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INTRODUCTION

3 Shoulder pain has an estimated prevalence of 15-30% of the population¹, rotator cuff

4 tendinopathy implicated as the cause in approximately a third of these patients ².

5 Evidence highlights that the associated pain and functional limitations from rotator

6 cuff tendinopathy have a profound impact on daily life and can lead to substantial

7 societal burden via work absenteeism and utilisation of healthcare resources ³. Up to

8 50% of those affected experience ongoing pain and disability beyond 12 months and

9 many eventually have surgical intervention ⁴.

10

11 Conservative management including advice, activity modification and clinician guided

12 exercise is recommended as the first-line treatment for 6-12 weeks prior to

13 considering imaging, injection or surgical referral ^{5, 6}. Although consensus among

14 guidelines recommends exercise for rotator cuff tendinopathy ⁵⁻⁹, the optimal type of

15 exercise and exercise parameters are unknown ^{10, 11}.

16

17 Bury and Littlewood ¹², performing a similar survey to Littlewood et al. ¹³, found that

18 physiotherapy practice in the United Kingdom (UK) was in line with guideline

19 recommendations in rotator cuff tendinopathy. A similar survey design by Pieters et al

20 ¹⁴ found this was also true for Belgian and Dutch physiotherapists. Australian

21 physiotherapist adherence to recommended care is currently unknown, but a survey

22 of Australian general practitioners and rheumatologists demonstrated practice that

23 was contrary to recommended practice guidelines ^{15, 16}. Specifically, imaging, injection

24 and surgical referrals were recommended prior to appropriate conservative treatment

25 15.

26

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

35

36 MATERIALS AND METHODS:

37 Study design

38 A cross-sectional survey exploring physiotherapists' management of rotator cuff
39 tendinopathy was performed. The design was adapted from a similar survey used in a
40 prior study by Bury and Littlewood¹². The research was approved by Monash
41 University Human Research Ethics Committee (project ID: 12800).

42

43 Recruitment and sampling method

44 This study used a cross-sectional survey design to gather information from
45 physiotherapists located within Australia. The survey was advertised in the Australian
46 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

70 understanding of values and specific practice of clinicians in regards to exercise
71 parameters (e.g. load-intensity, sets, repetitions) and education (e.g. about exercise
72 progression and regression) they provide patients with rotator cuff tendinopathy.
73

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.

74 Figure 1. Clinical Vignette

75

76 Determination of recommended care

77 To establish whether participant responses were consistent with current

78 recommended management we compared their answers to relevant guidelines. A

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

81

82 Statistical analysis

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

93

94 Each open ended question response was transcribed verbatim with identifying data
95 removed. Microsoft Excel (Microsoft excel, 2016) was used to manage the survey data
96 and compare the responses. A qualitative content analysis approach was employed.

97 This analysis approach allows for large amounts of data to be reduced to concepts that
98 describe the research ¹⁸. Two researchers collaboratively identified units of meaning by
99 reading each response, and manually developing initial codes. The codes were

100 deductively derived into initial categories inspired by the focus of the open questions,

101 topics which are often addressed during physiotherapy management. Following regular

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

107

108

RESULTS

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

111

112

113

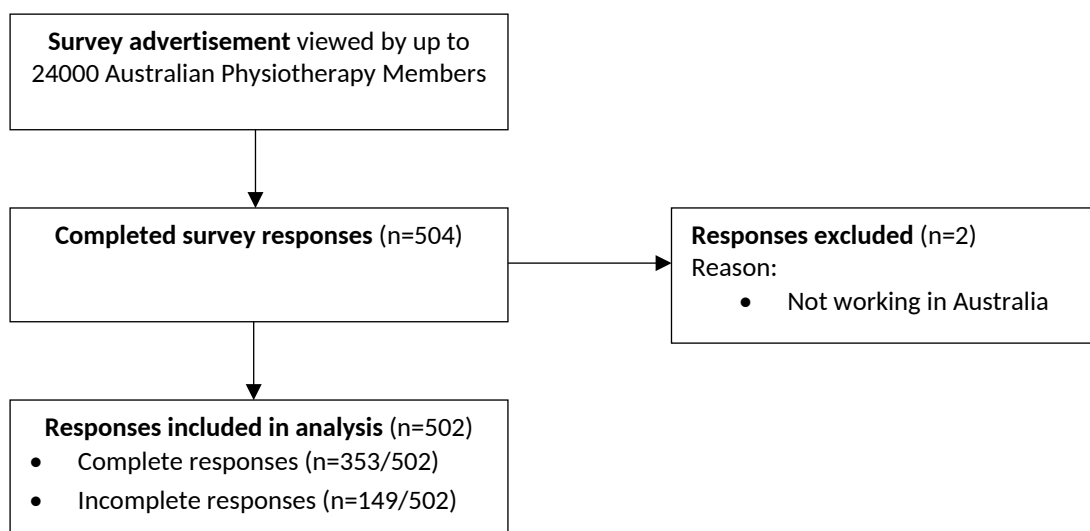
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119 Figure 2. Recruitment flowchart

120 The demographic characteristics of the cohort are shown in Table 1. Most respondents
121 worked in private practice (344/480; 71.7%) and a metropolitan locations (340/483;
122 69.0%). Similar proportions reported that they did or did not have a special interest in
123 managing shoulder pain and post graduate clinical training (e.g. masters or post

124 graduate diploma). Respondents had been treating shoulder pain for an average of
 125 14.8 years (SD=11.7, range 1 to 51 years).

126

	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%

127 Table 1. Respondent demographic information

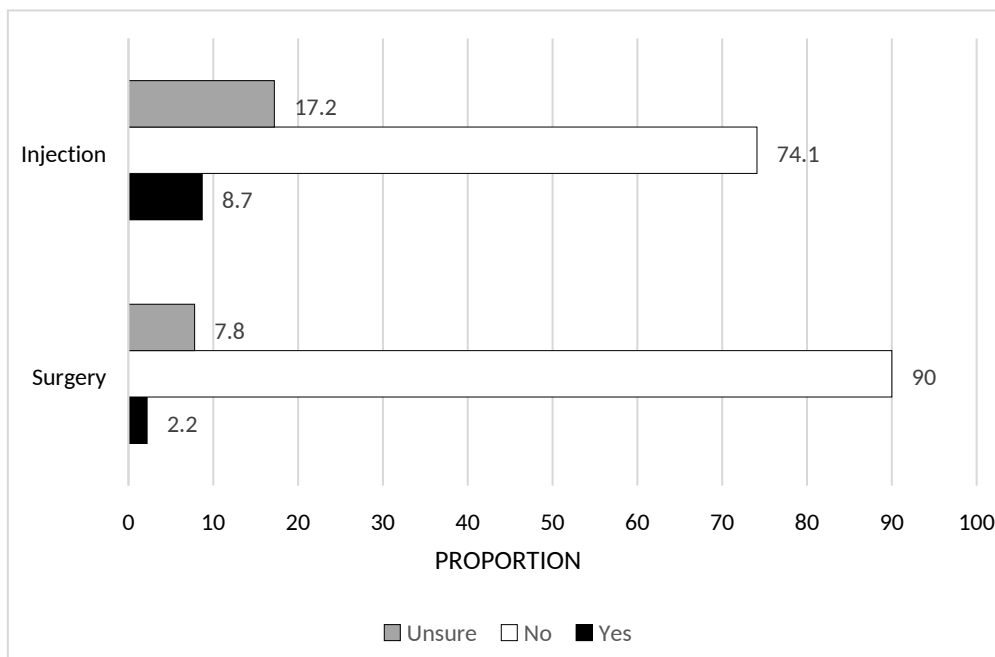
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129 Recommended care for the clinical vignette

130 *Referrals*

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

135 in shoulder pain (19/214; 8.9%) recommended imaging significantly more than those
136 without a special interest (11/245; 4.3%) (Chi-squared=4.095, p=.043). Work setting,
137 location and level of training were not associated with imaging decision.
138



139
140 Figure 3. Proportion of physiotherapists recommending referral for clinical vignette

141
142 Referral for injection (figure 3). was not recommended by most physiotherapists for
143 the case presented (340/459; 74.1%) shown in figure 3. The remaining 25.9%
144 (119/459) were either unsure or would recommend injection. Physiotherapists
145 working in non-private practice environments were significantly more uncertain
146 (answering 'unsure') about referral for injection (34/128; 26.6%) than those working in
147 private practice 13.6% (45/331) (Chi-squared=11.063, p=.004). Special interest,
148 location and training were not significantly associated with referral decision.

149

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

154

155 *Management*

156 Figure 4 shows that various strategies are recommended by physiotherapists for
157 rotator cuff tendinopathy. Consistent with recommended care, 99.8% (501/502)

158 prescribed some form of exercise. The most popular exercise included scapular

159 exercise (366/502; 72.9%), rotator cuff exercise (358/502; 71.3%) and isometric

160 exercise (302/502; 60.2%). Less than 30.0% of participants recommended

161 proprioceptive (147/502; 29.3%) or stretching exercise (135/502; 26.9%).

162

163 Considering adjunctive management, shown in figure 5, most physiotherapists would

164 provide massage (314/502; 62.5%) and taping (267/502; 53.2%). Almost half (240/502;

165 47.8%) would recommend treatment directed towards the thoracic or cervical spine,

166 47% (236/502) recommended mobilisation, 43.2% (217/502) recommend use of

167 paracetamol and oral anti-inflammatories and 30.3% (152/502) perform acupuncture

168 or dry needling. The least common treatments were hot or cold therapy (144/502;

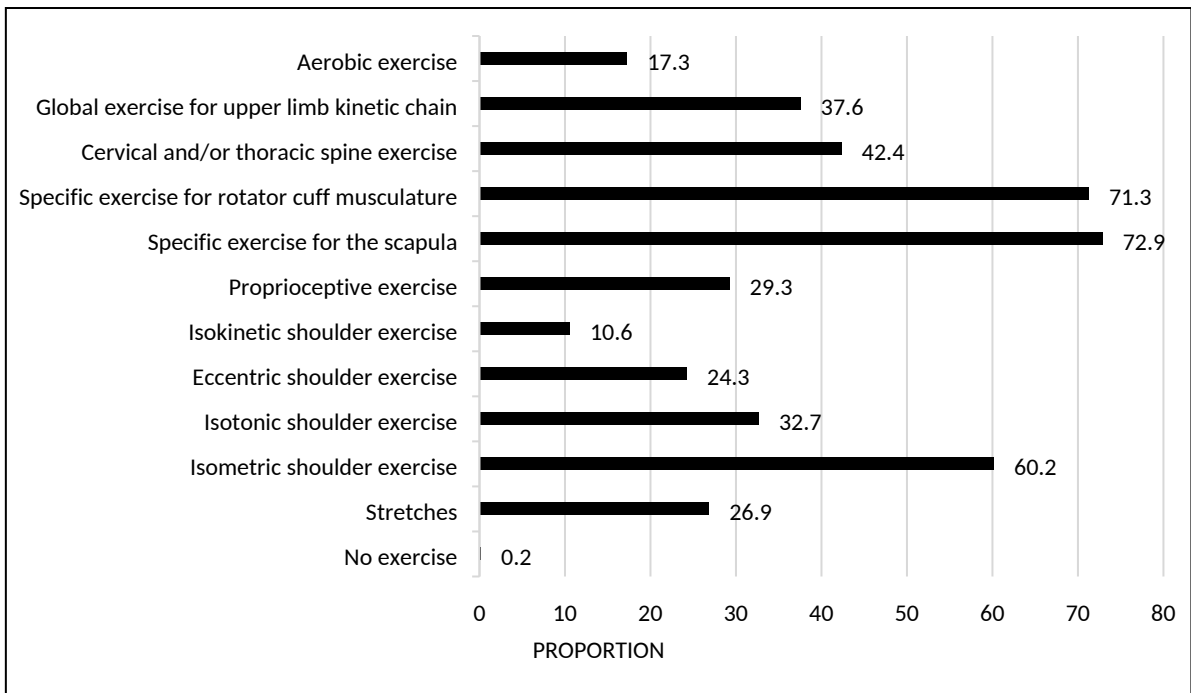
169 28.7%), electrotherapy (56/502; 11.2%), rest (53/502; 10.6%) and manipulation

170 (15/502; 3%). In the 'other' category further comments were made with

171 recommendations including yoga, postural re-education, trigger point and myofascial

172 therapy.

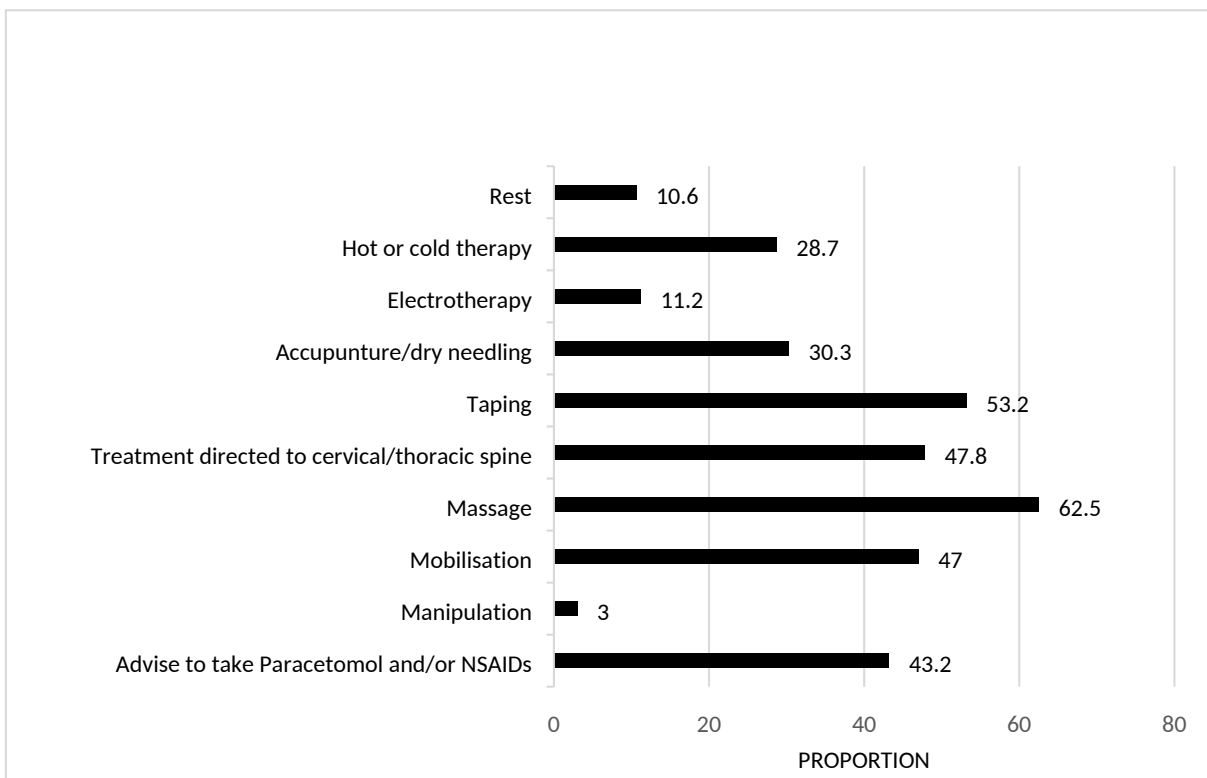
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174

175 Figure 4. Proportion of recommended exercise strategies

176



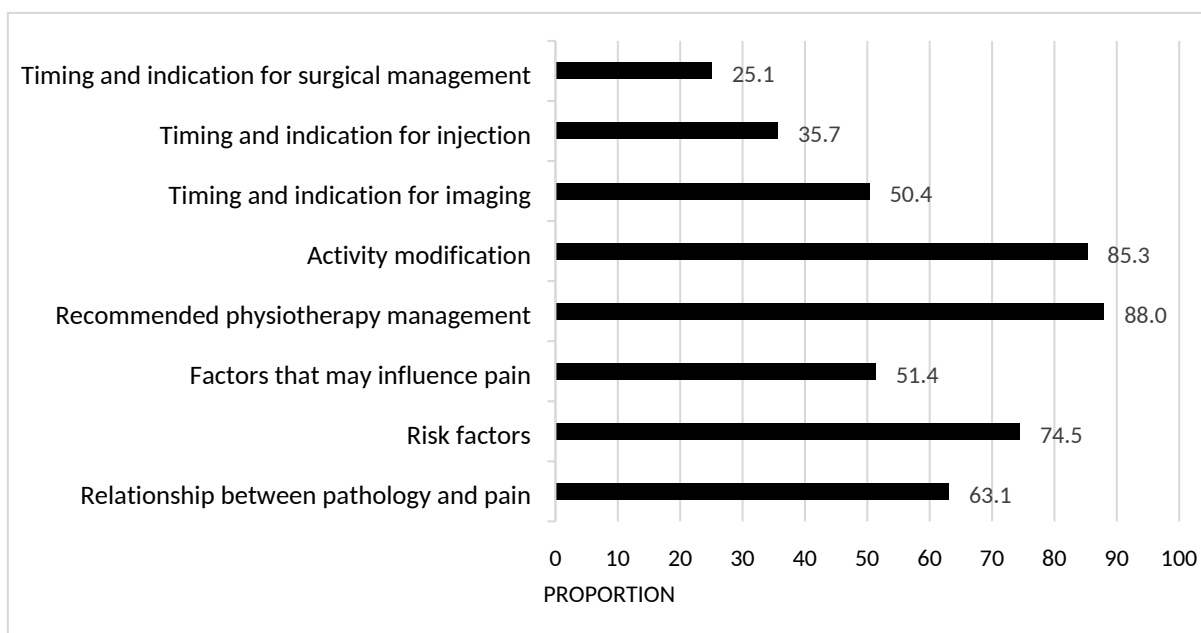
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178 Figure 5. Proportion of recommended adjunctive treatment

179

180 Figure 6 shows the proportion of physiotherapists that would deliver various forms of
181 education. Most physiotherapists (442/502; 88%) would provide education regarding
182 recommended physiotherapy management, discuss activity modification in response
183 to pain (428/502; 85.3%), educate about risk factors (374/502; 74.5%) and explore the
184 relationship between pathology and pain (317/502; 63.1%). About half of the
185 physiotherapists surveyed would provide education on factors that modify pain
186 (258/502; 51.4%) and educate patients on the role of imaging (253/502; 50.4%). A
187 minority of physiotherapists reported discussing the role of injections (179/502;
188 35.7%) and surgery (126/502; 25.1%). Open responses related to education included
189 education on posture and scapula positioning, prognosis and the anatomy of the
190 shoulder.

191



192

193 Figure 6. Proportion of recommended education topics

194

195 *Information formats*

196 Most physiotherapists would provide written or printed information (396/502;

197 78.9%), followed by verbal information (384/502; 76.5%) whilst a minority would

198 provide website links (85/502; 16.9%) or recorded videos (162/502; 32.3%).

199

200 *Management frequency and duration*

201 Almost all physiotherapists would review rotator cuff tendinopathy patients either

202 weekly (176/353; 49.8%) or fortnightly (161/353; 45.6%) to progress or modify

203 exercises. The majority (176/353; 49.8%) are consistent with expert recommendations

204 of weekly review for at least 12 weeks¹⁹. Respondents in private practice (141/320;

205 44.1%) were more likely to review frequently (weekly) compared with public sector

206 physiotherapists (35/121; 28.9%) (Chi square = 4.50, p=0.025). Metropolitan

207 physiotherapists (135/230; 58.7%) were also more likely to review patients weekly

208 compared to their rural counterparts (41/105; 39.1%) (Chi square=11.161, p=0.001).

209 Special interest and training did not influence frequency of reviews. Some

210 physiotherapists reported in the open response field that patient review would

211 depend on patient factors such as stage of recovery, independence and coping ability.

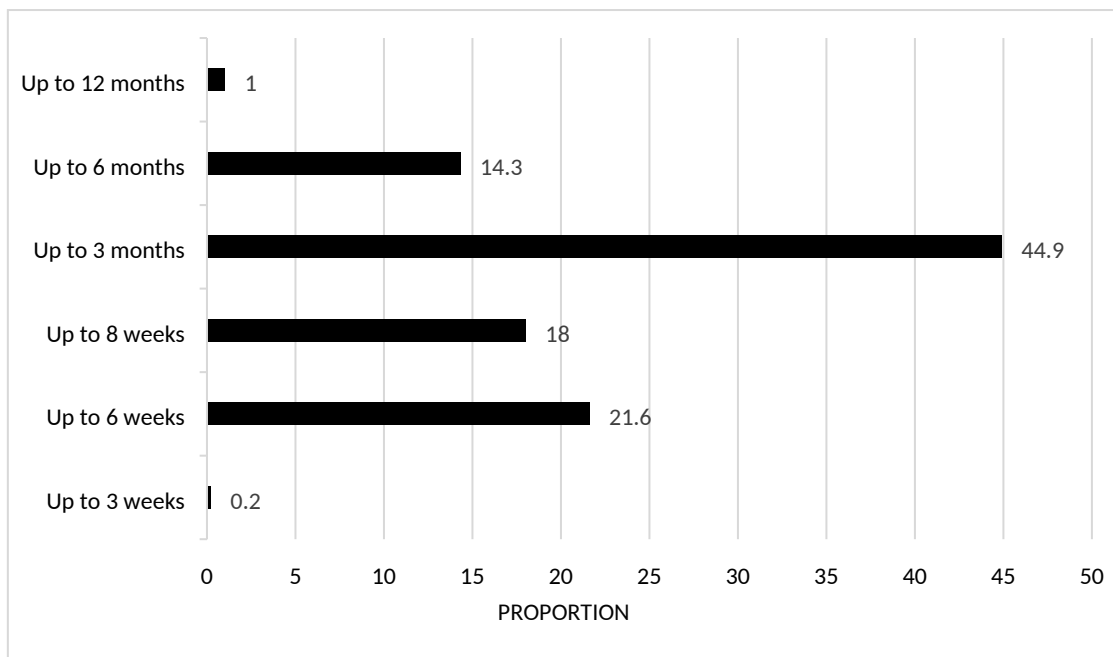
212 Others reported that appointment availability and patient finances would influence

213 attendance frequency.

214

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

222



223

224 **Figure 7. Proportion of expected treatment duration**

225

226 *Qualitative findings*

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

229

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

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

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

245 Exercise prescription parameters and the reasoning behind these reportedly varied
246 among respondents. Over **half** of respondents (196/380; 51.6%) reported graduated
247 intensity with no reasoning to justify their discussion, such as “Start with low load, 1-
248 2kg” (P238) or “Exercises start at 60-70% of Repetition Maximum” (P 280). **Load**
249 **intensity was described as symptom dependent (e.g. “Whatever load results in an**
250 **initial 4-5/10 in pain but doesn’t worsen ”; P 35) or fatigue dependent (e.g. “Enough**
251 **load so that fatigued at the end of 12-15 reps”;** P155) by 24.7% (94/380) of
252 **respondents**. Of the remaining responses 11.1% (42/380) described load as dependent

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

258

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

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

270

271 Responses describing why they would progress exercises fell into three categories: (1)
272 patient’s ability to correctly perform the exercise without worsening symptoms
273 (97/158; 61.4%); (2) **progression based on timelines** (e.g. “every 3-4 weeks”; P 1)
274 (25/158; 15.8%) and (3) **individual performance during clinical assessment** (36/158;
275 22.8%). Similar categories were reported when respondents discussed when they

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

281

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

284 Substantial variability was expressed by respondents concerning the clinical reasoning
285 behind the prescription of exercise repetitions and sets. Most participants (254/396;
286 64.1%) cited the prescription of a specific number of repetitions and sets without
287 providing reasoning. The number of repetitions and sets was highly variable ranging in
288 number from “1 set of 15” (P 104) to, “An easy approach to remember: 8-12
289 repetitions, 3-5 sets” (P 343). Where a reason was given, this commonly related to
290 ensuring appropriate pain and tolerance to exercise (43/396; 10.9%). For example, one
291 respondent indicated, “it depends on their pain and [symptom] irritability. Often more
292 endurance based, 2-3 sets 15-20, but more irritable patients do smaller doses more
293 frequently” (P 391). Other respondent reported that prescribed repetitions and sets
294 were dependent on the type of exercise (34/396; 8.6%) (e.g. “3x45sec holds
295 [isometric], 3x12 [isotonic]”) (P 12), the ability to “generate fatigue” (P 472) (5.3%:
296 21/396), the patient’s goals (22/396; 5.6%) or **clinical reassessment** (22/396; 5.6%)
297

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

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

308

309 DISCUSSION

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

318

319 *Exercise treatment*

320 We found that almost all (99.8%) of physiotherapists surveyed provide some form of
321 exercise for rotator cuff tendinopathy, however, there was substantial variability
322 regarding exercise type. This is unsurprising when considering the number of exercise
323 trials and the non-uniformity of exercise interventions in the literature ^{10, 11, 20}. The
324 most recent Cochrane systematic review on exercise interventions for rotator cuff
325 tendinopathy included 60 exercise trials varied in regards to exercise type and
326 parameters ¹⁰. From the survey, most physiotherapists direct exercise treatment
327 towards the scapula (72.9%) and rotator cuff musculature (71.3%), consistent with
328 current literature and guideline suggestions ^{6, 8}. Isometric exercise is the most popular
329 exercise type used by 60.2% of physiotherapists in the survey, despite limited evidence
330 on this approach¹⁰. Isotonic exercise, more commonly described in the literature is
331 only used by 32.7% of physiotherapists. However, it is possible that they used both
332 isometric and isotonic exercise types in parallel, as has been recommended by
333 narrative reviews in other tendinopathies ²¹.

334

335 *Physiotherapists' views about exercise parameters*

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

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

349

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

357

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

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

367

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

377

378 *Adjunctive treatment*

379 Adjunctive care was also highly varied, but most physiotherapists recommended some
380 form of manual therapy (massage, mobilization) in line with current guideline
381 recommendations ⁵⁻⁷. Surprisingly almost half (43.2%) of the respondents discussed
382 the use of paracetamol and oral anti-inflammatories **for pain despite clear guidelines**
383 **about over-the-counter drugs in physiotherapy's scope of practice** ²⁶. Physiotherapists
384 may engage in this because they view it as low risk for potential benefit and because
385 these pain medications are recommended as first line management for general
386 practitioners ^{5, 6, 8}. Given the proportion of physiotherapists engaging in out of scope
387 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

434 shown to increase the burden on rural physiotherapy services, impeding their ability to
435 provide frequent reviews³⁴. Whether weekly physiotherapy services are required for
436 rotator cuff tendinopathy and whether they can be partly replaced by remote care in
437 rural areas or even online resources requires further investigation.

438

439 *Comparison to other nationalities*

440 Since this study is similar to those of Bury and Littlewood¹² and Pieters et al.¹⁴ some
441 comparisons can be made between the current physiotherapy practice of Australia,
442 the UK, Belgium and the Netherlands. Frequency of imaging referral for Australian
443 physiotherapists (6.4%) was similar to that in the UK (9%) whereas a higher proportion
444 (31%) of Belgian and Dutch physiotherapists would recommend imaging^{12, 14}. Similar
445 to the Dutch and Belgians (37.8%), Australian physiotherapists (47%) would often
446 recommend mobilisation as part of treatment, compared to only 21% of those in the
447 UK^{12, 14}. Exercise and education were highly recommended, a staple of management
448 by all nationalities, however differences within this practice are evident by region.
449 Isotonic exercise was recommended less commonly by Australian physiotherapists
450 (32.7%) compared to their counterparts in the UK (67%) and the Netherlands and
451 Belgium (59.8%)^{12, 14}. The rates of recommending exercise into some discomfort were
452 comparable between regions, as were the low use of electrotherapy and
453 recommendations for injection or surgical opinion.

454

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

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

461

462

LIMITATIONS

463 Although we were able to sample a large cohort (>500 respondents), a small
464 proportion of questions (open responses about exercise parameters and questions
465 about frequency and duration) were incomplete. Further, we used convenience
466 sampling methods and were unable to calculate a response rate. There are 26000
467 Australian Physiotherapy Association members that may have seen our advertisement
468 (a much smaller number is likely to have seen it) and we surveyed 502 people (1.9% of
469 members). It is possible there was selection bias, for example, clinicians that were
470 confident in their rotator cuff tendinopathy knowledge responded. There were also
471 significantly more responses from clinicians in private practice and from metropolitan
472 regions, so the responses may not be indicative of the wider Australian physiotherapy
473 population. Regardless of this limitation, this is a first step towards understanding the
474 quality of care delivered by physiotherapists managing rotator cuff tendinopathy.
475 There are also limitations related to de-identified online surveys that need to be
476 highlighted. De-identified online surveys introduce the risk of participants completing
477 the questionnaire more than once and the possibility that participants are not
478 registered physiotherapists. Use of a clinical vignette may be considered a limitation as
479 it can reduce external validity of the findings³⁵, impacting the strength of this study.

480 However careful construction of the vignette using current research to inform design
481 may reduce this risk³⁵.

482

483

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591

- 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

1 **Abstract**

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

7 Methods: A cross-sectional online survey

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

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

18

19

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

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