

Original article

Management of thoracic spine pain and dysfunction: A survey of clinical practice in the UK

Nicola R. Heneghan^{a,*}, S. Gormley^b, C. Hallam^c, Alison Rushton^a^a Centre of Precision Rehabilitation for Spinal Pain, School of Sport, Exercise & Rehabilitation Sciences, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK^b Shropshire Physiotherapy, Newport, Shropshire, TF10 7AB, UK^c Reading Football Club, Reading, Berkshire, RG2 0FL, UK

ARTICLE INFO

Keywords:

Thoracic spine
Examination
Management
Clinical practice survey

ABSTRACT

Background: The thoracic spine (TS) is relatively under-researched compared to the neck and low back. As the challenge of managing spinal pain persists, understanding current physiotherapy clinical practice for TS pain and dysfunction is necessary to inform future research in this area.

Objective: To investigate physiotherapy practice for managing thoracic spine pain and dysfunction (TSPD) in the UK, with a secondary focus on examining differences across settings and expertise.

Design and method: A cross sectional e-survey informed by existing evidence was designed. Comprising closed and open questions, the survey is reported in line with Checklist for Reporting Results of Internet E-Surveys. Eligible participants were UK-trained physiotherapists managing patients with TSPD, recruited for 9 weeks up to 8/2/16. Data analysis included descriptive analyses (closed questions) and thematic analysis (open questions).

Results: From the 485 respondents, fulfilling the required sample size, key findings included. Examination: Active motion testing, palpation and postural assessment was 'always' undertaken by > 89% of respondents. Management: Active (exercises) and passive (e.g. mobilisations) techniques were used by > 85% of respondents, with ~50% using manipulation, taping and acupuncture. Practice settings: Although broadly similar passive techniques were used more in private practice and sport. Expertise: Broadly similar patterns were seen for use of exercise across levels of expertise, although differences observed for electrotherapy and manipulation.

Conclusion: Despite limited research exercise is widely used in all areas of practice and across all level of expertise. Further research is required to investigate exercise prescription for TSPD and implementation of evidence-based practice.

1. Introduction

The escalating prevalence and societal costs (e.g. decreased productivity, disability claim, days lost from work *etc.*) associated with managing chronic spinal pain continues unabated, with neck and low back pain leading causes of disability globally (Global Burden of Disease Study, 2016; Foster *et al.*,). Management of neck and low back pain is informed by evidence-based clinical practice guidelines; however, no comparable guidelines exist for the thoracic spine (TS); despite a growing body of evidence reporting thoracic spine pain and dysfunction (TSPD) (Briggs *et al.*, 2009; Heneghan *et al.*, 2015, 2016, 2018a; Roquelaure *et al.*, 2014; Berglund *et al.*, 2008).

The lifetime prevalence of isolated pain in the TS is relatively low, 13–17% (Briggs *et al.*, 2009; Leboeuf-Yde *et al.*, 2009), compared to neck and low back pain, 40% and 57% respectively (Leboeuf-Yde *et al.*,

2009); however, there is now compelling evidence of a complex relationship between the TS and other regions. Literature has demonstrated co-existing thoracic pain in musculoskeletal complaints in other regions e.g. neck and elbow (Heneghan *et al.*, 2018a; Roquelaure *et al.*, 2014; Berglund *et al.*, 2008), motion analysis studies where full functional arm elevation is affirmed as a composite of shoulder flexion and thoracic extension (Theisen *et al.*, 2010; Theodoridis and Ruston, 2002) and, TS intervention studies reporting improvements for complaints in the neck (Salom-Moreno *et al.*, 2014; Gonzalez-Iglesias *et al.*, 2009; Cleland *et al.*, 2007a, 2007b; Suvarnnato *et al.*, 2013; Young *et al.*, 2004; Cross *et al.*, 2011; Lau *et al.*, 2011), shoulder (Peek *et al.*, 2015; Strunce *et al.*, 2009; Walser *et al.*, 2009; Muth *et al.*, 2012), and low back (Sung *et al.*, 2014). More specifically, passive TS interventions, including joint mobilisation, manipulation, have shown promising improvements in neck (Salom-Moreno *et al.*, 2014; Cleland *et al.*, 2005,

* Corresponding author.

E-mail addresses: n.heneghan@bham.ac.uk (N.R. Heneghan), scott.physiotherapy@hotmail.co.uk (S. Gormley), chrishallam94@gmail.com (C. Hallam), a.b.rushton@bham.ac.uk (A. Rushton).

<https://doi.org/10.1016/j.msksp.2018.11.006>

Received 11 April 2018; Received in revised form 3 November 2018; Accepted 12 November 2018

2468-7812/ Crown Copyright © 2018 Published by Elsevier Ltd. All rights reserved.

2007b; Suvarnato et al., 2013; Puntumetakul et al., 2015; Casanova-Méndez et al., 2014) and shoulder complaints (Peek et al., 2015; Strunce et al., 2009; Sanzo et al., 2016). Adopting the term ‘dysfunction’ recognises impairment in the musculoskeletal system of TS which may affect its integrity during functional movement; a synergy of motion occurring across different joints (Heneghan and Rushton, 2016).

Within a biopsychosocial model of practice, where a multimodal approach to the management of spinal complaints is recommended (National Institute for Health and Care Excellence (NICE) guidelines, 2015; National Institute for Health and Care Excellence (NICE) guidelines, 2016) the therapeutic value of passive interventions (e.g. mobilisation and manipulation) is recognised, hence their inclusion in some clinical practice guidelines. In contrast, active interventions, such as exercise, which are unequivocally recommended in clinical practice guidelines (Foster et al., ; National Institute for Health and Care Excellence (NICE) guidelines, 2015; National Institute for Health and Care Excellence (NICE) guidelines, 2016; Blanpied et al., 2017; Buchbinder et al.,) have received relatively little attention in TSPD. Exercise interventions including ‘stretching’, ‘endurance’, ‘postural control’, ‘motor control’ and ‘stabilisation’, are utilised widely in the management of neck pain (Carlesso et al., 2014) and offer considerable potential for TSPD. With recent research providing preliminary evidence to support TS stabilisation exercises for postural back pain (Çelenay Ş, 2017) and the development of inexpensive valid and reliable measurement approaches the foundation is growing to support further research in this spinal region (Bucke et al., 2017; Johnson et al., 2012).

Whilst there is clearly a considerable way to go in conquering the challenge of musculoskeletal-related dysfunction (Foster et al., ; Buchbinder et al.), knowledge of the current landscape of managing patients with TSPD will assist prioritising research efforts in this relatively under-researched spinal region (Heneghan and Rushton, 2016). As evidenced by earlier surveys of physiotherapy management for neck and low back pain (Carlesso et al., 2014; Foster et al., 1999) the trajectory of subsequent research has largely been focused, rationalised and evidence informed; a critical consideration given the finite resources available. Furthermore, knowledge of practice across settings and levels of expertise are required to inform professional practice priorities linked to implementation of evidence based practice.

1.1. Aim of the study

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

2. Design and methods

An online 20-question survey was created using LimeSurvey software package [<https://www.limesurvey.org/about-us/imprint>], see Appendix A. The survey was designed, and results were analysed and reported in accordance with the Checklist for Reporting Results of Internet E-Surveys (CHERRIES) (Eysenbach, 2004), see Appendix B. The survey could be completed on any electronic device with internet access and was available for completion from 24/12/15 to 08/02/16.

2.1. Survey development

Survey structure and content were informed by a review of current evidence, including comparable surveys of management of neck and low back pain (Carlesso et al., 2014; Foster et al., 1999), reviews (Peek et al., 2015; Heneghan and Rushton, 2016) and author expertise (NRH, AR, SG). The survey comprised primarily closed questions with open questions for additional information e.g. types of training courses or details of additional approaches to examination and management. The survey was developed to capture 1) demographic data, training and

qualifications, clinical presentations of TSPD (Questions 1–10), 2) approaches to examination (Questions 11–13, 3) approaches to management (Questions 14–19) and 4) to explore differences across practice settings and levels of expertise. A final open-ended question (Question 20) invited free text responses for other comments.

Content validity was enhanced through the inclusion of evidence-based clinical examination and management approaches (Suvarnato et al., 2013; Peek et al., 2015; Walser et al., 2009; Heneghan and Rushton, 2016; Carlesso et al., 2014; Fernández-de-las-Penas, 2007; Petty and Moore, 2002) and clinical expert opinion (NRH, AR).

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

2.2. Sample and recruitment

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

$$\text{Sample size} = \frac{(Np) \cdot (p) \cdot (1-p)}{(Np-1) \cdot (B/C)^2 + (p) \cdot (1-p)}$$

Where Np = size of target population, p = proportion of population predicted to choose one of two response categories, B = sampling error ($0.05 = \pm 5\%$ of the true population value), $C = Z$ statistic associated with the confidence level (Dillman, 2007). The total UK physiotherapy population (Np) is $\sim 53,000$. The proportion of the population (p) expected to choose one of the two response categories (to participate or not) was set as 0.50. The acceptable sampling error (B) was set as 0.05, and the confidence level (C) at 95%, giving a corresponding Z statistic of 1.645. The required sample size was therefore $n = 270$ based on the calculation of 269.25.

2.3. Data analysis

Data summaries were produced via LimeSurvey with data imported into Microsoft Office Excel and SPSS [IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY] to facilitate reporting of data and development of graphs and tables. Participant characteristics (sex, age, practice location, physiotherapy grade, years qualified, years practising in musculoskeletal physiotherapy, and qualification), approaches to examination and management of TSPD were analysed from categorical variables and presented as frequencies and percentages. Pie charts and bar graphs are used to visually display results. *Posteriori* content analysis (themes and frequencies) for free text data was used for data generated from open questions (Questions 1,3, 7, 8, 10, 11, 13–20) involving 3 researchers (SG, NRH, CH). This resulted in additional themes/categories which were quantified with calculation of frequencies (Vaismoradi and Bondas, 2013). Further descriptive analyses were used to enable comparison across practice setting and levels of experience. For each we only included data from participants who declared their graded level of practice or practice setting [National Health Service (NHS), private practice or sport setting] as their primary work setting; to avoid contamination where some respondents do not align to

a specific grade or regularly work in different practice settings.

2.4. Ethics

This study was approved by the School of Sport, Exercise and Rehabilitation Sciences Ethics Committee, University of Birmingham. Participation in the survey was voluntary, with informed consent assumed through completion of the survey. Participants were informed regarding the survey content and duration prior to commencing the survey, with clear details informing options to withdraw and assurance of participant anonymity through the process of analysis and reporting.

3. 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.

3.1. 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.

3.2. Professional development

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

3.3. Clinical presentation of TSPD

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

3.4. Examination of TSPD

3.4.1. History taking and special questions

The majority of respondents included the following special questions: painful deep breath (96%, n = 465), history of cancer (94%, n = 454), pain coughing/sneezing (89%, n = 429), pain lying down (75%, n = 362), shortness of breath (73%, n = 354), pain on exertion (62%, n = 299), and a relatively small percentage asking about symptom behaviour with eating/drinking (29%, n = 139). ‘Other’

Table 1
Characteristics of respondents.

| | | Physiotherapists n (%) |
|------------------------------------|--|------------------------|
| Sex | Female | 268 (55.2) |
| | Male | 200 (41.2) |
| | N/A | 18 (3.7) |
| Age | < 25 years | 49 (9.3) |
| | 26–35 years | 215 (44.3) |
| | 36–55 years | 210 (43.3) |
| | > 56 years | 15 (3.1) |
| | | |
| Physiotherapy Grading ^a | 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) |
| | Other – Sport | 36 (7.4) |
| Years Qualified | 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) |
| Years in Musculoskeletal Practice | 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) |
| Physiotherapy Qualifications | 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) |

^a Grading is based on level of experience and expertise within musculoskeletal physiotherapy professional practice.

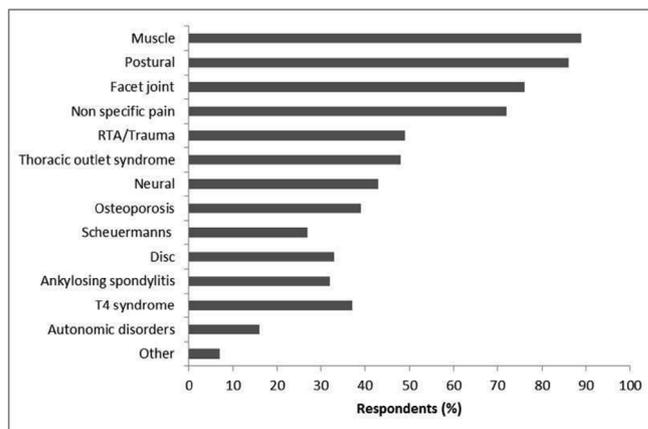


Fig. 1. TS clinical presentations.

possible special questions were provided by 17% (n = 84) of respondents. These included neural involvement, weight loss, and malaise/night sweat/fever, history of tuberculosis, previous fracture/osteoporosis, infection/visceral involvement, red flags, pain pattern, trauma, steroid use and rheumatological screening.

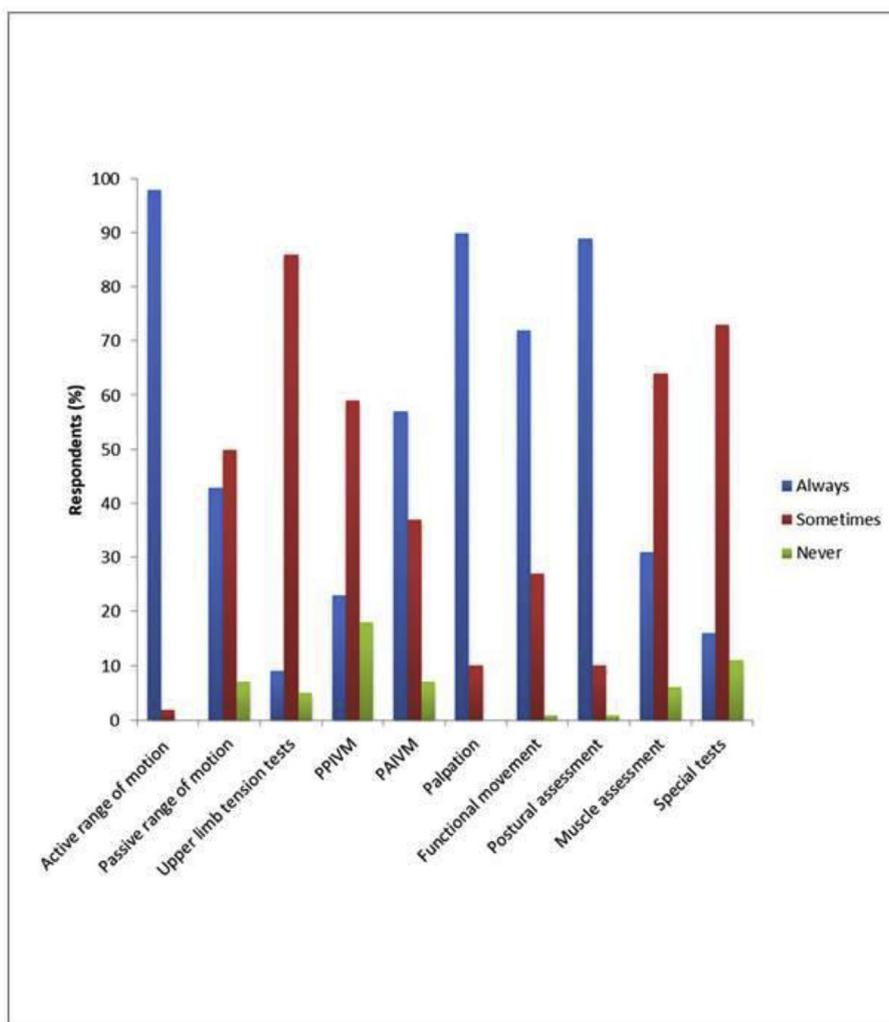


Fig. 2. TS physical examination techniques.

3.4.2. Physical Examination Techniques

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

3.5. Management of TSPD

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

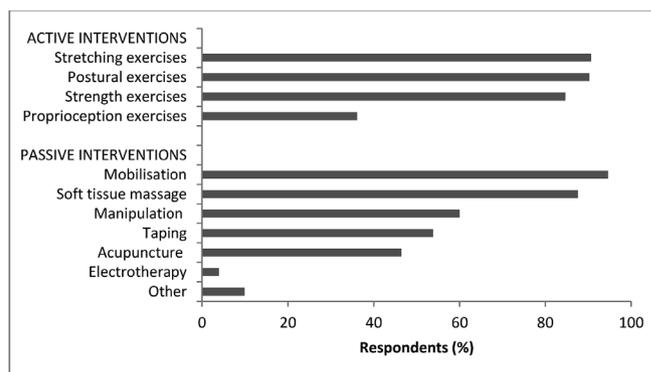


Fig. 3. Active and Passive Interventions used to Manage TSPD.

3.5.1. Use of interventions targeted at the TS to manage other Clinical Complaints

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

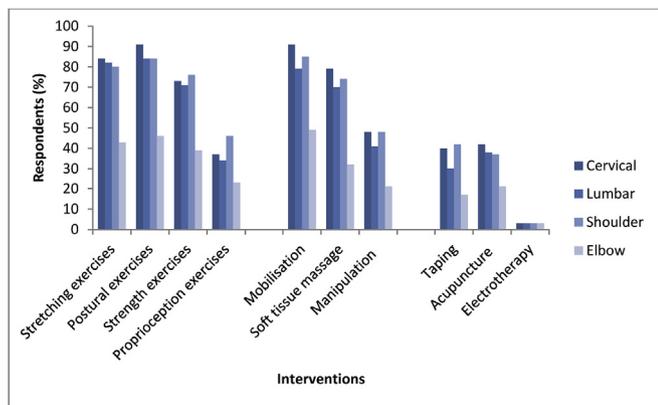


Fig. 4. Management of Clinical Complaints using TS Targeted Interventions.

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

3.6. Comparison of clinical presentations across clinical practice settings (private vs NHS vs sport)

Across different settings the prevalence of clinical presentations was similar with respect to muscle, posture, thoracic outlet syndrome and neural presentations. Notwithstanding the smaller sample of respondents working primarily in a sports setting (n = 26) reported seeing some clinical conditions less than those in NHS and private setting, most notably autonomic disorders, T4 syndrome, Ankylosing spondylitis, disc, Scheuermann's disease, osteoporosis, and RTA/trauma compared to the NHS and private practice. Specific diseases/conditions were more prevalent within the NHS, e.g. T4 syndrome, whereas non-specific complaints relating to muscle and facet joint, were more prevalent in private practice and sports setting. See Fig. 5.

3.7. Physical examination of TSPD

Across all practice settings, the majority of respondents indicated

using active range of motion, palpation, functional movement, and postural assessment routinely to examine TSPD. See Fig. 6 for details.

3.8. Examination of TS for other complaints

The majority of respondents across all practice settings indicated they examine the TS in patients experiencing cervical spine and shoulder issues. See Fig. 7 for details. More variability exists for the lumbar spine with those working in private (79%) or sports setting (89%) examining the TS compared to 69% in NHS. Examination of the TS with elbow and hip complaints was notably higher for those working in private (n = 19, n = 8 respectively) or sports setting (n = 15, n = 23 respectively) compared to less than 5 respondents in NHS. With respect to the high percentage of those working in sport reporting using techniques for 'Other' complaints these included complaints related to the arm (n = 4), ribs/chest (n = 4), knee (n = 4), sacroiliac/pelvis (n = 4), foot and ankle (n = 2). See Fig. 7.

3.9. Management of TSPD

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

3.10. Clinical Experience and the influence of management approaches

From those respondents who declared their level of experience/expertise some variability was observed between levels of experience and the management strategies used for TSPD. The majority of respondents across all experience levels indicated they use active exercises in patients presenting with TSPD. More variability exists in the use of proprioceptive exercises across grades, ranging from 13 to 48%.

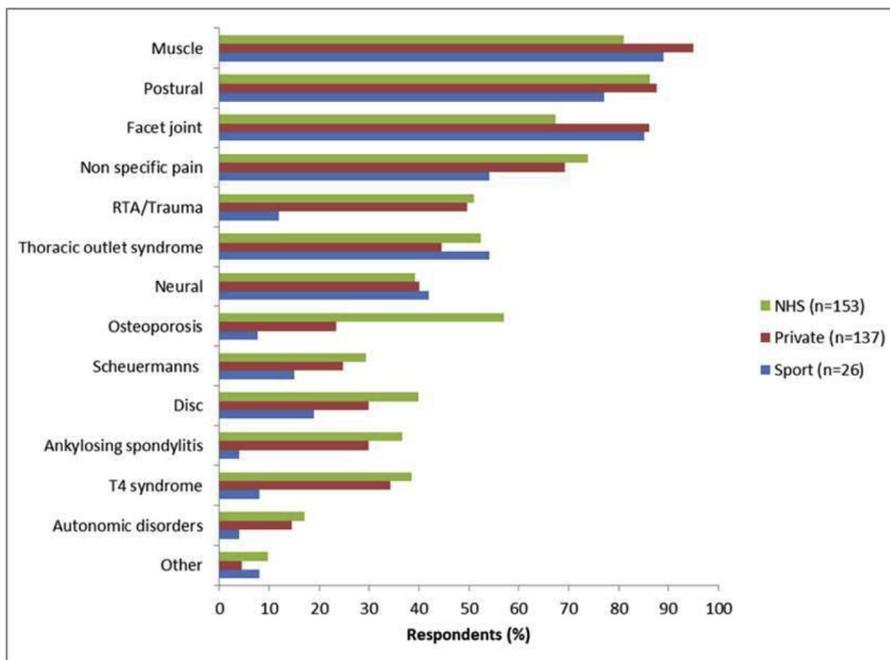


Fig. 5. Clinical presentations across practice settings.

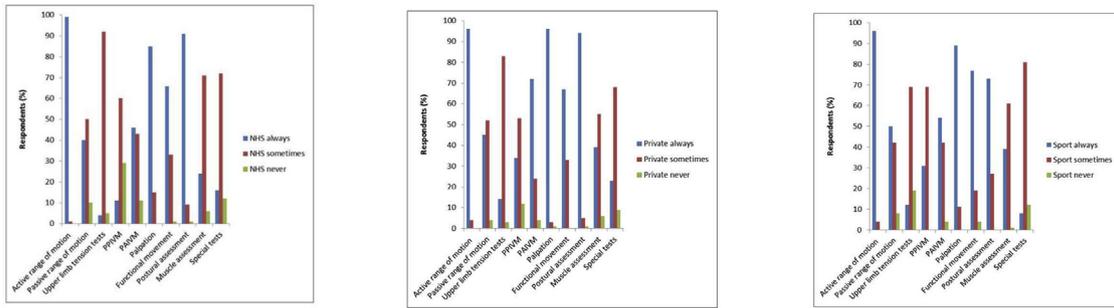


Fig. 6. Physical Examination Techniques for TSPD across Practice Settings in a. NHS b. Private Practice and c. Sport Practice Setting.

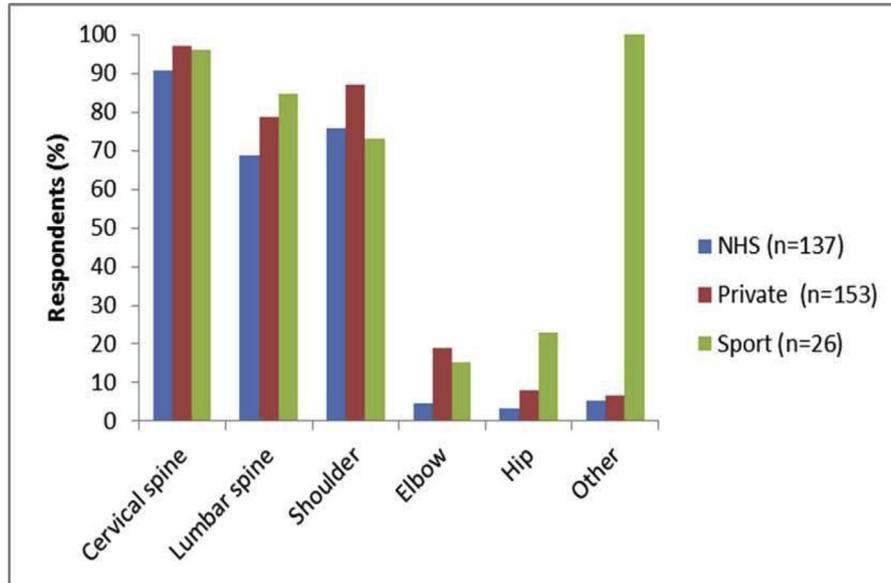


Fig. 7. Examination of the TS in cervical and lumbar spine, shoulder, elbow, hip, and other complaints across practice settings.

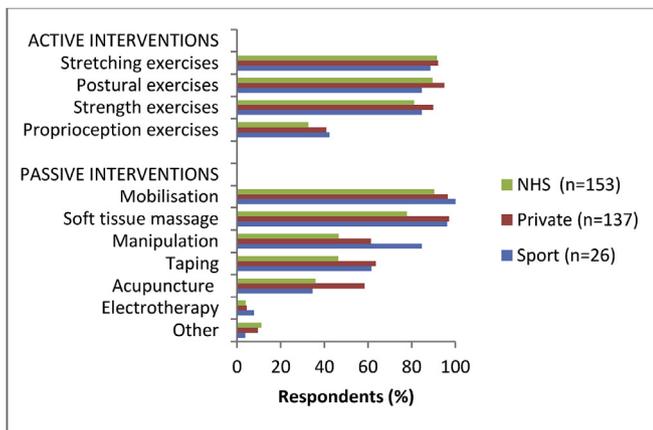


Fig. 8. Management of TSPD.

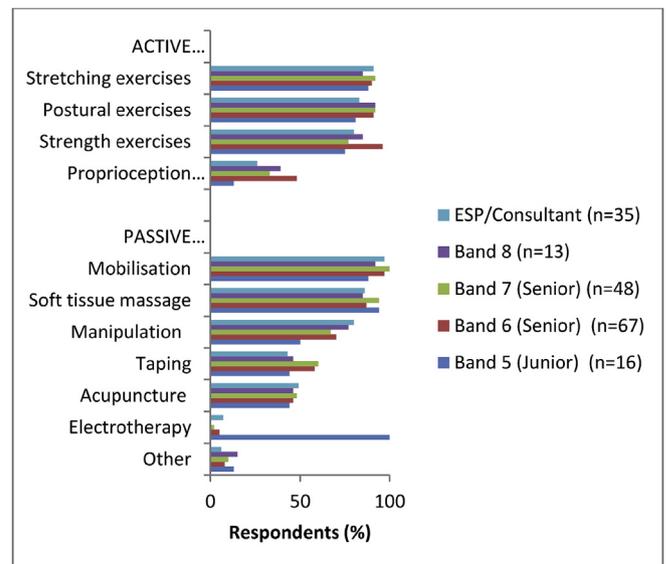


Fig. 9. Influence of clinical experience on management approach for TSPD.

For passive interventions, patterns were similar for mobilisation, soft tissue massage and acupuncture, although manipulation techniques were used by just half the junior respondents compared to more than 67% in other groups, with the highest percentage being advanced practitioners (> 80%). Electrotherapy was used by all junior band respondents compared to less than 7% in any other categories. See Fig. 9.

3.11. Additional comments

Additional comments were provided by 76 respondents with 7 key

themes including, importance of the TS as part of kinetic chain and linked to regional interdependence (n = 20), different presentations seen or approaches used including, respiratory dysfunction, ribs, relaxation, pain sciences (n = 17), population specific factors e.g. function and movement patterns in swimmers, women's health, trauma

(n = 14), decisions would be based on clinical reasoning (n = 9), poor teaching on undergraduate programmes and often over-looked (n = 8), association with more serious presentations/red flag/metastases (n = 6), bias of passive treatments (n = 3), and 'Others' (n = 12) (e.g. more research required, experiences of manipulation, lacking innovation in rehabilitation, acupuncture, or reporting nil else to add *etc.*)

4. Discussion

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

4.1. Clinical presentation

The reported ratio of complaints seen in practice across spinal region (12, 8, and 4, lumbar, cervical and thoracic cases per week) closely reflects the ratio of reported lifetime prevalence of spinal pain (lumbar 57%, cervical 40%, TS 17%) (Leboeuf-Yde et al., 2009). Respondents reported seeing an array of presentations of TSPD including, specific conditions e.g. osteoporosis, pathologies affecting musculoskeletal tissues e.g. muscle, facet joint, or complaints relating to a broader description of a presentation e.g. posture. This range of presentations is reflected in the epidemiology literature where pain prevalence varies widely (Briggs et al., 2009), is associated with a known condition or disease, or where thoracic pain co-exists with pain in other regions, albeit less severe or secondary to the primary complaint (Briggs et al., 2009; Heneghan et al., 2016, 2018a; Berglund et al., 2008).

4.2. Physical examination of the TS for TSPD and other complaints

Results illustrate consistency in the use of some clinical indicators although some variability was found for others, (e.g. Pain on eating or drinking) and many clinical indicators were reported in the 'Other' category. This may reflect the diversity of clinical presentations seen and encompassed within the broad clinical diagnosis of TSPD. Moreover where many clinical indicators were not exclusive to the TS this reflects the broader scope of spinal 'red flag' questions (Greenhalgh and Selfe, 2006) e.g. history of cancer.

The variability among examination approaches used by respondents for TSPD may be attributable to the range of presentations being managed, with some focused on pain and others dysfunction. Other plausible explanations include a lack of assessment techniques with known diagnostic utility, and convention driving clinical practice with those approaches used 'always' reflecting core teaching from standard textbooks (Petty and Moore, 2002). Although half the respondents had completed some form of higher degree e.g. Masters, it is unclear whether these were entry level or specialist programmes; a useful point for clarification to inform curriculum development.

Consistent with research supporting the use of thoracic techniques for managing complaints in other regions, respondents indicated examining the TS in patients with cervical, lumbar, and shoulder issues (Salom-Moreno et al., 2014; Gonzalez-Iglesias et al., 2009; Cleland et al., 2005, 2007a, 2007b; Suvarnnato et al., 2013; Peek et al., 2015; Walser et al., 2009).

4.3. Management of TSPD

In line with the survey investigating clinical practice for management of neck pain, active management approaches were used more consistently compared to passive approaches (Carlesso et al., 2014).

Whilst both exercise and manual therapy have good support for management of patients with neck and low back pain (National Institute for Health and Care Excellence (NICE) guidelines, 2016; Gross et al., 2016), there is little empirical evidence investigating TS exercise (Andersson et al., 2017). In recent years the emergence of research supporting the use of 'passive' thoracic mobilisation and manipulation (Suvarnnato et al., 2013; Young et al., 2004; Cross et al., 2011; Peek et al., 2015; Walser et al., 2009; Huisman et al., 2013) has exposed a relative gap in the literature regarding exercise prescription for the TS. A recent randomised controlled trial of thoracic spine stabilisation exercises found improvements in postural back pain and core endurance in young adults which highlights the need for further research on TSPD (Çelenay Ş, 2017).

Management approaches often associated with specialist skills or further post qualifying training, e.g. manipulation, taping and acupuncture, were used by around half the respondents. Exploration of respondents' clinical reasoning would be useful, given empirical evidence is only currently available to support the use of manipulation (Cleland et al., 2005, 2007b; Walser et al., 2009). Notwithstanding the influence and importance of patient preference in management planning, our findings suggest that management decisions are not always underpinned by empirical evidence and highlight a need to further investigate exercise prescription for TSPD. Given the ever shrinking healthcare budget, increase in sedentary occupations and behaviours (Heneghan et al., 2018b), continued growth in spine related disability (Global Burden of Disease Study, 2016; Foster et al.,) there has never been a more urgent need to have evidence-based exercise guidelines for management of TSPD.

4.4. Comparison of Clinical Presentations and practises across practice settings

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

4.5. Comparison of Clinical Presentations and practises across levels of Clinical Experience

Whilst similar patterns of practice were seen for many management approaches, some differences were seen, with all junior respondents using electrotherapy; a noteworthy finding given that electrotherapy is largely unsupported nor recommended in the management of spinal complaints (National Institute for Health and Care Excellence (NICE) guidelines, 2015; Blanpied et al., 2017; Gross et al., 2016). Although not considered entry level skills for UK physiotherapist acupuncture and taping were used by almost half of all respondents within each grade for the management of TSPD, suggesting these are perceived beneficial adjunctive skills to manage patients' complaints. For manipulation, where evidence and guidelines supports their use (Young et al., 2004; Blanpied et al., 2017; Gross et al., 2015) there was a trend for greater use with higher levels of experience, perhaps related to different caseloads, knowledge of evidence and/or confidence/skills in performing manipulation.

4.6. Strengths and limitations

Survey development was informed based on current evidence (Heneghan et al., 2018a; Walser et al., 2009; Muth et al., 2012; Heneghan and Rushton, 2016; Sueki et al., 2013), expertise (NRH, AR) and comparable surveys (Carlesso et al., 2014; Foster et al., 1999). View and participation rates for the survey were excellent compared to other e-surveys (Nulty, 2008). With a third of respondents working primarily in a single practice setting, establishing levels of respondent expertise allowed for a more detailed analysis of data to inform further research or make recommendations for the UK physiotherapy profession. Limitations include the closed nature of this type of survey that precludes an understanding of respondent's clinical reasoning in decisions. Many respondents were working in a mixed practice setting and were therefore excluded from the analysis of practice across settings. Findings are only representative of a self-selected population, so caution should be taken in generalising these findings. Finally the survey was focused to exploring examination and management from a biophysiological perspective, mirroring existing surveys in the cervical and lumbar spine (Carlesso et al., 2014; Foster et al., 1999). Whilst this enables some comparisons to be made across spinal regions data relating to management within a biopsychosocial framework was not captured.

4.7. Clinical and research implications

Findings from this survey identified priorities for practice and further research in TSPD; a requirement for evidence-based practice and research led teaching, and in lieu of limited resources e.g. time, and funding. Given the widespread use of active management approaches with little supporting empirical evidence a key priority is a review of exercise prescription in the TS, with subsequent research focused to optimising dose response of a range of exercise interventions. In turn this will inform clinical trials of exercise interventions for managing patients with TSPD. Further, consideration of approaches to assist sub classification of TSPD may also facilitate focused research in more homogenous groups, such as those with common clinical symptoms, clinical signs, examination techniques etc. In terms of findings across levels of experience, there is now a need to further examine mechanisms for knowledge and evidence dissemination to expedite evidence-based practice; a finding that mirrors findings from a survey of practice focused to thoracic manipulation (Heneghan et al., 2018c). Further qualitative research could usefully examine physiotherapists' clinical reasoning in managing patients with TSPD and assist prioritisation of further research in TSPD. This would potentially inform curriculum development, skills development and knowledge translation strategies to optimise evidence informed management at all levels of practice. Findings can be used to inform further focused research in TSPD or related areas, for example differences in management for thoracic pain and thoracic dysfunction, recognising them as different entities, as well as knowledge translation strategies, curriculum design and trials of clinical interventions.

5. Conclusion

As well as examining patients with TSPD, UK physiotherapists assess the TS in patients with neck, low back and shoulder complaints, using active range of motion testing, palpation and postural assessment. The majority of UK physiotherapists use exercise, mobilisation and soft tissue massage to manage patients presenting with TSPD, despite a paucity of high quality empirical evidence supporting their use. Further research is now required to investigate the identified non-evidence-based interventions, specifically exercise given its widespread use. Additionally strategies to optimise knowledge translation are required to promote evidence-based education and clinical practice.

Conflicts of interest

None declared

Ethical approval

Granted by the School of Sport, Exercise and Rehabilitation Sciences 16/12/15 (Ref RR_24/11/15).

Funding

None

Funding statement

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

Acknowledgements

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

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.msksp.2018.11.006>.

References

- Andersson, S., Bahr, R., Clarsen, B., Myklebust, G., 2017. Preventing overuse shoulder injuries among throwing athletes: a cluster randomised controlled trial in 660 elite handball players. *Br. J. Sports Med.* 51 (0), 1–9.
- Berglund, K.M., Persson, B.H., Denison, E., 2008. Prevalence of pain and dysfunction in the cervical and thoracic spine in persons with and without lateral elbow pain. *Man. Ther.* 13 (4), 295.
- Blanpied, P.R., Gross, A.R., Elliott, J.M., Devaney, L.L., Clewley, D., Walton, D.M., et al., 2017. Clinical practice guidelines linked to the international classification of functioning, disability and health from the orthopaedic section of the American physical therapy association. *JOSPT* 47 (7), A1–A83.
- Briggs, A.M., Smith, A.J., Straker, L.M., Bragge, P., 2009. Thoracic spine pain in the general population: prevalence, incidence and associated factors in children, adolescents and adults. A systematic review. *BMC Musculoskel. Disord.* 10 (77), 1–2.
- Buchbinder R, van Tulder M, Öberg B, Costa LM, Woolf A, Schoene M, et al. Low back pain: a call for action. *Lancet.* 391(10137):2384–2388.
- Bucke, J., Spencer, S., Fawcett, L., Sonvico, L., Rushton, A., Heneghan, N.R., 2017. Validity of the digital inclinometer and iPhone when measuring thoracic spine rotation. *J. Athl. Train.* 52 (9), 820–825.
- Carlesso, L.C., MacDermid, J.C., Gross, A.R., Walton, D.M., Santguida, P.L., 2014. Treatment preferences amongst physical therapists and chiropractors for the management of neck pain: results of an international survey. *Chiropr. Man. Ther.* 22 (11), 1–15.
- Casanova-Méndez, A., Olivia-Pascual-Vaca, A., Rodriguez-Blanco, C., Heredia-Rizo, A.M., Gogorza-Arroitaonandia, C., Almazán-Campos, G., 2014. Comparative short-term effects of two thoracic spinal manipulation techniques in subjects with chronic mechanical neck pain: a randomized controlled trial. *Man. Ther.* 19, 331–337.
- Çelenay Ş, K.D., 2017. An 8-week thoracic spine stabilization exercise program improves postural back pain, spine alignment, postural sway, and core endurance in university students: a randomized controlled study. *Turk. J. Med. Sci.* 47 (2), 504–513.
- Cleland, J.A., Childs, J.D., McRae, M., Palmer, J.A., Stowell, T., 2005. Immediate effects of thoracic manipulations in patients with neck pain: a randomised clinical trial. *Man. Ther.* 10 (2), 127–135.
- Cleland, J.A., Childs, J.D., Fritz, J.M., Whitman, J.M., Eberhart, S.L., 2007a. Development of a clinical prediction rule for guiding treatment of a subgroup of patients with neck pain: use of thoracic spine manipulation, exercise and patient education. *Phys. Ther.* 87 (1), 9–23.
- Cleland, J.A., Glynn, P., Whitman, J.M., Eberhart, S.L., MacDonald, C., Childs, J.D., 2007b. Short-term effects of thrust versus non thrust mobilization/manipulation directed at the thoracic spine in patients with neck pain: a randomized clinical trial. *Phys. Ther.* 87 (4), 431–440.
- Cross, K.M., Kuenze, C., Grindstaff, T., Hertel, J., 2011. Thoracic spine thrust manipulation improves pain, range of motion, and self-reported function in patients with mechanical neck pain: a systematic review. *JOSPT* 41 (9), 633–642.
- Dillman, D.A., 2007. *Mail and Internet Surveys: the Tailored Design Method*, second ed.

- John Wiley, Hoboken (NJ).
- Eysenbach, G., 2004. Improving the quality of web surveys: the checklist for reporting results of Internet e-surveys (CHERRIES). *J. Med. Int. Res.* 6 (3e34), 1–6.
- Fernández-de-las-Penas, 2007. Myofascial Trigger Points in Subjects Presenting with Mechanical Neck Pain: a Blinded, Controlled Study.
- Foster, N., Phil, D., Thompson, K., Baxter, G., 1999. Management of nonspecific low back pain by physiotherapists in Britain and Ireland: a descriptive questionnaire of current clinical practice. *Spine (Phila Pa 1976)* 24 (13), 1332.
- Foster NE, Anema JR, Cherkin D, Chou R, Cohen SP, Gross DP, et al. Prevention and treatment of low back pain: evidence, challenges, and promising directions. *The Lancet.* 391(10137):2368–2383.
- Global Burden of Disease Study, C., 2016. Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet* 388 (10053), 1545–1602.
- Gonzalez-Iglesias, J., Fernandez-de-las-Penas, C., Cleland, J.A., Albuquerque-Sendin, F., Palomeque-del-Cerro, L., Mendez-Sanchez, R., 2009. Inclusion of thoracic spine thrust manipulation into an electro-therapy/thermal program for the management of patients with acute mechanical neck pain: a randomized clinical trial. 14 (3), 306–313.
- Greenhalgh, S., Selfe, J., 2006. Red Flags: a Guide to Identifying Serious Pathology of the Spine. Churchill Livingstone.
- Gross, A.L.P., Burnie, S.J., Bédard-Brochu, M.S., Empey, B., Dugas, E., Faber-Dobrescu, M., Andres, C., Graham, N., Goldsmith, C.H., Brønfort, G., Hoving, J.L., 2015. LeBlanc F Manipulation and Mobilisation for Neck Pain Contrasted against an Inactive Control or Another Active Treatment (Review).
- Gross, A.R., Paquin, J.P., Dupont, G., Blanchette, S., Lalonde, P., Cristie, T., et al., 2016. Exercises for mechanical neck disorders: a Cochrane review update. *Man. Ther.* 24, 25–45.
- Heneghan, N.R., Rushton, A., 2016. Understanding why the thoracic region is the 'Cinderella' region of the spine. *Man. Ther.* 21, 274–276.
- Heneghan, N.R., Adab, P., Jackman, S., Balanos, G.M., 2015. Musculoskeletal dysfunction in COPD an observational study. *Int. J. Ther. Rehabil.* 22 (3), 119–128.
- Heneghan, N.R., Smith, R., Rushton, A., 2016. Thoracic dysfunction in whiplash-associated disorders: a systematic review and meta-analysis protocol. *Syst. Rev.* (26), 5.
- Heneghan, N.R., Smith, R., Tyros, I., Falla, D., Rushton, A., 2018a. Thoracic dysfunction in whiplash associated disorders; a systematic review. *PloS One* 13 (3), e0194235.
- Heneghan, N.R., Baker, G., Thomas, K., Falla, D., Rushton, A., 2018b. The influence of sedentary behaviour and physical activity on thoracic spinal mobility in young adults: an observational study. *BMJ Open*, e019371.
- Heneghan, N.R., Davies, S., Puente-dura, E.J., Rushton, A., 2018c. Knowledge and Pre-thoracic Spinal Thrust Manipulation Examination: a Survey of Current Practice in the UK JMMT. E-pub ahead of print - 5 Sep. 2018.
- Huisman, P.A., Speksnijder, C.M., A dW, 2013. The effect of thoracic spine manipulation on pain and disability in patients with non-specific neck pain: a systematic review. *Disabil. Rehabil.* 36 (20), 1677–1685.
- Johnson, K.D., Kim, K., Yu, B., Saliba, S.A., Grindstaff, T.L., 2012. Reliability of thoracic spine rotation range-of-motion measurements in healthy adults. *J. Athl. Train.* 47 (1), 52–60.
- Lau, H.M.C., Chiu, T.T.W., Lam, T.H., 2011. The effectiveness of thoracic manipulation on patients with chronic mechanical neck pain – a randomized controlled trial. *Man. Ther.* 16 (2), 141–147.
- Leboeuf-Yde, C., Nielsen, J., Kyvik, K.O., Fejer, R., Hartvigsen, J., 2009. Pain in the lumbar, thoracic or cervical regions: do age or gender matter? A population-based study of 34,902 Danish twins 20–71 years of age. *BMC Musculoskel. Disord.* 10 (39), 1–12.
- Muth, S., Barbe, M., Lauer, R., McClure, P., 2012. The effects of thoracic spine manipulation in subjects with signs of rotator cuff tendinopathy. *JOSPT* 42, 1005–1016.
- National Institute for Health and Care Excellence (NICE) guidelines, 2015. Neck Pain - Non-specific. NICE Available from: <https://cks.nice.org.uk/neck-pain-non-specific>.
- National Institute for Health and Care Excellence (NICE) guidelines, 2016. Low Back Pain and Sciatica in over 16s: Assessment and Management. NICE Available from: <https://www.nice.org.uk/guidance/ng59>.
- Nulty, D.D., 2008. The adequacy of response rates to online and paper surveys: what can be done? *Assess Eval. High Educ.* 33 (3), 301–314.
- Peek, A., Miller, C., Heneghan, N., 2015. Thoracic manual therapy in the management of non-specific shoulder pain: a systematic review. *J. Man. Manip. Ther.* 23 (4), 176–187.
- Petty, N., Moore, A., 2002. Neuromuscular Examination and Assessment a Handbook for Therapists. Churchill Livingstone, Edinburgh.
- Puntumetakul, R., Suvarnnato, T., Werasirirat, P., Uthairak, S., Yamauchi, J., Boucaut, R., 2015. Acute effects of single and multiple level thoracic manipulations on chronic mechanical neck pain: a randomized controlled trial. *Neuropsychiatr. Dis. Treat.* 11, 137–144.
- Roquelaure, Y.B.J., Ha, C., Le Marec, F., Fouquet, N., Ramond-Roquin, A., Goldberg, M., Descatha, A., Petit, A., Imbernon, E., 2014. Incidence and risk factors for thoracic spine pain in the working population: the French pays de la Loire study. *Arthritis Care Res. (Hoboken)* 66 (11), 1695–1702.
- Salom-Moreno, J., Ortega-Santiago, R., Cleland, J., Palacios-Ceña, M., Truyols-Domínguez, S., Fernández-de-las-Peñas, C., 2014. Immediate changes in neck pain intensity and widespread pressure pain sensitivity in patients with bilateral chronic mechanical neck pain: a randomized controlled trial of thoracic thrust manipulation vs non-thrust mobilization. *J. Manipulative Physiol. Therapeut.* 37 (5), 312–319.
- Sanzo, P., Yeung, E., Levesque, L., Maheu, E., Woodard, T., Michels, S., et al., 2016. Is thoracic manipulation effective in managing shoulder dysfunction a systematic review. *Man. Ther.* 25, e154.
- Strunce, J.B., Walker, M.J., Boyles, R.E., Young, B.A., 2009. The immediate effects of thoracic spine and rib manipulation on subjects with primary complaints of shoulder pain. *J. Man. Manip. Ther.* 17 (4), 230–236.
- Sueki, D.G., Cleland, J.A., Wainner, R.S., 2013. A regional interdependence model of musculoskeletal dysfunction: research, mechanisms, and clinical implications. *J. Man. Manip. Ther.* 21 (2), 90–102.
- Sung, Y.B., Lee, J.H., Park, Y.H., 2014. Effects of thoracic mobilization and manipulation on function and mental state in chronic lower back pain. *J. Phys. Ther. Sci.* 26, 1711–1714.
- Suvarnnato, T., Puntumetakul, R., Kaber, D., Boucaut, R., Boonphakob, Y., Arayawichanon, P., et al., 2013. The effects of thoracic manipulation versus mobilization for chronic neck pain: a randomized controlled trial pilot study. *J. Phys. Ther. Sci.* 25 (7), 865–871.
- Theisen, C., van Wagenveld, A., Timmesfeld, N., Efe, T., Heyse, T.J., Fuchs-Winkelmann, S., et al., 2010. Co-occurrence of outlet impingement syndrome of the shoulder and restricted range of motion in the thoracic spine—a prospective study with ultrasound-based motion analysis. *BMC Musculoskel. Disord.* (11), 135.
- Theodoridis, D., Ruston, S., 2002. The effect of shoulder movements on thoracic spine 3D motion. *Clin. Biomech. (Bristol, Avon)* 17 (5), 418–421.
- Vaismoradi, M.T.H., Bondas, T., 2013. Content analysis and thematic analysis: implications for conducting a qualitative descriptive study. *Nurs. Health Sci.* 15 (3), 398–405.
- Walser, R.F., Meserve, B.B., Boucher, T.R., 2009. The effectiveness of thoracic spine manipulation for the management of musculoskeletal conditions: a systematic review and meta-analysis of randomized clinical trials. *J. Man. Manip. Ther.* 17 (4), 237–338.
- Young, J.L., Walker, D., Snyder, S., Daly, K., 2004. Thoracic manipulation versus mobilization in patients with mechanical neck pain: a systematic review. *J. Man. Manip. Ther.* 22 (3), 141–153.