITATIONS

Although we were able to sample a large cohort (>500 respondents), a small proportion of questions (open responses about exercise parameters and questions about frequency and duration) were incomplete. Further, we used convenience sampling methods and were unable to calculate a response rate. There are 26000 Australian Physiotherapy Association members that may have seen our advertisement (a much smaller number is likely to have seen it) and we surveyed 502 people (1.9% of members). It is possible there was selection bias, for example, clinicians that were confident in their rotator cuff tendinopathy knowledge responded. There were also significantly more responses from clinicians in private practice and from metropolitan regions, so the responses may not be indicative of the wider Australian physiotherapy population. Regardless of this limitation, this is a first step towards understanding the quality of care delivered by physiotherapists managing rotator cuff tendinopathy. There are also limitations related to de-identified online surveys that need to be highlighted. De-identified online surveys introduce the risk of participants completing the questionnaire more than once and the possibility that participants are not registered physiotherapists. Use of a clinical vignette may be considered a limitation as it can reduce external validity of the findings[35], impacting the strength of this study.

However careful construction of the vignette using current research to inform design may reduce this risk[35].

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- Physiotherapists are broadly consistent with best practice recommendations
- Heterogeneity exists in delivery of exercise, education and adjunctive treatment
- Many physiotherapists engage in out of scope care through recommending medication
- Australian physiotherapy practice is comparable to that of other nationalities

**Abstract**

Background: Rotator cuff tendinopathy is a common and disabling cause of shoulder pain. While conservative treatment is recommended as initial management, recent findings suggest that general practitioners and rheumatologists do not consistently align with recommended care. This study aimed to survey Australian physiotherapists to explore the extent to which recommended management is being applied.

Methods: A cross-sectional online survey

Results: Five hundred and two Australian physiotherapists completed the survey. Results demonstrated the majority of physiotherapists provide conservative management consistent with guideline recommendations, through delivery of exercise and education, comparable to management by physiotherapists in the United Kingdom, Belgium and the Netherlands. Parameters and construction of exercise treatment programs were highly variable within the cohort, qualitative analysis highlighting varied reasoning underpinning these management decisions.

Conclusions: Australian physiotherapists are broadly consistent with providing recommended management, however heterogeneity exists in the methods and parameters of treatment delivery.

**Keywords:** rotator cuff, management, tendinopathy