

## Management of thoracic spine pain and dysfunction

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DOI:

[10.1016/j.msksp.2018.11.006](https://doi.org/10.1016/j.msksp.2018.11.006)

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*Document Version*

Peer reviewed version

*Citation for published version (Harvard):*

Heneghan, N, Gormley, S, Hallam, C & Rushton, A 2019, 'Management of thoracic spine pain and dysfunction: A survey of clinical practice in the UK', *Musculoskeletal Science and Practice*, vol. 39, pp. 58-66.  
<https://doi.org/10.1016/j.msksp.2018.11.006>

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## INTRODUCTION

1  
2  
3 The escalating prevalence and societal costs (e.g. decreased productivity, disability claim, days lost  
4 from work *etc.*) associated with managing chronic spinal pain continues unabated, with neck and  
5 low back pain leading causes of disability globally (1, 2). Management of neck and low back pain is  
6 informed by evidence-based clinical practice guidelines; however, no comparable guidelines exist for  
7 the thoracic spine (TS); despite a growing body of evidence reporting thoracic spine pain and  
8 dysfunction (TSPD) (3-8).

9  
10 The lifetime prevalence of isolated pain in the TS is relatively low, 13-17% (3, 9), compared to neck  
11 and low back pain, 40% and 57% respectively (9); however, there is now compelling evidence of a  
12 complex relationship between the TS and other regions. Literature has demonstrated co-existing  
13 thoracic pain in musculoskeletal complaints in other regions e.g. neck and elbow (5, 7, 8), motion  
14 analysis studies where full functional arm elevation is affirmed as a composite of shoulder flexion  
15 and thoracic extension (10, 11) and, TS intervention studies reporting improvements for complaints  
16 in the neck (12-19), shoulder (20-23), and low back (24). More specifically, passive TS interventions,  
17 including joint mobilisation, manipulation, have shown promising improvements in neck (12, 15, 16,  
18 25-27) and shoulder complaints (20, 21, 28). Adopting the term 'dysfunction' recognises impairment  
19 in the musculoskeletal system of TS which may affect its integrity during functional movement; a  
20 synergy of motion occurring across different joints (29).

21 Within a biopsychosocial model of practice, where a multimodal approach to the management of  
22 spinal complaints is recommended (30, 31) the therapeutic value of passive interventions (e.g.  
23 mobilisation and manipulation) is recognised, hence their inclusion in some clinical practice  
24 guidelines. In contrast, active interventions, such as exercise, which are unequivocally recommended  
25 in clinical practice guidelines (2, 30-33) have received relatively little attention in TSPD. Exercise  
26 interventions including 'stretching', 'endurance', 'postural control', 'motor control' and  
27 'stabilisation', are utilised widely in the management of neck pain (34) and offer considerable

28 potential for TSPD. With recent research providing preliminary evidence to support TS stabilisation  
29 exercises for postural back pain (35) and the development of inexpensive valid and reliable  
30 measurement approaches the foundation is growing to support further research in this spinal region  
31 (36, 37).

32

33 Whilst there is clearly a considerable way to go in conquering the challenge of musculoskeletal-  
34 related dysfunction (2, 33), knowledge of the current landscape of managing patients with TSPD will  
35 assist prioritising research efforts in this relatively under-researched spinal region (29). As  
36 evidenced by earlier surveys of physiotherapy management for neck and low back pain (34, 38) the  
37 trajectory of subsequent research has largely been focused, rationalised and evidence informed; a  
38 critical consideration given the finite resources available. Furthermore, knowledge of practice across  
39 settings and levels of expertise are required to inform professional practice priorities linked to  
40 implementation of evidence based practice.

41

#### 42 Aim of the Study

43 To investigate clinical physiotherapy practice for managing TSPD in the UK, with a secondary focus  
44 on examining differences across practice settings and levels of physiotherapist expertise.

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#### DESIGN AND METHODS

49 An online 20-question survey was created using LimeSurvey software package  
50 [<https://www.limesurvey.org/about-us/imprint>], see Appendix A. The survey was designed,  
51 and results were analyzed and reported in accordance with the Checklist for Reporting Results of  
52 Internet E-Surveys (CHERRIES) (39), see Appendix B. The survey could be completed on any  
53 electronic device with internet access and was available for completion from 24/12/15 to 08/02/16.

## 54 Survey Development

55 Survey structure and content were informed by a review of current evidence, including comparable  
56 surveys of management of neck and low back pain (34, 38), reviews (20, 29) and author expertise  
57 (NH, AR, SG). The survey comprised primarily closed questions with open questions for additional  
58 information e.g. types of training courses or details of additional approaches to examination and  
59 management. The survey was developed to capture 1) demographic data, training and qualifications,  
60 clinical presentations of TSPD (Questions 1-10), 2) approaches to examination (Questions 11-13, 3)  
61 approaches to management (Questions 14-19) and 4) to explore differences across practice settings  
62 and levels of expertise. A final open-ended question (Question 20) invited free text responses for  
63 other comments.

64 Content validity was enhanced through the inclusion of evidence-based clinical examination and  
65 management approaches (16, 20, 22, 29, 34, 40, 41) and clinical expert opinion (NRH, AR).

66 The survey was piloted by 5 musculoskeletal UK-trained physiotherapists. Based on their  
67 feedback revisions were made regarding wording, clarification of response choices, and  
68 expected duration of completion. Participants and pilot study data were not included in the main  
69 study.

70

## 71 Sample and Recruitment

72 Inclusion criteria: UK-trained physiotherapists who manage patients with TSPD as part of their  
73 clinical practice. Participants were invited, based on stated eligibility criteria (UK physiotherapist  
74 working primarily in musculoskeletal physiotherapy) included within the information sheet to  
75 participate online via professional networks, e-mail [interactive Chartered Society of Physiotherapy  
76 (iCSP), Musculoskeletal Association of Chartered Physiotherapists (MACP)] and social media (Twitter,  
77 LinkedIn, and Facebook). Promoting participation in the survey was continuous throughout the  
78 period the survey was live with specific prompts and updates on participation provided at 3 and 6

79 weeks using the same sources. The required sample size to ensure precision for the UK  
80 physiotherapy population was determined based on:

81

$$82 \quad \text{Sample size} = \frac{(Np) (p) (1-p)}{(Np-1) (B/C)(B/C) + (p) (1-p)}$$

83

84

85 Where Np= size of target population, p=proportion of population predicted to choose one of two  
86 response categories, B= sampling error (0.05 = ±5% of the true population value), C=Z statistic  
87 associated with the confidence level (42).The total UK physiotherapy population (Np) is ~53,000. The  
88 proportion of the population (p) expected to choose one of the two response categories (to  
89 participate or not) was set as 0.50. The acceptable sampling error (B) was set as 0.05, and the  
90 confidence level (C) at 95%, giving a corresponding Z statistic of 1.645. The required sample size was  
91 therefore n=270 based on the calculation of 269.25.

92

### 93 Data Analysis

94 Data summaries were produced via LimeSurvey with data imported into Microsoft Office Excel and  
95 SPSS [IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY] to facilitate reporting of data and  
96 development of graphs and tables. Participant characteristics (sex, age, practice location,  
97 physiotherapy grade, years qualified, years practising in musculoskeletal physiotherapy, and  
98 qualification), approaches to examination and management of TSPD were analysed from categorical  
99 variables and presented as frequencies and percentages. Pie charts and bar graphs are used to  
100 visually display results. *Posteriori* content analysis (themes and frequencies) for free text data was  
101 used for data generated from open questions (Questions 1,3, 7, 8, 10, 11, 13-20) involving 3  
102 researchers (SG, NH, CH). This resulted in additional themes/categories which were quantified with  
103 calculation of frequencies (43). Further descriptive analyses were used to enable comparison across  
104 practice setting and levels of experience. For each we only included data from participants who

105 declared their graded level of practice or practice setting [National Health Service (NHS), private  
106 practice or sport setting] as their primary work setting; to avoid contamination where some  
107 respondents do not align to a specific grade or regularly work in different practice settings.

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109 Ethics

110 This study was approval by the xx. Participation in the survey was  
111 voluntary, with informed consent assumed through completion of the survey. Participants were  
112 informed regarding the survey content and duration prior to commencing the survey, with clear  
113 details informing options to withdraw and assurance of participant anonymity through the process  
114 of analysis and reporting.

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## RESULTS

A total of 627 surveys (unique IP addresses) were returned of the 681 viewed, resulting in a view rate of 99%. With 485 surveys complete in full, this accounts for a participation rate of 72% (485/672). A further 187 incomplete surveys were not included in the final analysis as inclusion of returns with missing data would introduce bias and affect overall findings.

### Demographics and Characteristics

Respondents worked primarily in one of the following practice settings, NHS (32%, n=153), private (28%, n=137) or mixed (e.g. NHS and private) (32%, n=156). Other settings included sport (5%), military (2%), and academia (1%). Other respondent characteristics are detailed in Table 1.

|  |  | Physiotherapists n (%) |
|--|--|------------------------|
| <b>Sex</b>                               | Female   | 268 (55.2)             |
|  | Male   | 200 (41.2)             |
|  | N/A  | 18 (3.7)               |
| <b>Age</b>                               | <25 years  | 49 (9.3)               |
|  | 26 – 35 years  | 215 (44.3)             |
|  | 36 – 55 years  | 210 (43.3)             |
|  | >56 years  | 15 (3.1)               |
| <b>Physiotherapy Grading*</b>            | Band 5 (Junior)  | 42 (8.7)               |
|  | Band 6 (Senior)  | 155 (32.0)             |
|  | Band 7 (Senior)  | 128 (26.4)             |
|  | Band 8 (Advanced Practitioner)                                 | 42 (8.7)               |
|  | Extended Scope Practitioner/Consultant (Advanced Practitioner) | 76 (15.7)              |
|  | Lecturer/Researcher  | 6 (1.2)                |
| <b>Years Qualified</b>                   | Other – Sport  | 36 (7.4)               |
|  | 0 – 2 years  | 43 (8.9)               |
|  | 3 – 5 years  | 60 (12.4)              |
|  | 6 – 10 years   | 141 (29.1)             |
|  | 11 – 15 years  | 90 (18.6)              |
|  | 16 – 20 years  | 57 (11.8)              |
|  | 21 – 25 years  | 34 (7.0)               |
| >25 years                                | 61 (12.6)  |                        |
| <b>Years in Musculoskeletal Practice</b> | 0 – 2 years  | 62 (12.8)              |
|  | 3 – 5 years  | 94 (19.4)              |
|  | 6 – 10 years   | 142 (45.6)             |
|  | 11 – 15 years  | 78 (16.1)              |
|  | 16 – 20 years  | 47 (9.7)               |
|  | 21 -24 years   | 36 (7.42)              |
|  | >25 years  | 29 (5.8)               |
| <b>Physiotherapy Qualifications</b>      | Postgraduate Diploma   | 8 (1.6)                |
|  | Graduate Diploma   | 29 (6.0)               |
|  | Bachelors  | 275 (56.7)             |
|  | Masters  | 93 (19.2)              |
|  | Musculoskeletal Association of Chartered Physiotherapists      | 71 (14.6)              |
|  | Other  | 9 (1.9)                |

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144

**TABLE 1. Characteristics of Respondents**

145 *\*Grading is based on level of experience and expertise within musculoskeletal physiotherapy*  
146 *professional practice.*

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150 Professional Development

151 The majority of respondents indicated they had completed continuing professional development  
152 courses focussing on the lumbar (81%, n=391), cervical (74%, n=357) and thoracic (60%, n=289)  
153 spine regions. Of the 198 respondents that provided detail of TSPD specific training, this included  
154 specialist postgraduate training (e.g. Masters or Postgraduate Diploma Advanced Musculoskeletal  
155 Physiotherapy) (29%, n=57), manipulation/osteopathic techniques (16%, n=32), Society of  
156 Orthopaedic Medicine/Cyriax (12%, n=23), in-service training (9%, n=18), Mulligan concept (9%,  
157 n=18), McKenzie (9%, n=17), 'Linda Joy Lee course/Thoracic ring' (7%, n=13), muscle energy  
158 techniques (5%, n=10) and a range of Other courses making up the rest (22%, n=44) e.g. soft tissue  
159 massage, acupuncture, radiology/imaging, and Pilates.

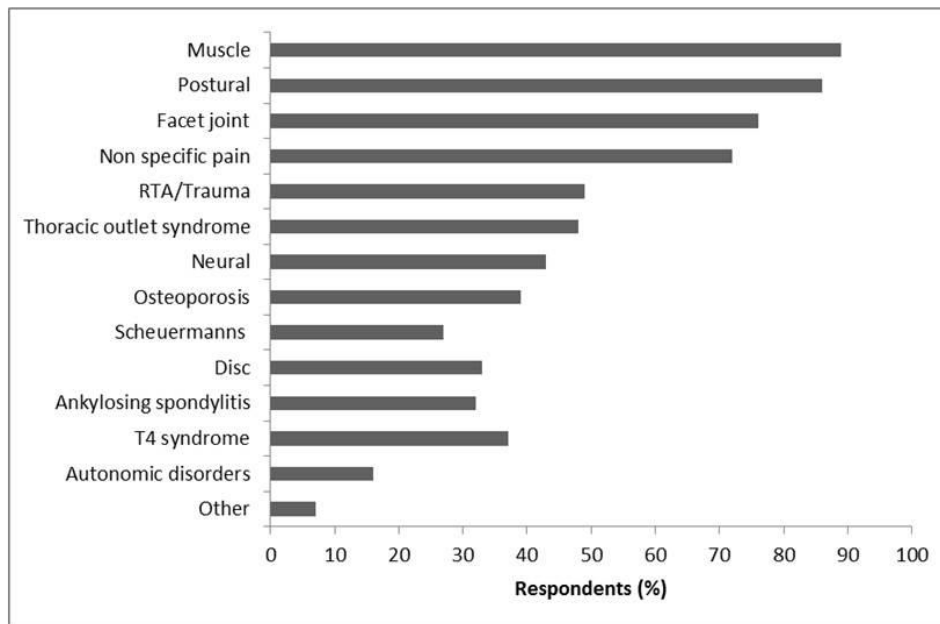
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161 Clinical Presentation of TSPD

162 Compared to a mean of 12 lumbar and 8 cervical spine patients per week, respondents reported  
163 seeing just 4 patients per week with TSPD. Thoracic presentations were wide ranging with muscular  
164 (89%, n=430), postural (86%, n=419), facet joint (76%, n=371), non-specific pain (72%, n=348) the  
165 most common presentations (Figure 1). Using thematic analysis presentations reported in 'Other'  
166 included scoliosis (n=3), movement imbalances/overuse (n=3), pregnancy related pain (n=2), post  
167 hepatic neuralgia (n=2), costochondritis (n=1), tumour (n=1) and centrally maintained pain (n=1).

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171

**FIGURE 1. TS Clinical Presentations**

172

173 Examination of TSPD

174 *History Taking and Special Questions*

175 The majority of respondents included the following special questions: painful deep breath (96%,  
 176 n=465), history of cancer (94%, n=454), pain coughing/sneezing (89%, n=429), pain lying down (75%,  
 177 n=362), shortness of breath (73%, n=354), pain on exertion (62%, n=299), and a relatively small  
 178 percentage asking about symptom behaviour with eating/drinking (29%, n=139). 'Other' possible  
 179 special questions were provided by 17% (n=84) of respondents. These included neural involvement,  
 180 weight loss, and malaise/night sweat/fever, history of tuberculosis, previous fracture/osteoporosis,  
 181 infection /visceral involvement, red flags, pain pattern, trauma, steroid use and rheumatological  
 182 screening.

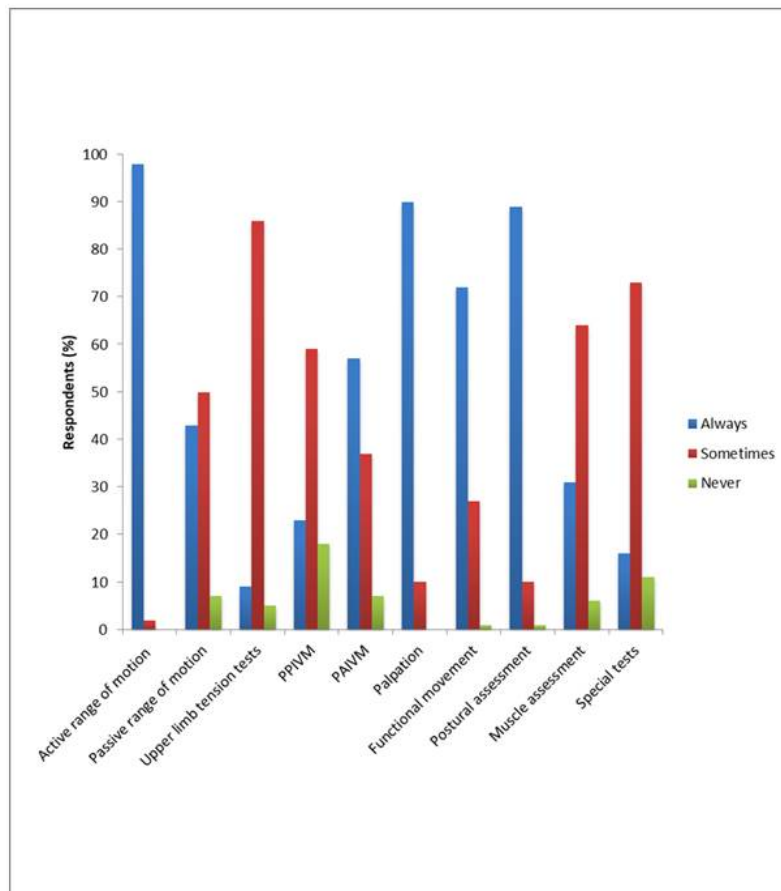
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185 *Physical Examination Techniques*

186 The majority of respondents reported 'always' including active range of movement testing (98%,  
187 n=476), palpation (90%, n=435), postural assessment (89%, n=432), functional movement (72%,  
188 n=349) and passive accessory intervertebral movements (PAIVMs) (57%, n=274). The majority of  
189 respondents indicated routinely examining the TS in patients with issues in the cervical (94%,  
190 n=458), lumbar (76%, n=367) spine, and shoulder regions (81%, n=395). TS physical  
191 examination was routinely used less frequently by respondents for issues involving the  
192 elbow (14%, n=68), hip (8%, n=40), rib dysfunction (n=5), lumbar/sacral/pelvic (n=4), lower  
193 limb issues (n=4), other upper limb issues not involving the shoulder or elbow (e.g. wrist,  
194 forearm) (n=4), and neural presentations (n=3). See Figure 2.

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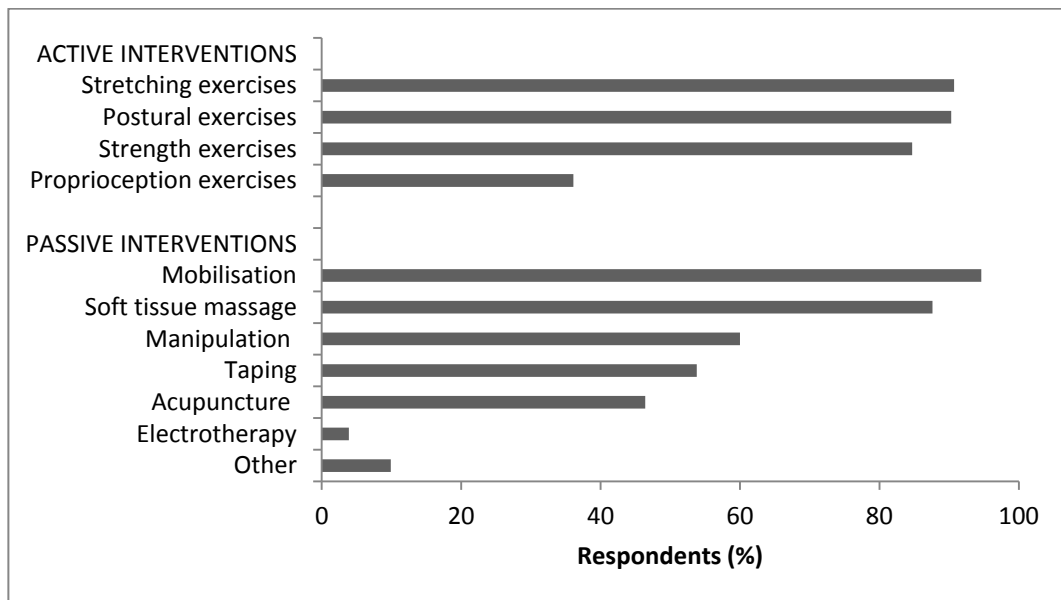
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**FIGURE 2. TS Physical Examination Techniques**

198 Management of TSPD

199 The majority of respondents used both active and passive techniques, with exercise, passive  
200 mobilisation and soft tissue massage being utilised most. See Figure 3. From our thematic analysis  
201 'Other' interventions included other exercises (n=15) (e.g. motor control, cardiovascular, foam roller,  
202 breathing), education (n=12), muscle energy techniques (n=6), Mulligan techniques (n=6), relaxation  
203 (n=3), needling (e.g. electro acupuncture or dry needling) (n=2), neural mobilisation (n=3),  
204 hydrotherapy (n=3), McKenzie mobilisations (n=1), and TENS (n=1). See Figure 3.

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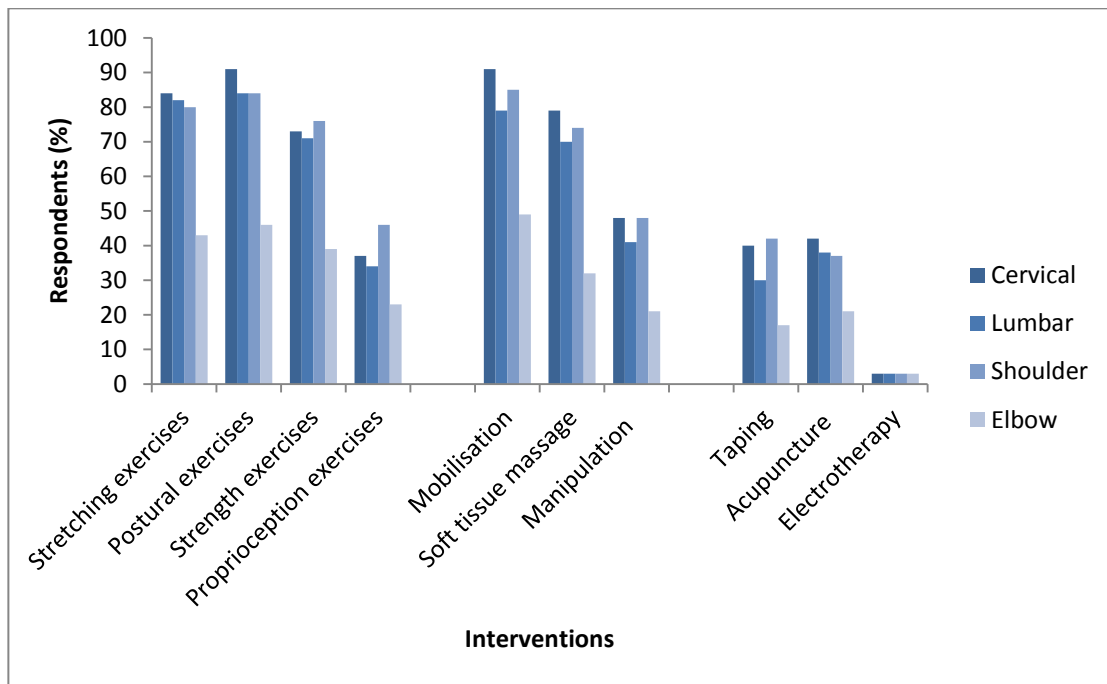
207 **FIGURE 3. Active and Passive Interventions used to Manage TSPD**

208

209 *Use of Interventions Targeted at the TS to Manage Other Clinical Complaints*

210 Treatment techniques targeting the TS were used to assist in the management of issues in the  
211 cervical spine (89%, n=429), shoulder (82%, n=398), lumbar spine (63%, n=306), and elbow (17%,  
212 n=82). From our thematic analysis 'Other' regions (6%, n=31) mentioned by respondents included  
213 lower limb (n=7), pelvis/sacroiliac joint/groin (n=6), rib (n=3), hand and wrist (n=4), neurodynamic  
214 symptoms (n=4), autonomic presentations (n=3), and headache (n=1). See Figure 4 for details of the

215 specific TS treatment techniques used to aid in management of issues in the cervical lumbar,  
 216 shoulder, and elbow regions: grouped to differentiate, active, passive and miscellaneous treatments.



217

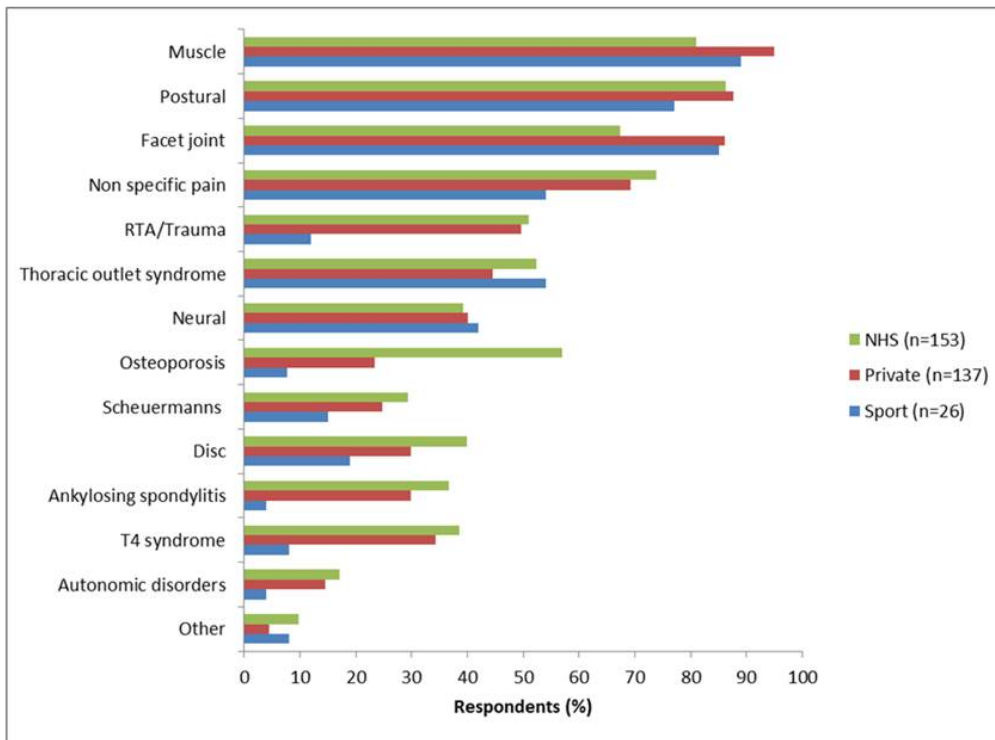
218 **FIGURE 4. Management of Clinical Complaints using TS Targeted Interventions**

219

220 Comparison of Clinical Presentations across Clinical Practice Settings (Private vs NHS vs Sport)

221 Across different settings the prevalence of clinical presentations was similar with respect to muscle,  
 222 posture, thoracic outlet syndrome and neural presentations. Notwithstanding the smaller sample of  
 223 respondents working primarily in a sports setting (n=26) reported seeing some clinical conditions  
 224 less than those in NHS and private setting, most notably autonomic disorders, T4 syndrome,  
 225 Ankylosing spondylitis, disc, Scheuermann's disease, osteoporosis, and RTA/trauma compared to the  
 226 NHS and private practice. Specific diseases/conditions were more prevalent within the NHS, e.g. T4  
 227 syndrome, whereas non-specific complaints relating to muscle and facet joint, were more prevalent

228 in private practice and sports setting. See Figure 5.



229

**FIGURE 5. Clinical Presentations Across Practice Settings**

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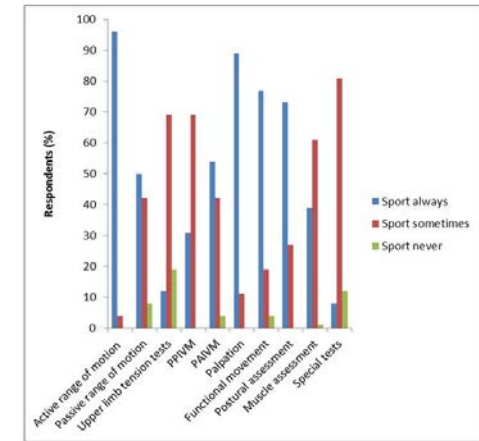
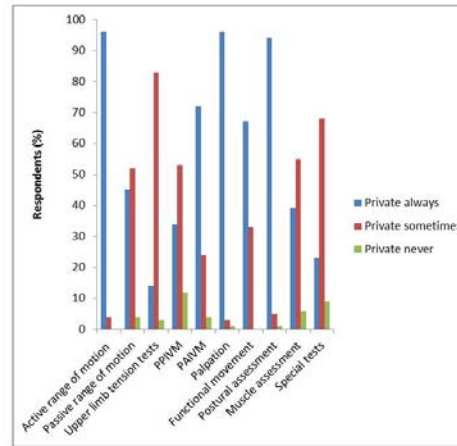
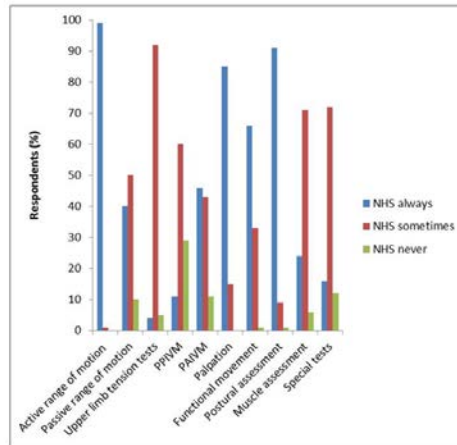
233 Physical Examination of TSPD

234 Across all practice settings, the majority of respondents indicated using active range of motion,

235 palpation, functional movement, and postural assessment routinely to examine TSPD. See Figure 6

236 for details.

237



**FIGURE 6. Physical Examination Techniques for TSPD across Practice Settings in a. NHS b. Private Practice and c. Sport Practice Setting**

238 *Examination of TS for Other Complaints*

239

240 The majority of respondents across all practice settings indicated they examine the TS in

241 patients experiencing cervical spine and shoulder issues. See Figure 7 for details. More

242 variability exists for the lumbar spine with those working in private (79%) or sports setting (89%) 245

243 examining the TS compared to 69% in NHS. Examination of the TS with elbow and hip complaints

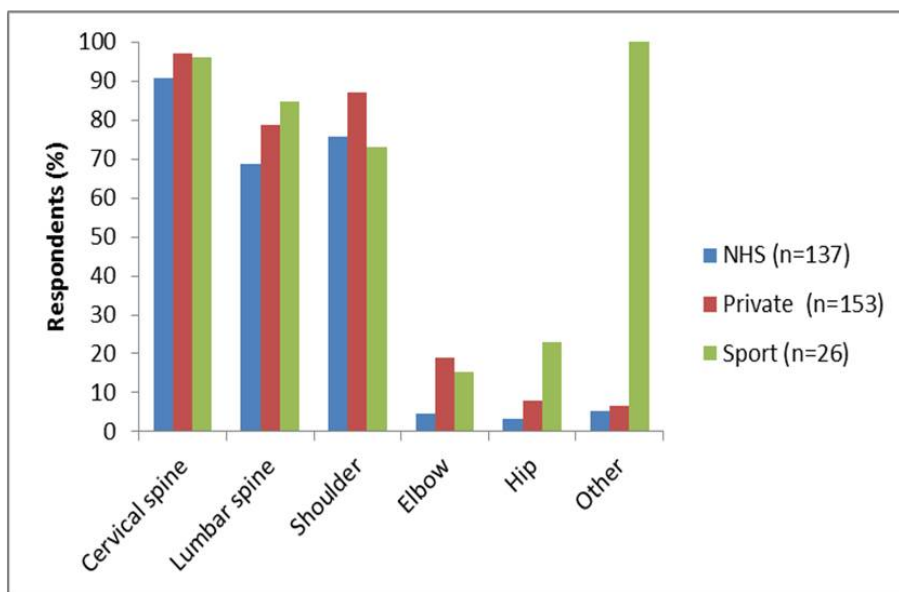
244 was notably higher for those working in private (n=19, n=8 respectively) or sports setting (n=15,

245 n=23 respectively) compared to less than 5 respondents in NHS. With respect to the high percentage

246 of those working in sport reporting using techniques for 'Other' complaints these included

247 complaints related to the arm (n=4), ribs/chest (n=4), knee (n=4), sacroiliac/pelvis (n=4), foot and

248 ankle (n=2). See Figure 7.



249

250 **FIGURE 7. Examination of the TS in Cervical and Lumbar Spine, Shoulder, Elbow, Hip, and Other**  
251 **Complaints across Practice Settings**

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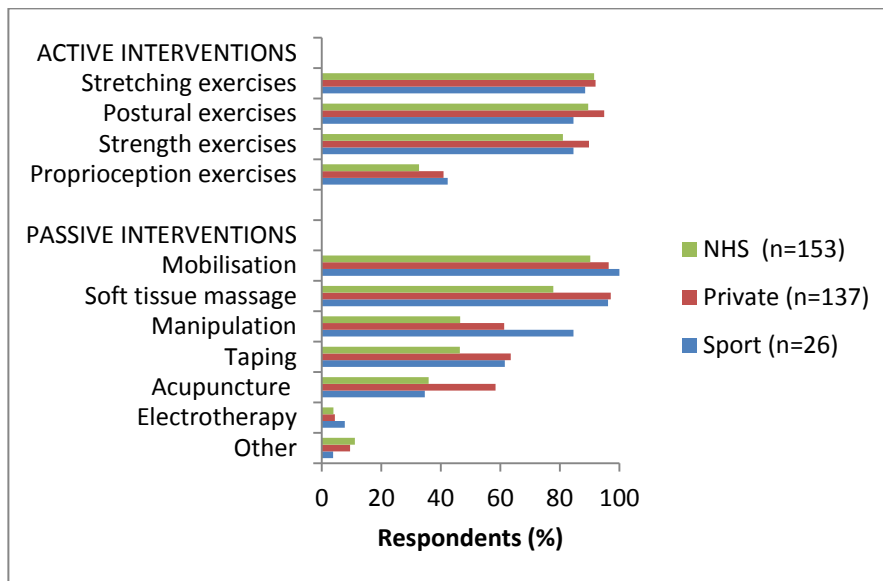
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259 *Management of TSPD*

260 Exercise interventions, including stretching, and postural and strengthening exercises were used to  
261 manage TSPD across all settings with little variability. Overall, passive interventions were used  
262 more frequently in private and sport settings with the exception of acupuncture, which was  
263 used by approximately a third of those working in NHS (36%) and sport settings (35%) and  
264 two-thirds of those working in private practice (58%). Of the all the passive interventions  
265 available, use of manipulation varied most, with 85% of those respondents working in sport  
266 using this technique, compared to 61% and 47% in private practice and NHS respectively.  
267 See Figure 8.

268



269

270 **FIGURE 8. Management of TSPD**

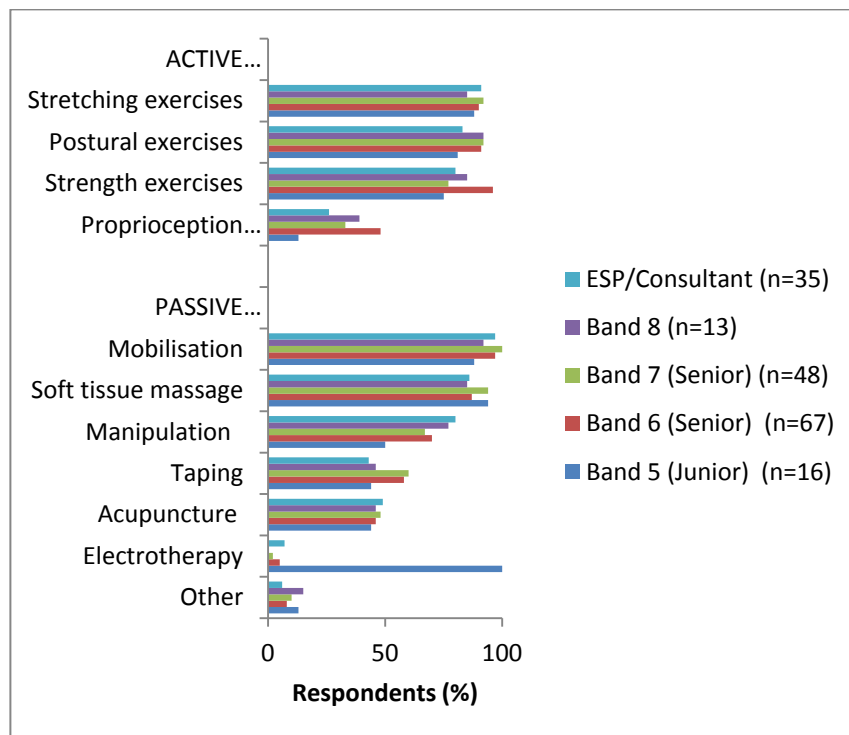
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273 Clinical Experience and the Influence of Management Approaches

274 From those respondents who declared their level of experience/expertise some variability was  
275 observed between levels of experience and the management strategies used for TSPD. The  
276 majority of respondents across all experience levels indicated they use active exercises in

277 patients presenting with TSPD. More variability exists in the use of proprioceptive exercises  
 278 grades, ranging from 13 to 48%. For passive interventions patterns were similar for mobilisation, soft  
 279 tissue massage and acupuncture, although manipulation techniques were used by just half the junior  
 280 respondents compared to more than 67% in other groups, with the highest percentage being  
 281 advanced practitioners (>80%). Electrotherapy was used by all junior band respondents compared to  
 282 less than 7% in any other categories. See Figure 9.



283  
 284 **Figure 9. Influence of Clinical Experience on Management Approach for TSPD**

285  
 286 Additional comments

287 Additional comments were provided by 76 respondents with 7 key themes including, importance of  
 288 the TS as part of kinetic chain and linked to regional interdependence (n=20), different presentations  
 289 seen or approaches used including, respiratory dysfunction, ribs, relaxation, pain sciences (n=17),  
 290 population specific factors e.g. function and movement patterns in swimmers, women's health,  
 291 trauma (n=14), decisions would be based on clinical reasoning (n=9), poor teaching on  
 292 undergraduate programmes and often over-looked (n=8), association with more serious

293 presentations/red flag/metastases (n=6), bias of passive treatments (n=3), and 'Others' (n=12) (e.g.  
294 more research required, experiences of manipulation, lacking innovation in rehabilitation,  
295 acupuncture, or reporting nil else to add etc.)

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## DISCUSSION

300 This is the first survey investigating clinical practice for TSPD in the UK and incorporating differences  
301 in practice across settings and levels of expertise. Results indicate that active interventions, including  
302 stretching, postural, and strengthening exercises, and passive interventions, including mobilisation  
303 and soft tissue massage are preferred management strategies by the majority of respondents  
304 irrespective of practice setting and level of expertise; approaches which reflect current practice for  
305 managing neck and low back pain.

306

### *Clinical Presentation*

308 The reported ratio of complaints seen in practice across spinal region (12, 8, and 4, lumbar, cervical  
309 and thoracic cases per week) closely reflects the ratio of reported lifetime prevalence of spinal pain  
310 (lumbar 57%, cervical 40%, TS 17%) (9). Respondents reported seeing an array of presentations of  
311 TSPD including, specific conditions e.g. osteoporosis, pathologies affecting musculoskeletal tissues  
312 e.g. muscle, facet joint, or complaints relating to a broader description of a presentation e.g.  
313 posture. This range of presentations is reflected in the epidemiology literature where pain  
314 prevalence varies widely (3), is associated with a known condition or disease, or where thoracic pain  
315 co-exists with pain in other regions, albeit less severe or secondary to the primary complaint (3, 5, 6,  
316 8).

317

### *Physical Examination of the TS for TSPD and Other Complaints*

319 Results illustrate consistency in the use of some clinical indicators although some variability was  
320 found for others, (e.g. Pain on eating or drinking) and many clinical indicators were reported in the

321 'Other' category. This may reflect the diversity of clinical presentations seen and encompassed  
322 within the broad clinical diagnosis of TSPD. Moreover where many clinical indicators were not  
323 exclusive to the TS this reflects the broader scope of spinal 'red flag' questions (44) e.g. history of  
324 cancer.

325 The variability among examination approaches used by respondents for TSPD may be attributable to  
326 the range of presentations being managed, with some focused on pain and others dysfunction.  
327 Other plausible explanations include a lack of assessment techniques with known diagnostic utility,  
328 and convention driving clinical practice with those approaches used 'always' reflecting core teaching  
329 from standard textbooks (41). Although half the respondents had completed some form of higher  
330 degree e.g. Masters, it is unclear whether these were entry level or specialist programmes; a useful  
331 point for clarification to inform curriculum development.

332 Consistent with research supporting the use of thoracic techniques for managing complaints in other  
333 regions, respondents indicated examining the TS in patients with cervical, lumbar, and shoulder  
334 issues (12-16, 20, 22, 27).

335

### 336 *Management of TSPD*

337 In line with the survey investigating clinical practice for management of neck pain, active  
338 management approaches were used more consistently compared to passive approaches (34). Whilst  
339 both exercise and manual therapy have good support for management of patients with neck and low  
340 back pain (31, 45), there is little empirical evidence investigating TS exercise (46). In recent years the  
341 emergence of research supporting the use of 'passive' thoracic mobilisation and manipulation (16-  
342 18, 20, 22, 47) has exposed a relative gap in the literature regarding exercise prescription for the TS.  
343 A recent randomised controlled trial of thoracic spine stabilization exercises found improvements in  
344 postural back pain and core endurance in young adults which highlights the need for further  
345 research on TSPD (35).

346 Management approaches often associated with specialist skills or further post qualifying training,  
347 e.g. manipulation, taping and acupuncture, were used by around half the respondents. Exploration  
348 of respondents' clinical reasoning would be useful, given empirical evidence is only currently  
349 available to support the use of manipulation (15, 22, 27). Notwithstanding the influence and  
350 importance of patient preference in management planning, our findings suggest that management  
351 decisions are not always underpinned by empirical evidence and highlight a need to further  
352 investigate exercise prescription for TSPD. Given the ever shrinking healthcare budget, increase in  
353 sedentary occupations and behaviours (48), continued growth in spine related disability (1, 2) there  
354 has never been a more urgent need to have evidence-based exercise guidelines for management of  
355 TSPD.

356

#### 357 Comparison of Clinical Presentations and Practises across Practice Settings

358 Patterns of practice, including use of special questions and techniques for physical examination  
359 across settings showed little variability, despite medical conditions or diseases being likely managed  
360 in the NHS. The observed differences in use of passive physiological intervertebral movements and  
361 PAIVMs, TS examination and management approaches across UK practice settings may be attributed  
362 to factors such as specialisation, confidence in using clinical practical skills, level of experience,  
363 patient contact time and managing different caseload types (acute vs sub-acute vs chronic); all of  
364 which were not captured in this survey. Notwithstanding the value of having further data to support  
365 a more in-depth analysis, groups were comparable with respect to years qualified although less than  
366 half (48%) of NHS respondents had more than 10 years' experience working specifically in  
367 musculoskeletal physiotherapy compared to a third in private practice (33%) and sport (31%); years  
368 in practice and expertise are not necessarily proportional.

369

#### 370 Comparison of Clinical Presentations and Practises across Levels of Clinical Experience

371 Whilst similar patterns of practice were seen for many management approaches, some differences  
372 were seen, with all junior respondents using electrotherapy; a noteworthy finding given that  
373 electrotherapy is largely unsupported nor recommended in the management of spinal complaints  
374 (30, 32, 45). Although not considered entry level skills for UK physiotherapist acupuncture and  
375 taping were used by almost half of all respondents within each grade for the management of TSPD,  
376 suggesting these are perceived beneficial adjunctive skills to manage patients' complaints. For  
377 manipulation, where evidence and guidelines supports their use (17, 32, 49) there was a trend for  
378 greater use with higher levels of experience, perhaps related to different caseloads, knowledge of  
379 evidence and/or confidence/skills in performing manipulation.

380

#### 381 Strengths and Limitations

382 Survey development was informed based on current evidence (5, 22, 23, 29, 50), expertise (NH, AR)  
383 and comparable surveys (34, 38). View and participation rates for the survey were excellent  
384 compared to other e-surveys (51). With a third of respondents working primarily in a single practice  
385 setting, establishing levels of respondent expertise allowed for a more detailed analysis of data to  
386 inform further research or make recommendations for the UK physiotherapy profession. Limitations  
387 include the closed nature of this type of survey that precludes an understanding of respondent's  
388 clinical reasoning in decisions. Many respondents were working in a mixed practice setting and were  
389 therefore excluded from the analysis of practice across settings. Findings are only representative of a  
390 self-selected population, so caution should be taken in generalising these findings. Finally the survey  
391 was focused to exploring examination and management from a biophysiological perspective,  
392 mirroring existing surveys in the cervical and lumbar spine (34, 38). Whilst this enables some  
393 comparisons to be made across spinal regions data relating to management within a biopsychosocial  
394 framework was not captured.

395

396

397 Clinical and Research Implications

398 Findings from this survey identified priorities for practice and further research in TSPD; a  
399 requirement for evidence-based practice and research led teaching, and in lieu of limited resources  
400 e.g. time, and funding. Given the widespread use of active management approaches with little  
401 supporting empirical evidence a key priority is a review of exercise prescription in the TS, with  
402 subsequent research focused to optimising dose response of a range of exercise interventions. In  
403 turn this will inform clinical trials of exercise interventions for managing patients with TSPD. Further,  
404 consideration of approaches to assist sub classification of TSPD may also facilitate focused research  
405 in more homogenous groups, such as those with common clinical symptoms, clinical signs,  
406 examination techniques *etc.* In terms of findings across levels of experience, there is now a need to  
407 further examine mechanisms for knowledge and evidence dissemination to expedite evidence-based  
408 practice; a finding that mirrors findings from a survey of practice focused to thoracic manipulation  
409 (52). Further qualitative research could usefully examine physiotherapists' clinical reasoning in  
410 managing patients with TSPD and assist prioritisation of further research in TSPD. This would  
411 potentially inform curriculum development, skills development and knowledge translation strategies  
412 to optimise evidence informed management at all levels of practice. Findings can be used to inform  
413 further focused research in TSPD or related areas, for example differences in management for  
414 thoracic pain and thoracic dysfunction, recognising them as different entities, as well as knowledge  
415 translation strategies, curriculum design and trials of clinical interventions.

416

417 CONCLUSION

418 As well as examining patients with TSPD, UK physiotherapists assess the TS in patients with neck, low  
419 back and shoulder complaints, using active range of motion testing, palpation and postural  
420 assessment. The majority of UK physiotherapists use exercise, mobilisation and soft tissue massage  
421 to manage patients presenting with TSPD, despite a paucity of high quality empirical evidence  
422 supporting their use. Further research is now required to investigate the identified non-evidence-

423 based interventions, specifically exercise given its widespread use. Additionally strategies to  
424 optimise knowledge translation are required to promote evidence-based education and clinical  
425 practice.

426

427

#### 428 Funding statement

429 This research did not receive any specific grant from funding agencies in the public, commercial, or  
430 not-for-profit sectors.

#### 431 Acknowledgements

432 The authors gratefully acknowledge the assistance of all the physiotherapists who took part in this  
433 study and those that assisted promotion including the Musculoskeletal Association of Chartered  
434 Physiotherapists.

435

#### 436 Highlights

- 437 • Each week 4 patients are seen with TSPD compared to 12 lumbar and 8 cervical
- 438 • Thoracic spine examination is included in neck, low back and shoulder complaints
- 439 • Exercise is widely used for TSPD despite a paucity of supporting evidence
- 440 • Passive hands on interventions are used more in private practice and sport settings
- 441 • Use of electrotherapy and manipulation varied across levels of expertise

442

443

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