

# BMJ Open Do physical therapists follow evidence-based guidelines when managing musculoskeletal conditions? Systematic review

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## ABSTRACT

**Objectives** Physicians often refer patients with musculoskeletal conditions to physical therapy. However, it is unclear to what extent physical therapists' treatment choices align with the evidence. The aim of this systematic review was to determine what percentage of physical therapy treatment choices for musculoskeletal conditions agree with management recommendations in evidence-based guidelines and systematic reviews.

**Design** Systematic review.

**Setting** We performed searches in Medline, Embase, Cumulative Index to Nursing and Allied Health Literature, Cochrane Central Register of Controlled Trials, Allied and Complementary Medicine, Scopus and Web of Science combining terms synonymous with 'practice patterns' and 'physical therapy' from the earliest record to April 2018.

**Participants** Studies that quantified physical therapy treatment choices for musculoskeletal conditions through surveys of physical therapists, audits of clinical notes and other methods (eg, audits of billing codes, clinical observation) were eligible for inclusion.

**Primary and secondary outcomes** Using medians and IQRs, we summarised the percentage of physical therapists who chose treatments that were recommended, not recommended and had no recommendation, and summarised the percentage of physical therapy treatments provided for various musculoskeletal conditions within the categories of recommended, not recommended and no recommendation. Results were stratified by condition and how treatment choices were assessed (surveys of physical therapists vs audits of clinical notes).

**Results** We included 94 studies. For musculoskeletal conditions, the median percentage of physical therapists who chose recommended treatments was 54% (n=23 studies; surveys completed by physical therapists) and the median percentage of patients that received recommended physical therapy-delivered treatments was 63% (n=8 studies; audits of clinical notes). For treatments not recommended, these percentages were 43% (n=37; surveys) and 27% (n=20; audits). For treatments with no recommendation, these percentages were 81% (n=37; surveys) and 45% (n=31; audits).

**Conclusions** Many physical therapists seem not to follow evidence-based guidelines when managing musculoskeletal conditions. There is considerable scope to increase use of recommended treatments and reduce use of treatments that are not recommended.

## Strengths and limitations of this study

- This is the first study to summarise the percentage of physical therapy treatment choices for musculoskeletal conditions that agree with management recommendations in evidence-based guidelines and systematic reviews.
- We used a systematic approach to identify studies on physical therapy treatment choices and classified recommendations for physical therapy treatments according to evidence-based guidelines and systematic reviews.
- Experts provided feedback to help refine our classification, and a second reviewer double checked all the extracted data to ensure accuracy.
- The main limitation is that primary studies only reported treatment choices for individual treatments and not for combinations of treatments.
- Recommended treatments such as advice and reassurance might not have been documented in clinical notes or listed in a survey because they may be viewed as a routine part of physical therapy; this could have underestimated the percentage of physical therapists that provided recommended treatments.

**PROSPERO registration number** CRD42018094979.

## INTRODUCTION

Musculoskeletal conditions (such as back and neck pain) have remained the leading cause of disability worldwide over the past two decades and the burden is increasing.<sup>1</sup> Concerns about the harms of medicines such as opioids, and new evidence on the lack of effectiveness of common surgical procedures have shifted guideline recommendations for musculoskeletal conditions so there is now more explicit recommendation of non-pharmacological treatments such as those provided by physical therapists. For example, the Center for Disease Control and Prevention recommends exercise therapy instead of opioids in the management of chronic pain.<sup>2</sup>

Similarly, the 2018 Royal Australian College of General Practitioners guideline for the management of hip and knee osteoarthritis discourages opioids and arthroscopy for knee osteoarthritis and recommends aquatic and land-based exercise.<sup>3</sup>

Physicians often refer patients with musculoskeletal conditions to physical therapy for non-pharmacological care. In the USA, there are nearly 250 000 physical therapists<sup>4</sup> and in Australia there are now more practising physical therapists than general practitioners.<sup>5 6</sup> It is important to appreciate however that there are a range of non-pharmacological treatments that physical therapists can provide; some such as exercise are recommended in guidelines for musculoskeletal conditions while others such as electrotherapy are recommended against.<sup>7</sup>

While there has been considerable attention in medicine on whether physicians are providing recommended care, there has been less attention on whether health services that physicians refer for involve recommended care.<sup>8</sup> Determining whether physical therapists are providing treatments recommended in evidence-based guidelines when they manage musculoskeletal conditions is an important step towards ensuring evidence-based care across all healthcare settings.

The aim of this systematic review was to summarise the percentage of physical therapy treatment choices for musculoskeletal conditions that agree with management recommendations in evidence-based guidelines and systematic reviews.

## METHODS

This review was conducted in accordance with the 'Preferred Reporting Items for Systematic Reviews and Meta-Analyses' statement.<sup>9</sup> Due to the size of the review, other research questions in our registered protocol (including physical therapy treatment choices for cardiorespiratory and neurological conditions) will be addressed in separate manuscripts. Other deviations to our registered protocol include using a modified version of the 'Downs and Black' checklist to rate study quality and changing the focus from 'high-value and low-value care' to 'recommended and not-recommended care'.

### Data sources and searches

We conducted a comprehensive keyword search in Medline, Embase, Cumulative Index to Nursing and Allied Health Literature, Cochrane Central Register of Controlled Trials, Allied and Complementary Medicine, Scopus and Web of Science, from the earliest record until April 2018. Our search strategy combined terms relating to 'practice patterns' and 'physical therapy' (online supplementary table 1) and was designed to capture studies investigating physical therapy treatment choices for any condition (as per our registered protocol). We performed citation tracking and reviewed the reference lists of included studies to identify those missed by our initial database search.

Two independent reviewers (JZ and MO) performed the selection of studies by subsequently screening the title, abstract and full text of studies retrieved through our electronic database search. Any disagreements between the two reviewers were resolved through discussion.

### Study selection

We included any study that reported physical therapy treatment choices for musculoskeletal conditions through surveys of physical therapists (with or without vignettes), audits of clinical notes and other methods (eg, surveys of patients). We only included full-text studies in English. There was no restriction on the musculoskeletal condition treated (eg, neck pain, rehabilitation post knee arthroplasty) or practice setting (eg, private, public), but we excluded studies that reported treatment choices for conditions where there were no known effective or ineffective physical therapist-delivered treatments. We also excluded studies that only quantified physical therapists' use of assessment procedures, outcome measures, referrals, treatments without specifying a target condition, pharmacological treatments (eg, recommending paracetamol) or treatments outside the usual scope of physical therapy practice (eg, injections); and studies where physical therapy treatment choices were unable to be separated from other healthcare providers.

### Data extraction and quality assessment

One reviewer (JZ) independently extracted individual study characteristics (eg, condition, country, participant demographics) and percentages that quantified physical therapy treatment choices (see Data synthesis and Analysis sections). A second reviewer (MO) double checked the extracted data to ensure accuracy. Discrepancies were resolved by discussion between the two reviewers and rechecking data against the original citation. We contacted authors when it appeared that relevant data were not reported.

The methodological quality of included studies was assessed independently by two reviewers (JZ and MO) using a modified version of the Downs and Black checklist. Any disagreements between the two reviewers were resolved through discussion. We modified the original 27-item Downs and Black checklist<sup>10</sup> and selected eight items that were relevant to studies on treatment choices (online supplementary table 2). For item eight, we considered the following assessments of treatment choices as 'accurate': observation, audits of clinical notes, audits of billing codes, treatment recording forms and validated surveys.

### Data synthesis

The following definitions were used to classify treatments as recommended, not recommended and no recommendation:

- *Recommended treatments* included physical therapy treatments endorsed in well-recognised evidence-based clinical practice guidelines (eg, guidelines from the

National Institute for Health and Care Excellence, NICE) or found to be effective in recent systematic reviews. Treatments recommended in guidelines were further categorised as those that ‘must be provided’ (‘core’ treatments) and those that ‘should be considered’. When guidelines specified core treatments, only these treatments were considered ‘recommended’ in our primary analysis (see Treatment choices that involved treatments that were recommended, not recommended and had no recommendation section). Otherwise, treatments that should be considered were accepted as recommended.

- ▶ *Not-recommended treatments* included physical therapy treatments not recommended in guidelines or found to be ineffective in recent systematic reviews.
- ▶ *Treatments with no recommendation* included physical therapy treatments where guideline recommendations and evidence from systematic reviews was inconclusive, or where treatments had not been investigated in a systematic review.

We used one clinical practice guideline per condition to classify physical therapy treatments (primary guideline) and contacted leading experts to help us select our primary guideline and refine our classification for a number of conditions (see Acknowledgements). If we found a physical therapy treatment that was not mentioned in the primary guideline, we searched in other evidence-based clinical practice guidelines and systematic reviews to inform our classification (online supplementary table 3). We selected recently published high-quality systematic reviews where possible.

### Assessments of treatment choices

Data on physical therapy treatment choices were divided into two main categories (and analysed separately) due to differences in how each category is interpreted:

#### Treatment choices assessed by surveys completed by physical therapists (with or without vignettes)

*Interpretation.* Surveys completed by physical therapists yielded data on the percentage of physical therapists that provide (survey without vignette) or would provide (survey with vignette) a particular treatment for a condition they frequently treat.

*Survey without vignette.* Physical therapists outlined the treatments they provide for a condition or rated how often they provide a particular treatment for a condition (eg, ‘frequently’; ‘sometimes’; ‘rarely’; or ‘never’). When studies reported how often treatments were provided, we extracted the percentage of treatments that were provided at least sometimes. We combined data when studies separated survey responses by different samples of physical therapists (usually by country or practice setting). Some surveys were completed by a senior physical therapist on behalf of the physical therapy department within a hospital (eg, management following knee arthroplasty).

*Survey with vignette.* Physical therapists outlined the treatments they would provide for a particular case

(vignette). For studies that included multiple vignettes of the same condition, we took an average of physical therapists’ responses across vignettes of equal sample sizes or used data from the vignette with the highest sample size.

#### Treatment choices assessed by audits of clinical notes, audits of billing codes, treatment recording forms, clinical observation or surveys completed by patients

*Interpretation.* These assessment measures (reported as ‘assessed by clinical notes’ in the results tables) yielded data on the percentage of patients that received a particular physical therapy-delivered treatment in a single treatment session or throughout an episode of care (ie, from initial consultation to discharge).

Audits of clinical notes and billing codes were performed retrospectively in the included studies. Treatment recording forms provided similar information to clinical notes, except they were often implemented as part of a study or registry on treatment practices (prospective). Within a study, we combined data across samples that presented with the same condition (eg, physical therapists from different countries treatment low back pain).

### Analysis

We used counts and ranges to summarise study characteristics for each condition. We used medians and IQRs to summarise the percentage of physical therapy treatment choices that involved treatments that were recommended, not recommended and had no recommendation across studies. We provided an overall result for all studies and then separately for individual musculoskeletal conditions (eg, low back pain). Since physical therapists can provide multiple treatments for the same patient, and treatment choices were summarised across studies, the percentage of treatment choices that involved treatments that were recommended, not recommended and had no recommendation do not sum to 100%. For example, 70% of physiotherapists might provide recommended treatments for low back pain, but the same percentage might also provide some treatments that are not recommended or have no recommendation.

#### Treatment choices that involved treatments that were recommended, not recommended and had no recommendation

Where possible, recommended treatment was based on treatment choices involving all core treatments recommended in guidelines (ie, physical therapists ‘must’ or ‘should’ provide). For example, the NICE guidelines for low back pain recommend that all patients receive advice and education to support self-management, reassurance and advice to keep active.<sup>7</sup> Since studies did not report combinations of treatments, we used the lowest value across all core treatments. For example, if 30% of physical therapists provide reassurance and 50% provide advice to stay active, we used 30% as the percentage of treatment choices that involved recommended treatments. This is because no more than 30% of the sample could have provided both reassurance and advice to stay

active (core treatments). If guidelines did not mention core treatments or if there were no guidelines for a condition, we used data from the most frequently provided recommended treatment that should be considered or was found to be effective in a systematic review. We used data from the most frequently provided treatment that was not recommended and had no recommendation to provide an estimate of the percentage of physical therapists' treatment choices that involve at least one treatment that is not recommended and had no recommendation. For studies that reported treatment choices stratified by the duration of symptoms (acute vs chronic) or different settings (inpatient vs outpatient), we used the highest value of treatments that were recommended, not recommended and had no recommendation across the strata. We summarised the percentage of physical therapy treatment choices that were recommended, not recommended and had no recommendation across all musculoskeletal conditions where guidelines recommended core treatments.

#### Physical therapy treatments provided for various musculoskeletal conditions

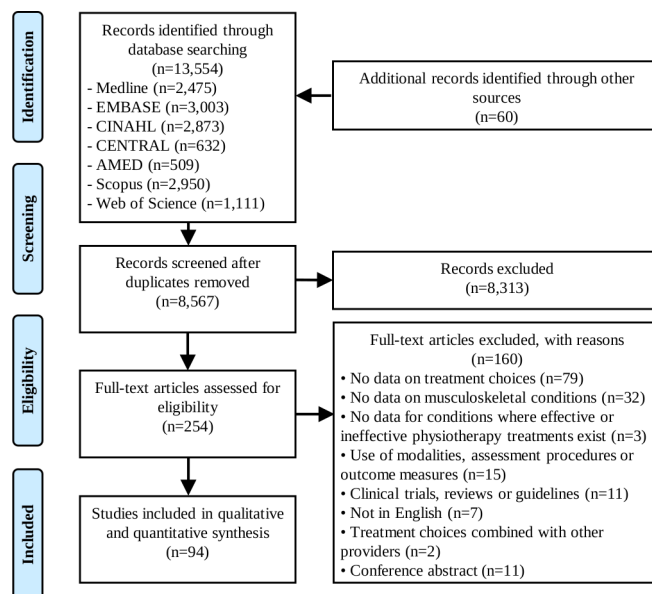
We summarised the percentage of physical therapy treatments provided for various conditions within the categories of recommended, not recommended and no recommendation. Treatments that were procedurally similar and had the same recommendation (ie, recommended, not recommended and no recommendation) were grouped together. For example, according to the NICE low back pain guidelines, mobilisation, manipulation and massage should all be 'considered'.<sup>7</sup> Hence, these were grouped as 'manual therapy'. Studies rarely reported combinations of physical therapy treatments, so we used data from the most frequently provided treatment where appropriate. For example, if 67% of physical therapists provide massage for acute low back pain and 20% provide mobilisation, we used 67% as the best estimate for the percentage of physical therapists that provide manual therapy.

#### Patient or public involvement

Patients and members of the public were not involved in the design of this study.

## RESULTS

After removing duplicates and screening 8567 titles and abstracts and 254 full-texts reports, 94 studies were included (figure 1). Physical therapy treatment choices were investigated for low back pain (n=48 studies),<sup>11–58</sup> knee pain (n=10),<sup>32 34 57 59–65</sup> neck pain or whiplash (n=11),<sup>15 18 32 34 51 66–71</sup> foot or ankle pain (n=5),<sup>72–76</sup> shoulder pain (n=7),<sup>15 51 77–81</sup> pre or post knee arthroplasty (n=6)<sup>46 82–86</sup> (including one study of hip and knee arthroplasty<sup>86</sup>) and other musculoskeletal or orthopaedic conditions (where treatment choices were only reported in one study or where one of either recommended or



**Figure 1** Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram. AMED, Allied and Complementary Medicine; CENTRAL, Cochrane Central Register of Controlled Trials; CINAHL, Cumulative Index to Nursing and Allied Health Literature.

not recommended treatments could not be inferred from guidelines or systematic reviews) (n=18).<sup>87–104</sup> We contacted 15 authors for data (regarding 18 studies): 12 responded and 5 were able to provide the data we requested (regarding six studies).<sup>15 16 22 64 89 100</sup> A summary of study characteristics across conditions is presented in table 1. Characteristics of included studies are presented in online supplementary table 4.

Seven studies investigated treatment choices for shoulder pain: four<sup>15 78 80 81</sup> focused on subacromial pain syndrome (the most common form of shoulder pain<sup>105</sup>), two<sup>77 79</sup> included patients with various diagnoses (including subacromial pain syndrome) and one<sup>51</sup> did not specify a diagnosis (online supplementary table 4). Evidence on the management of subacromial pain syndrome was used to categorise treatment choices for all studies on shoulder pain. Similarly, evidence on the management of lateral ankle sprains was used to categorise treatment choices for all studies on acute ankle injuries (n=2/3 studies on lateral ankle sprains<sup>75 76</sup>) and evidence on the management of knee osteoarthritis for all studies on knee pain (excluding one study on acute knee injuries<sup>57</sup> and another on a mixed sample of hip and knee osteoarthritis<sup>60</sup>—see online supplementary table 5).

#### Methodological quality

Individual study scores ranged from 4 to 8 (out of a possible 8) with a mean score of 6.0 (median=6) (online supplementary table 6). The most common methodological limitations included failing to report that physical therapists who were prepared to participate were representative of the population from which they were drawn (n=88/94) and not using an accurate assessment of

**Table 1** Summary of study characteristics by condition

Condition	N	Countries	Age range†; mean (SD) unless stated otherwise	Experience‡; mean years (SD) unless stated otherwise Low: lowest values from studies High: highest values from studies	Sample size range‡	Assessment measure
<b>Musculoskeletal</b>						
Low back pain (one study did not contribute data)	48	USA (n=9); UK (n=8); Netherlands (n=6); Ireland (n=6); Canada (n=5); New Zealand (n=3); Australia; Brazil; Denmark; Ghana; India; Nigeria Norway; South Africa; Spain; Sweden; Thailand	PTs: 32.6 (7.8) to 47 (9.3) and 5 y Pts: 34.5 (17) to 53.9 (14.5).	<b>Low:</b> 2 (IQR 5) or 77.3% between 1 and 5 y <b>High:</b> 24 (9.4) or 50% between 15 and 24 y	PTs: 44–1239 Pts: 42–8714 Treatment sessions: 1151–12387	Survey with vignettes=12 Survey without vignette=11 Treatment recording forms=15 Audit of clinical notes=7 Survey of Pts=1 Audit of billing codes=1 Clinical observation=1
▲ Acute (n=18)						
▲ Subacute or chronic (n=17)						
▲ No duration specified or unable to stratify (n=26)						
Neck pain and whiplash*	11	USA (n=3); Australia (n=2); various (n=2); Canada; Nigeria; Singapore; Spain; Sweden**	PTs: 32.6 (7.8) or 60%>40 y Pts: 35.5 (11.5) to 53.9 (14.5)	<b>Low:</b> 8.4 (7.4) or 14.8%<3 y <b>High:</b> 16 (12) or 38%≥20 y or median (range) 20 y (1–47)	PTs: 27–278 Pts: 532–2491	Survey with vignettes=2 Survey without vignette=5 Treatment recording forms=2 Audit of clinical notes=2 Audit of billing codes=1 NB: one study included both a survey without vignette and audit of clinical notes
▲ Neck pain (n=8)						
▲ Whiplash (n=3)						
Subacromial pain or shoulder pain†	7	Sweden (n=2); Belgium; India; Netherlands; Nigeria; Spain	PTs: 29.1 (5.4) to 50.6 (26.2) Pts: 50 (13) to 53.9 (14.5)	<b>Low:</b> 4.9 (5.1) <b>High:</b> 14 (11.8)	PTs: 57–271 Pts: 121–365	Survey with vignettes=2 Survey without vignette=2 Treatment recording forms=1 Audit of clinical notes=1 Audit of billing codes=1
Knee osteoarthritis (one study combined knee and hip osteoarthritis)	7	UK (n=2); Belgium; Canada; Netherlands; Nigeria; Norway	PTs: 45.7 (11.7) to 66.7 (13.2)	<b>Low:</b> 8.4 (7.4) or 41.7% between 1 and 5 y <b>High:</b> 21 (12) or median (range) 26 (1–45)	Departments: 83 PTs: 123–538 Pts: 870	Survey with vignettes=2 Survey without vignette=3 Survey to department=1 Treatment recording forms=1
Knee pain‡	3	USA (n=2); Netherlands	PTs: 32.6 (7.8) or 60%<35y Pts: 36.2 (17.6) or 39% between to 41.2 (14.1) or 12%>60 y	8.4 (7.4)	PTs: 141–462 Pts: 416–2491	Treatment recording forms=3
Lateral ankle sprains	3	Netherlands (n=3)	PTs: 43 (no SD) to 51 (9) Pts: 34.7% between 0 and 24 y to 5.2% ≥ 65y or 33 (17)	4 (4) to 8 (15) (within the same study; two separate groups)	PTs: 83–332 Pts: 251–1413	Survey without vignette=1 Treatment recording forms=2
Plantar fasciitis	2	UK; USA	Pts: 5.2%<20y to 11.3%≥60y	5% between 0 and 2 y 11% between 3 and 5 y 27%≥20y (within the same study)	PTs: 257 Pts: 57 800	Survey without vignette=1 Audit of billing codes=1

Continued

Table 1 Continued

Condition	N	Countries	Age range†; mean (SD) unless stated otherwise		Experience†; mean years (SD) unless stated otherwise		Sample size range‡	Assessment measure
			Low: lowest values from studies	High: highest values from studies	Low: lowest values from studies	High: highest values from studies		
Lumbar spine stenosis	1	Canada	Pts: 70 (11)	16.8 (no SD)	16.8 (no SD)	16.8 (no SD)	PTs: 76 Pts: 44	Survey without vignette and survey of Pts=1
Pregnancy-related acute low back pain	1	UK	No data	21.5 (10)	21.5 (10)	21.5 (10)	PTs: 499	Survey with vignettes=1
Pelvic girdle pain	1	Norway; Australia (within the same study)	PTs: 33.5 (9.3) (Norway) 37.9 (11.2) (Australia)	9.3 (9.3) (Norway) 15.4 (11.6) (Australia)	9.3 (9.3) (Norway) 15.4 (11.6) (Australia)	9.3 (9.3) (Norway) 15.4 (11.6) (Australia)	PTs: 142	Survey with vignettes=1
Chronic lateral epicondylitis	1	Sweden	No data	No data	No data	No data	PTs: 47	Survey without vignette=1
Thumb carpometacarpal joint pain	1	USA	No data	No data	Hand therapy experience: 4.6% ≤5y; 13.9% between 6 and 10 y; 64.3% ≥11 y	Hand therapy experience: 4.6% ≤5y; 13.9% between 6 and 10 y; 64.3% ≥11 y	PTs: 547	Survey without vignette=1
Rheumatoid arthritis	2	Canada; Netherlands	PTs: 43 (10.8) Pts: 59.2 (13.8)	Low: 19 (SD 10.3) High: 22.5 (no SD)	Low: 19 (SD 10.3) High: 22.5 (no SD)	Low: 19 (SD 10.3) High: 22.5 (no SD)	PTs: 26-233	Survey without vignette=1 Treatment recording forms=1
Osteoporosis	2	Canada; USA	No data	13.7 (10.8)	13.7 (10.8)	13.7 (10.8)	PTs: 67-83	Survey without vignette=2
Sports injuries	3	Greece; Nigeria; UK	Pts: 29.9 (10.8) to 35 (12.5)	No data	No data	No data	Pts: 171-1399	Treatment recording forms=2 Audit of clinical notes=1
Patella femoral pain syndrome and Achilles tendinopathy	1	UK	35 (12.5)	No data	No data	No data	Pts: 100	Audit of clinical notes=1
Combined musculoskeletal conditions (low back pain, neck pain, shoulder pain, knee pain and acquired deformities of the spine)	1	Netherlands	Pts: 46.1% ≥45 y	No data	No data	No data	Pts: 8714 Pts: 74	Treatment recording forms=1
<b>Orthopaedics</b>								
Knee arthroplasty§ (one study combined knee and hip arthroplasty)	6	UK (n=3); Australia; Greece; Netherlands	PTs: 40.4 (12.6) Pts: 71.4 (7.7)	Low: 34.1% <5 y High: 37.9% ≥20 y	Low: 34.1% <5 y High: 37.9% ≥20 y	Low: 34.1% <5 y High: 37.9% ≥20 y	Departments: 16-65 Pts: 132-303 Pts: 63	Survey without vignette=3 Survey to department=2 Audit of clinical notes=1
Lumbar surgery (fusion or discectomy)	2	UK (n=2)	No data	Condition specific experience: 10 (IQR 3-15)	Condition specific experience: 10 (IQR 3-15)	Condition specific experience: 10 (IQR 3-15)	Departments: 75 Pts: 71	Survey without vignette=1 Survey to department=1

Continued

Table 1 Continued

Condition	N	Countries	Age range <sup>‡</sup> ; mean (SD) unless stated otherwise		Experience <sup>‡</sup> ; mean years (SD) unless stated otherwise		Sample size range <sup>‡</sup>	Assessment measure
			Low: lowest values from studies	High: highest values from studies	Low: lowest values from studies	High: highest values from studies		
Pelvic surgery	1	Australia	No data	No data	No data	No data	PTs: 84	Survey without vignette=1
Distal radius fracture	1	Australia	PTs: median (IQR) 33.5 (23–40) PTs: 71%>51 y	Median (IQR) 7 (0.8–11)	PTs: 70 Treatment sessions: 160			Treatment recording forms=1

\*Two studies also provided data on physical therapy treatment choices for low back pain and shoulder pain and one for low back pain only.

†Two studies also provided data on physical therapy treatment choices for low back pain and neck pain.

‡Two studies also provided data on physical therapy treatment choices for neck pain and low back pain, and one for low back pain only.

§One study also provided data on physical therapy treatment choices for low back pain.

¶Single values indicate that only one study provided data for this field.

\*\*One study looked at data from more than one country.

N, number of studies; Pts, patients; PTs, physical therapists or physiotherapists; Y, years.

treatment choices (n=55/94). All studies clearly described their main findings and used appropriate statistical tests, and most scored positive on the remaining checklist items (online supplementary table 6).

### Treatment choices that involved treatments that were recommended, not recommended and had no recommendation (all studies)

Treatment choices assessed by surveys completed by physical therapists (with or without vignettes)

The median percentage of physical therapists that provide (or would provide) treatments that were recommended, not recommended and had no recommendation was 54%, 43% and 81% for all musculoskeletal conditions, respectively; 35%, 44% and 72% for low back pain; 85%, 38% and 97% for neck pain and whiplash; 93%, 90% and 79% for shoulder pain; 58%, 45% and 98% for knee pain; 39%, 14% and 7% for lateral ankle sprains; 29%, 43% and 98% for plantar fasciitis; and 93%, 52% and 62% following knee or hip arthroplasty (table 2 and figure 2).

Treatment choices assessed by audits of clinical notes, audits of billing codes, treatment recording forms, clinical observation or surveys completed by patients

The median percentage of patients that received physical therapy-delivered treatments that were recommended, not recommended and had no recommendation was 63%, 27% and 45% for all musculoskeletal conditions, respectively; 50%, 18% and 43% for low back pain; 79% (not recommended) and 57% (no recommendation) for neck pain and whiplash; 76%, 8% and 62% for shoulder pain; 65%, 21% and 53% for knee pain; 45% (no recommendation) for lateral ankle sprains; 87% (recommended) and 90% (no recommendation) for plantar fasciitis; and 65%, 43% and 2% following knee or hip arthroplasty (table 2 and figure 2).

### Physical therapy treatment choices for various musculoskeletal conditions

The results summarising the percentage of physical therapy treatments provided for various musculoskeletal conditions that were recommended, not recommended and had no recommendation can be found in table 3. For example, as assessed by surveys of physical therapists, the most frequently provided recommended treatment for acute low back pain that physical therapists 'must provide' was advice to stay active (median=32%, IQR 13%–55%, n=7 studies). The most frequently provided not recommended treatment for acute low back pain was McKenzie therapy (median=36%, IQR 24%–37%, n=6) (table 3). Treatment choices for conditions that were only reported in one study or where one of either recommended or not recommended treatments could not be inferred from guidelines or systematic reviews can be found in online supplementary table 5.

**Table 2** Percentage (median and IQR) of physical therapy treatment choices that involved treatments that were recommended, not recommended or had no recommendation

	Assessed by surveys of physical therapists†‡				Assessed by clinical notes			
	Median (%†)	Q1	Q3	N	Median (%‡)	Q1	Q3	N
<b>Musculoskeletal conditions*</b>								
Recommended	54	25	76	23	63	46	68	8
Not recommended	43	34	61	37	27	13	45	20
No recommendation	81	49	96	37	45	31	85	31
<b>Low back pain</b>								
Recommended	35	16	56	9	50	32	62	5
Not recommended	44	34	64	24	18	10	36	15
No recommendation	72	45	88	24	43	31	81	23
<b>Neck pain and whiplash</b>								
Recommended	85	82	94	6	–			
Not recommended	38	35	67	5	79	66	89	4
No recommendation	97	72	98	6	57	26	84	4
<b>Shoulder pain</b>								
Recommended§	93	90	94	4	76	68	79	3
Not recommended	90			1	8			1
No recommendation	79	69	88	4	62	57	77	3
<b>Knee osteoarthritis/pain</b>								
Recommended	58	49	65	5	65	65	66	2
Not recommended	45	35	55	6	21			1
No recommendation	98	88	100	5	53	42	64	2
<b>Lateral ankle sprains</b>								
Recommended	39	31	46	2	–			
Not recommended	14			1	–			
No recommendation	7			1	45			1
<b>Plantar fasciitis</b>								
Recommended	29			1	87			1
Not recommended	43			1	–			
No recommendation	98			1	90			1
<b>Knee arthroplasty**</b>								
Recommended	93	83	95	5	65			1
Not recommended	52	42	67	4	43			1
No recommendation	62	23	95	4	2			1

\*Summary values excluded shoulder pain and knee arthroplasty as they did not have guidelines that recommended 'core' physical therapy treatments.

†The percentage of physical therapists that report they provide (or would provide) treatments that were recommended, not recommended and had no recommendation.

‡The percentage of patients that received treatments from a physical therapist that were recommended, not recommended or had no recommendation for a given condition as determined by audits of clinical notes, audits of billing codes, treatment recording forms, clinical observation or surveys completed by patients.

§Recommended care was based on delivering treatment that was 'likely to be beneficial' according to Kulkarni et al.<sup>115</sup>

¶Summary values for knee arthroplasty include studies that assessed treatment choices by surveys to physical therapy departments.

\*\*Includes one study that combined treatment practices for knee and hip arthroplasty.

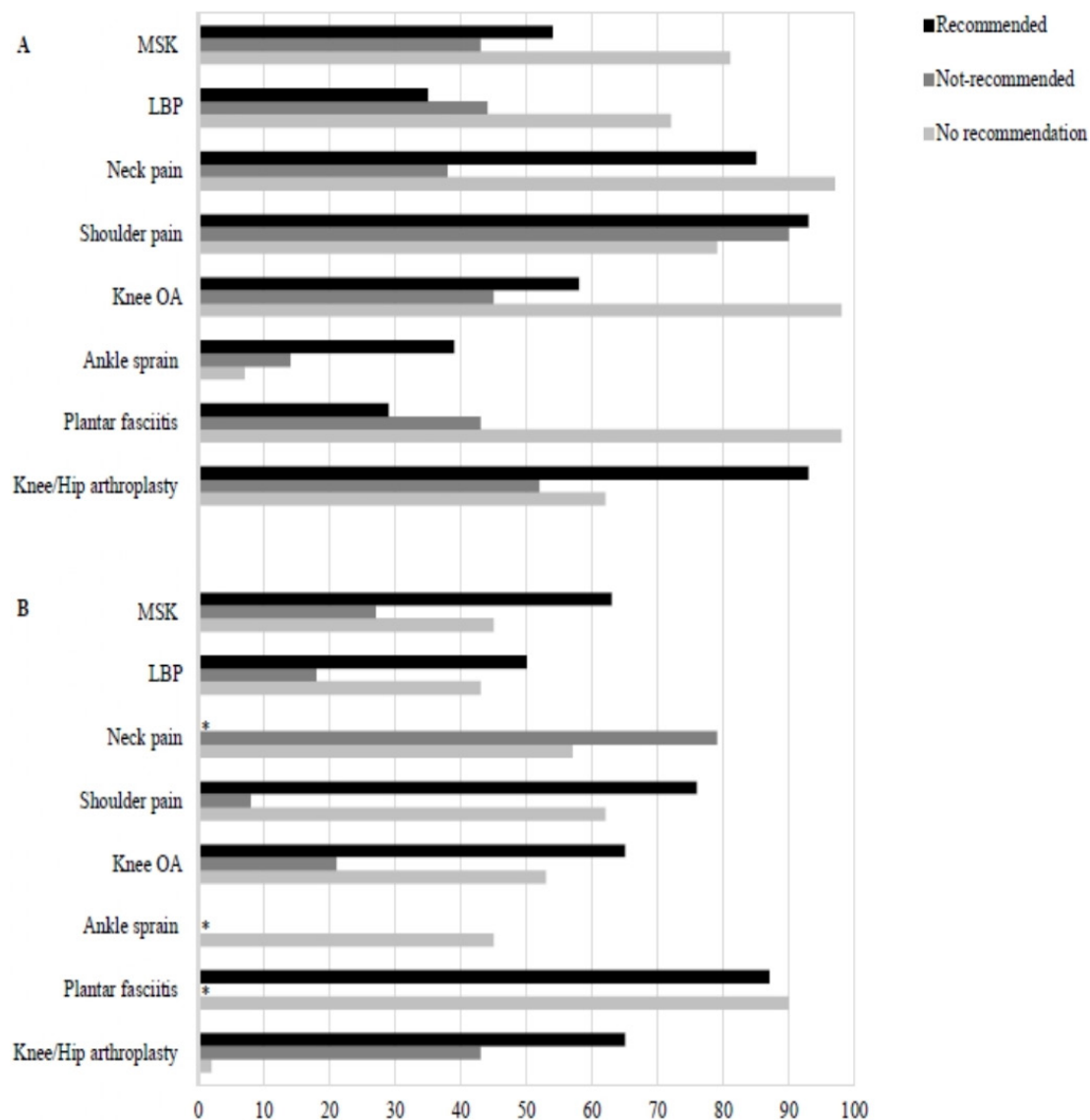
N, number of studies; Q1, first quartile; Q3, third quartile.

## DISCUSSION

Many physical therapists seem not to follow evidence-based guidelines when managing musculoskeletal conditions.

Our review highlights that there is considerable scope to increase the frequency with which physical therapists provide recommended treatments for musculoskeletal





**Figure 2** Median percentage of physical therapy treatment choices that involved treatments that are recommended, not recommended and had no recommendation. (A) The percentage of physical therapists that report they provide (or would provide) treatments that are recommended, not recommended and had no recommendation for a given condition. (B) The percentage of patients that received treatments that were recommended, not recommended and had no recommendation from a physical therapist for a given condition as determined by audits of clinical notes, audits of billing codes, treatment recording forms, clinical observation or surveys completed by patients. \*No treatment choices in this category(s) could be identified. LBP, low back pain; MSK: all musculoskeletal conditions (excluding shoulder pain and knee/hip arthroplasty); OA, osteoarthritis.

conditions and reduce the use of treatments that are not recommended or have no recommendation to guide their use. Across all musculoskeletal conditions, 54% of physical therapists chose recommended treatments, 43% chose treatments that were not recommended and 81% chose treatments that have no recommendation (based on surveys completed by physical therapists). Based on audits of clinical notes, 63% of patients received recommended physical therapy-delivered treatments, 27% received treatments that were not recommended and 45% received treatments that have no recommendation.

### Strengths and weaknesses of the study

The primary strength of this review is that we used a systematic approach to identify studies on physical therapy

treatment choices and classified recommendations for physical therapy treatments according to evidence-based guidelines and systematic reviews (online supplementary table 3). Experts provided feedback to help refine our classification, and a second reviewer double checked all the extracted data to ensure accuracy.

The main weakness of this review is that primary studies only reported treatment choices for individual treatments and not combinations of treatments. As a result, we could not determine the percentage of physical therapists that provided only recommended treatments, only not-recommended treatments, only treatments with no recommendation or other combinations of treatments. Second, it is possible that recommended treatments such as advice

**Table 3** Percentage (median and IQR) of physical therapy treatment choices that involved treatments that were recommended, not recommended or had no recommendation across different conditions

<b>Musculoskeletal</b>									
<b>Acute low back pain</b>									
	<b>Assessed by surveys of physical therapists</b>				<b>Assessed by clinical notes</b>				
<b>Recommended</b>	<b>Median (%)<sup>6</sup></b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	<b>Median (%)<sup>6</sup></b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	
<b>Must provide</b>									
Advice to keep active	32	13	55	7	70			1	
Reassurance	3			1	–				
<b>Consider providing</b>									
Group exercise	14	7	20	2	–				
Combination of two or more of 1–3	39	35	60	9	50	47	52	6	
1. Manual therapy <sup>1</sup>	45	39	68	9	60	47	78	6	
2. Exercise	72	44	78	10	65	51	82	6	
3. CBT	–				–				
Superficial heat	33	31	42	5	13	9	43	3	
<b>Not recommended</b>									
Paracetamol	39			1	–				
McKenzie	36	24	37	6	53			1	
US, ES, TENS, IF	34	29	49	7	16	13	29	4	
Poor advice <sup>2</sup>	9	2	28	8	–				
Acupuncture	6	3	16	7	–				
Traction	5	4	28	9	16			1	
External support <sup>3</sup>	2	2	16	5	–				
<b>No recommendation</b>									
Other advice <sup>4</sup>	70	54	75	11	49	34	62	5	
Cold therapy <sup>5</sup>	29	27	44	5	33	32	34	2	
Other electrophysical agents <sup>6</sup>	16	5	27	5	14	12	20	3	
Work-related/ergonomic interventions	16	10	28	7	–				
Back schools	11	7	18	5	–				
Other manual therapy <sup>7</sup>	8	8	20	3	7	7	9	3	
Biofeedback	1	0	1	3	–				
<b>Subacute or chronic low back pain</b>									
	<b>Assessed by surveys of physical therapists</b>				<b>Assessed by clinical notes</b>				
<b>Recommended</b>	<b>Median (%)<sup>6</sup></b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	<b>Median (%)<sup>6</sup></b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	
<b>Must provide</b>									
Advice to keep active	56	35	76	4	–				
<b>Consider providing</b>									
Group exercise	27	14	40	2	–				
Combination of two or more of 1–3	41	28	51	9	32	20	43	5	
1. Manual therapy <sup>1</sup>	49	30	51	9	58	25	74	6	
2. Exercise	64	51	78	10	64	32	75	5	
3. CBT	10			1	–				
McKenzie	28	19	35	6	32			1	
<b>Not recommended</b>									
US, ES, TENS, IF	38	23	46	6	18	16	32	5	
Traction	9	4	22	10	6	6	7	2	
Acupuncture	8	5	15	7	–				
External support <sup>3</sup>	2	2	9	5	24			1	
Poor advice <sup>2</sup>	1	0	6	7	–				

Continued

Table 3 Continued

No recommendation	Median (% <sup>ξ</sup> )	Q1	Q3	N	Median (% <sup>ξ</sup> )	Q1	Q3	N
Other advice <sup>4</sup>	68	57	86	9	–			
Superficial heat	38	27	47	4	51	38	55	3
Cold therapy <sup>5</sup>	24	14	34	6	32	18	37	3
Other electrophysical agents <sup>6</sup>	19	19	42	3	11	9	15	4
Work-related/ergonomic interventions	11	6	22	4	1			1
Other manual therapy <sup>7</sup>	10	7	20	3				
Back schools	6	5	26	5				
Biofeedback	1	1	1	2				
Iontophoresis	–				3			1
<b>Low back pain (duration not specified)</b>								
	Assessed by surveys of physical therapists				Assessed by clinical notes			
Recommended	Median (% <sup>ξ</sup> )	Q1	Q3	N	Median (% <sup>ξ</sup> )	Q1	Q3	N
Must provide								
Advice to keep active	35			1	50	30	56	3
Advice and education to support self-management	26	22	31	2	21	16	27	2
Reassurance	16			1	–			
Consider providing								
Group exercise	–				76			1
Combination of two or more of 1–3	59	46	86	8	34	24	46	12
1. Manual therapy <sup>1</sup>	60	57	87	9	34	23	44	12
2. Exercise	89	52	91	8	69	61	81	13
3. CBT	–				47			1
McKenzie	47	36	56	7	58	11	71	5
Superficial heat	39	28	55	7	16	10	34	4
Not recommended	Median (% <sup>ξ</sup> )	Q1	Q3	N	Median (% <sup>ξ</sup> )	Q1	Q3	N
US, ES, TENS, IF	67	37	75	8	14	8	30	5
Acupuncture	45			1	6	4	8	4
Traction	45	15	61	8	8	3	10	6
Poor advice <sup>2</sup>	26	6	57	4	23	12	33	3
External support <sup>3</sup>	23	14	31	2	2	2	2	4
No recommendation	Median (% <sup>ξ</sup> )	Q1	Q3	N	Median (% <sup>ξ</sup> )	Q1	Q3	N
Other advice <sup>4</sup>	89	77	93	4	68	33	91	9
Work-related/ergonomic interventions	71	52	87	4	26	23	29	2
Other manual therapy <sup>7</sup>	19	10	43	7	10	6	17	7
Other electrophysical agents <sup>6</sup>	15	9	41	8	23	17	40	8
Cold therapy <sup>5</sup>	7	5	17	4	13	6	49	3
Relaxation therapy	7			1	12			1
Back schools	–				45			1
Iontophoresis	–				3			1
<b>Neck pain<sup>8</sup></b>								
	Assessed by surveys of physical therapists <sup>9</sup>				Assessed by clinical notes			
Recommended	Median (% <sup>ξ</sup> )	Q1	Q3	N	Median (% <sup>ξ</sup> )	Q1	Q3	N
Should provide								
Importance of maintaining activity and movement	93	89	96	2	–			
Consider structured education <sup>10</sup> in combination with 1, 2, 3 or 4								
1. Multimodal care <sup>11</sup>	51			1	65	57	73	2

Continued

Table 3 Continued

2. Range of motion/flexibility and strengthening exercises	89 (range of motion or flexibility only)	84	93	2	55	54	56	2
3. Clinical massage	11			1	64	57	72	2
4. Laser	6			1	4			1
<b>Not recommended</b>	<b>Median (%<sup>§</sup>)</b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	<b>Median (%<sup>§</sup>)</b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>
Relaxation therapy	67			1	13			1
US, ES, TENS, SWD	27	23	31	2	32	25	39	3
Strengthening alone <sup>12</sup>	31			1	55	54	56	2
Heat or cold therapy	25			1	79	66	89	4
Poor advice <sup>2</sup>	12			1	–			
CBT	8			1	–			
<b>No recommendation</b>	<b>Median (%<sup>§</sup>)</b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	<b>Median (%<sup>§</sup>)</b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>
Advice on posture	96			1	2			1
Other exercise <sup>13</sup>	82	73	90	2	59	44	73	2
Acupuncture	40	38	42	2	–			
McKenzie	35			1	–			
Manual therapy alone <sup>14</sup>	31	20	41	2	86	74	90	4
Neural mobilisation	22			1	–			
Traction	20			1	33	24	43	2
Magnetic field therapy	–				2			1
Collar	–				1			1
Biofeedback								
<b>Acute whiplash</b>								
	<b>Assessed by surveys of physical therapists</b>				<b>Assessed by clinical notes</b>			
<b>Recommended</b>	<b>Median (%<sup>§</sup>)</b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	<b>Median (%<sup>§</sup>)</b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>
Should provide								
Importance of maintaining activity and movement	81	44	87	3	–			
Information on nature, management and course	56	41	70	2	–			
Consider structured education <sup>10</sup> in combination with 1 or 2								
1. Multimodal care <sup>11</sup>	81	79	84	2	–			
2. Range of motion/flexibility exercises	90	86	94	2	–			
<b>Not recommended</b>	<b>Median (%<sup>§</sup>)</b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	<b>Median (%<sup>§</sup>)</b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>
Heat or cold therapy	53	46	61	2	–			
Poor advice <sup>2</sup>	11	5	16	2	–			
Collar	7	4	10	2	–			
US, ES	4	2	7	2	–			
<b>No recommendation</b>	<b>Median (%<sup>§</sup>)</b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	<b>Median (%<sup>§</sup>)</b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>
Other exercise <sup>13</sup>	96	91	97	3	–			
Clinical massage	86			1	–			
Manual therapy alone <sup>14</sup>	83	79	86	2	–			
Advice on posture or analgesics	53	32	74	2	–			
Work-related/ergonomic interventions	39			2	–			
Traction	30			1	–			
Laser, IF	24	18	30	2	–			
McKenzie	9			1	–			
<b>Chronic whiplash</b>								
	<b>Assessed by surveys of physical therapists</b>				<b>Assessed by clinical notes</b>			

Continued

Table 3 Continued

Recommended	Median (% <sup>ξ</sup> )	Q1	Q3	N	Median (% <sup>ξ</sup> )	Q1	Q3	N
Should provide								
Importance of maintaining activity and movement	80	79	80	2	–			
Information on nature, management and course	60			1	–			
Consider structured education <sup>10</sup> in combination with 1, 2 or 3								
1. Multimodal care <sup>11</sup>	72			1	–			
2. Range of motion/flexibility and strengthening exercises	56			1	–			
3. Clinical massage	86			1	–			
Not recommended	Median (% <sup>ξ</sup> )	Q1	Q3	N	Median (% <sup>ξ</sup> )	Q1	Q3	N
Strengthening alone <sup>12</sup>	56			1	–			
Heat or cold therapy	43	38	48	2	–			
US, ES, TENS, SWD	30	30	30	2	–			
Poor advice <sup>2</sup>	10	5	15	2	–			
No recommendation	Median (% <sup>ξ</sup> )	Q1	Q3	N	Median (% <sup>ξ</sup> )	Q1	Q3	N
Advice on posture	95			1	–			
Other exercise <sup>13</sup>	94	93	95	2	–			
Work-related/ergonomic interventions	74	71	78	2	–			
Manual therapy alone <sup>14</sup>	68	59	77	2	–			
McKenzie	10			1	–			
Collar	1	1	2	2	–			
<b>Subacromial pain (surveys) or shoulder pain<sup>15</sup> (clinical notes)</b>								
	Assessed by surveys of physical therapists				Assessed by clinical notes			
Recommended <sup>16</sup>	Median (% <sup>ξ</sup> )	Q1	Q3	N	Median (% <sup>ξ</sup> )	Q1	Q3	N
Likely to be beneficial								
Exercise	89	85	92	4	72	67	76	2
Manual therapy <sup>1</sup>	49	20	80	4	61	59	68	3
Laser	36	20	52	2	23	18	27	2
Not recommended	Median (% <sup>ξ</sup> )	Q1	Q3	N	Median (% <sup>ξ</sup> )	Q1	Q3	N
IF, magnetic field therapy	90			1	8			1
No recommendation	Median (% <sup>ξ</sup> )	Q1	Q3	N	Median (% <sup>ξ</sup> )	Q1	Q3	N
Any advice <sup>17</sup>	79	77	82	2	91			1
Tape	59	54	64	2	15			1
Acupuncture	53	51	54	2	–			
Shockwave, ES, US, SWD, TENS, microwave current	44	33	65	4	26	13	39	3
Heat or cold therapy	38	24	55	4	47	39	54	2
Body awareness	11			1	–			
CBT	4			1	–			
Iontophoresis	–				15			1
<b>Knee osteoarthritis (surveys)<sup>18</sup> and knee pain (clinical notes)<sup>19</sup></b>								
	Assessed by surveys of physical therapists				Assessed by clinical notes			
Recommended	Median (% <sup>ξ</sup> )	Q1	Q3	N	Median (% <sup>ξ</sup> )	Q1	Q3	N
Must provide								
Advice to stay active	89	78	92	3	–			
Self-management strategies <sup>20</sup>	82	74	91	3	–			
Aerobic and strengthening	66	47	72	3	65	65	66	2
Advice on footwear	57			1	–			
Weight loss interventions	54	51	56	3	–			

Continued

Table 3 Continued

Advice on weight loss	49			1	–				
Consider providing									
Heat or cold therapy	62	15	73	5	69	63	74	2	
Manual therapy <sup>1</sup> , traction or stretching	60	54	76	5	79	78	79	2	
TENS	52	32	54	3	21	21	21	1	
Walking aids	8	5	38	3	–				
CBT	3			1	–				
<b>Not recommended</b>	<b>Median (%)<sup>ξ</sup></b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	<b>Median (%)<sup>ξ</sup></b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	
ES, US, Laser, IF, SWD	43	20	55	6	21			1	
Poor advice <sup>2</sup>	23	15	31	2	–				
Acupuncture	22	20	34	5	–				
<b>No recommendation</b>	<b>Median (%)<sup>ξ</sup></b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	<b>Median (%)<sup>ξ</sup></b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	
Other exercise <sup>21</sup>	98	88	100	5	75			1	
Balneotherapy <sup>22</sup>	16			1	–				
Iontophoresis	–				8			1	
<b>Acutelateral ankle sprains</b>									
	<b>Assessed by surveys of physical therapists</b>					<b>Assessed by clinical notes</b>			
<b>Recommended</b>	<b>Median (%)<sup>ξ</sup></b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	<b>Median (%)<sup>ξ</sup></b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	
Should provide									
Exercise	39	31	46	2	–				
Consider providing									
Rest, ice, compression and elevation <sup>23</sup>	12			1	–				
External support <sup>24</sup>	34			1	–				
<b>Not recommended</b>	<b>Median (%)<sup>ξ</sup></b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	<b>Median (%)<sup>ξ</sup></b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	
US, ES, Laser	14			1	–				
Joint mobilisation	3			1	–				
Heat or cold therapy	1			1	–				
<b>No recommendation</b>	<b>Median (%)<sup>ξ</sup></b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	<b>Median (%)<sup>ξ</sup></b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	
Advice or education	22	12	33	2	–				
IF, SWD, Diadynamic current	7			1	45			1	
<b>Plantar fasciitis</b>									
	<b>Assessed by surveys of physical therapists</b>					<b>Assessed by clinical notes</b>			
<b>Recommended</b>	<b>Median (%)<sup>ξ</sup></b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	<b>Median (%)<sup>ξ</sup></b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	
Should provide									
Stretching	100			1	–				
Manual therapy <sup>1</sup>	81			1	87			1	
Night splints	29			1					
May provide									
Strengthening exercises and movement training	94			1	–				
Education and counselling for weight loss	89			1	–				
Laser, US, ES	43			1	–				
<b>Not recommended</b>	<b>Median (%)<sup>ξ</sup></b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	<b>Median (%)<sup>ξ</sup></b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	
Acupuncture	31			1	–				
<b>No recommendation</b>	<b>Median (%)<sup>ξ</sup></b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	<b>Median (%)<sup>ξ</sup></b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	
Shockwave	10			1	–				
Heat or cold therapy	79			1	–				
Other exercise <sup>25</sup>	96			1	90			1	
Other advice <sup>26</sup>	98			1	–				

Continued

Table 3 Continued

Prefabricated orthotics <sup>27</sup>	70			1				
<b>Orthopaedics</b>								
<b>Knee or hip arthroplasty (surveys of physical therapists or physical therapy departments)<sup>28</sup></b>								
	<b>Inpatients</b>				<b>Outpatients<sup>29</sup></b>			
<b>Recommended</b>	<b>Median (%<sup>6</sup>)</b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	<b>Median (%<sup>6</sup>)</b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>
Exercise	94	94	95	2	76	66	86	4
<b>Not recommended</b>	<b>Median (%<sup>6</sup>)</b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	<b>Median (%<sup>6</sup>)</b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>
Passive range of motion	69	57	81	2	1			1
Cold therapy	28	25	30	2	20	16	25	2
<b>No recommendation</b>	<b>Median (%<sup>6</sup>)</b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>	<b>Median (%<sup>6</sup>)</b>	<b>Q1</b>	<b>Q3</b>	<b>N</b>
Manual therapy <sup>30</sup>	93			1	31			1
Advice or education	–				55	33	77	2
TENS, electrotherapy	–				0			1
Acupuncture	–				0			1

<sup>6</sup>The percentage of physical therapists that report they provide (or would provide) treatments that was recommended, not recommended and had no recommendation for a given condition.

<sup>7</sup>The percentage of patients that received treatments from a physical therapist that were recommended, not recommended or had no recommendation for a given condition as determined by audits of clinical notes, audits of billing codes, treatment recording forms, clinical observation or surveys completed by patients.

<sup>1</sup>Includes massage, mobilisation or manipulation.

<sup>2</sup>Advice promoting bed rest or time off work.

<sup>3</sup>Corsets, belts, braces, sticks or taping.

<sup>4</sup>Includes advice on posture, heavy lifting, sitting or standing habits, avoiding painful movements, analgesics.

<sup>5</sup>Including where heat and cold therapy could not be separated.

<sup>6</sup>Including laser, infrared therapy, microcurrent therapy, SWD, and so on.

<sup>7</sup>Includes neural mobilisation, Mulligan, Cyriax, myofascial release, and so on.

<sup>8</sup>Insufficient data to stratify by symptom duration. We used the guidelines for chronic neck pain from online supplementary table 3 as they classify a greater number of interventions as high and low value.

<sup>9</sup>Included two studies that combined treatment choices for neck pain and whiplash.

<sup>10</sup>No study reported structured education so the below interventions are reported in isolation.

<sup>11</sup>Includes mobilisation or manipulation and range of motion exercises.

<sup>12</sup>We were unable to determine the percentage of strengthening that was delivered in isolation.

<sup>13</sup>Any exercise not included in the above categories.

<sup>14</sup>Includes mobilisation or manipulation, but we were unable to determine the percentage of manual therapy that was delivered in isolation.

<sup>15</sup>Two studies combined physical therapy treatment choices for a variety of shoulder conditions.

<sup>16</sup>There is no high-quality evidence supporting a recommended physical therapy intervention for shoulder pain.

<sup>17</sup>Including advice on posture and advice to rest or reduce activity.

<sup>18</sup>One study that combined physical therapy treatment choices for knee and hip osteoarthritis was not included in this table (Barten *et al* 2015) (see online supplementary table 3).

<sup>19</sup>One study that combined physical therapy treatment choices for acute and chronic knee conditions was not included in this table (van Baar *et al* 1998) (see online supplementary table 3).

<sup>20</sup>Includes exercise, weight loss, use of suitable footwear or pacing, but we were unable to assess the content of self-management strategies reported in the included studies.

<sup>21</sup>Exercise that is neither aerobic nor strengthening.

<sup>22</sup>Spa bath therapy (separate to hydrotherapy which is included within 'other exercise').

<sup>23</sup>Only compression was mentioned in the included study.

<sup>24</sup>Includes braces, boots or taping.

<sup>25</sup>Exercise that is neither strengthening or movement training.

<sup>26</sup>Includes advice on self-management, pacing, ergonomics, and so on.

<sup>27</sup>Custom orthotics were provided by 63% of physical therapists.

<sup>28</sup>One study that reported physical therapy treatment choices as assessed by clinical notes is not included in this table but is represented in the summary table (table 2).

<sup>29</sup>Includes one study that reported physical therapy treatment choices for knee and hip arthroscopy combined.

<sup>30</sup>Includes massage or mobilisation.

CBT, cognitive-behavioural therapy; ES, electrical stimulation; IF, interferential current; N, number of studies; Q1, first quartile; Q3, third quartile; SWD, short wave diathermy; TENS, transcutaneous electrical nerve stimulation; US, Ultrasound.

and reassurance were not documented in clinical notes or listed in a survey because they are viewed as a routine part of physical therapy. For example, only 12 out of the 48 studies on low back pain reported that physical therapists provide advice to stay active, while even less reported reassurance (n=2) or advice and education to support self-management (n=2). This could have underestimated the percentage of recommended treatment choices. Third, physical therapists' treatment choices may have changed over time so including older studies could limit the relevance of our findings. Nevertheless, we do not believe that this is an important limitation because many guideline recommendations have remained largely consistent over time. For example, although some studies on treatment choices for low back pain are from 1994, a comparison of

low back pain guidelines between 1994 and 2000 found a high degree of consistency of recommendations, such as advice to stay active and avoid bed rest.<sup>106</sup> This is consistent with current low back pain guidelines. Finally, most studies did not use an accurate assessment of treatment choices (n=55/94). However, we stratified our analysis by how treatment choices were assessed so the influence of having an accurate method of assessment is clear to readers.

### Strengths and weaknesses in relation to other studies

Our finding that approximately half of treatment choices involved recommended treatments is similar to previous studies of healthcare. For example, the CareTrack study in Australia found that 57% of healthcare provided by general practitioners, specialists, physiotherapists,



chiropractors, psychologists and counsellors was appropriate,<sup>107</sup> while the earlier CareTrack study in the USA found a figure of 55%.<sup>108</sup> The percentage of recommended treatment choices for low back pain however was lower in our review (35%–50%) when compared with estimates from the Australian (72%)<sup>107</sup> and USA (69%) CareTrack studies.<sup>108</sup> A difference to our study is that the CareTrack studies used consensus of experts to judge the value of care, whereas we based this decision on evidence-based practice guidelines and systematic reviews. Another difference is that the CareTrack studies only assessed healthcare decisions through audits of clinical notes; we used audit of clinical notes, surveys, vignettes and clinical observation. Further, the Care Track studies reported primary data collected and were not systematic reviews.

### Meaning of the study

Our results suggest that physical therapy treatment choices for musculoskeletal conditions are often not based on research evidence. There was extensive use of not-recommended treatments and treatments without recommendations; for some conditions, treatments that were not recommended or had no recommendation were more common choices than recommended treatments (figure 2). As there are now over 42 000 clinical practice guidelines, systematic reviews and clinical trials to guide physical therapy practice, the challenge in physical therapy is applying this evidence to practice. Professional associations have a potential role to play in this area. Unfortunately, recent marketing from professional associations, popular social media handles and leading journals have emphasised the importance of early referral to physical therapy<sup>109</sup> rather than the nature of physical therapy care provided. The high percentage of non-evidence-based treatment choices in our review suggests that referring patients with musculoskeletal conditions for early physical therapy—without emphasising the importance of the type of non-pharmacological care they receive—may be unwise.

Treatment waste is another important issue highlighted in our review. Even when patients receive recommended treatments, they also usually receive not-recommended treatments and treatments that have no recommendation to guide their use. With nearly US\$100 billion spent on physical therapy, optometry, podiatry or chiropractic medicine each year in the USA,<sup>110</sup> the waste due to non-evidence-based physical therapy is likely enormous. Further, billing patients for physical therapy treatments that are not evidence based could also be considered unethical; the Vision Statement of the American Physical Therapy Association makes clear that there is an expectation that ‘physical therapists and physical therapist assistants will render evidence-based services’.<sup>111</sup>

### Unanswered questions and future research

Understanding what drives poor patterns of physical therapy care is important as it will guide the design of strategies to ensure the use of treatments that are not

recommended for musculoskeletal conditions does not simply shift from medicine to allied health. One possible explanation is the large variation in physical therapists who receive training in evidence-based practice (21%–82%) and can critically appraise research papers (48%–70%) (systematic review of 12 studies<sup>112</sup>). Physical therapists with a poor understanding of evidence-based practice might be misled into providing treatments with weak supporting evidence. Another explanation is a lack of awareness of, and agreement with, evidence-based clinical practice guidelines. For example, only 12% of physical therapists are aware of clinical practice guidelines for low back pain (survey of 108 physical therapists)<sup>113</sup> and 46% agree that guidelines should inform the management of low back pain (survey of 274 physical therapists).<sup>39</sup>

A recent initiative that could help physical therapists replace treatments that are not recommended with recommended treatments is *Choosing Wisely*.<sup>114</sup> Over 225 professional societies worldwide endorse *Choosing Wisely* and have published lists of tests and treatments that clinicians and their patients should question. This includes physical therapy associations in Australia, the USA and Italy. Testing strategies to increase adoption of *Choosing Wisely* recommendations among physical therapists is important. However, existing *Choosing Wisely* recommendations are likely not maximising the potential of the campaign to reduce the use of physical therapy treatments that are not recommended in guidelines and systematic reviews. For example, half of the Australian Physiotherapy Association *Choosing Wisely* recommendations target diagnostic testing that is not recommended, while other recommendations target treatments not part of routine physical therapy care, such as whirlpools for wound management and bed rest following diagnosis of acute deep vein thrombosis (American Physical Therapy Association). Our review highlighted the most frequently provided not-recommended non-pharmacological physical therapy treatments across a range of musculoskeletal conditions (table 3) and could be used to enhance the relevance of future *Choosing Wisely* recommendations. Further, in countries where physical therapists bill for specific treatments (eg, the USA), another approach could be to restrict funding for anything but recommended physical therapy treatments.

### CONCLUSION

Our results suggest that there is considerable scope to increase the contribution physical therapists could make to managing musculoskeletal conditions by increasing the frequency with which they provide treatments that are recommended in guidelines and systematic reviews and reduce their use of treatments that are not recommended or have no recommendations to guide their use.

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