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Original article

Comparing the range of musculoskeletal therapies applied by physical therapists with postgraduate qualifications in manual therapy in patients with non-specific neck pain with international guidelines and recommendations: An observational study

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ABSTRACT

The aim of this study is to compare Dutch usual care musculoskeletal therapy in patients with non-specific neck pain with recommendations from international clinical practice guidelines. Physical therapy is diverse, as it may consist of exercise, massage, advice, and other modalities. Physical therapists with post graduate qualifications in manual therapy (MT) may additionally apply spinal thrust manipulation or non-thrust mobilization techniques to treat neck pain. It is important that, in the absence of a Dutch clinical guideline for the treatment of patients with neck pain, musculoskeletal therapists use the available recommendations from international clinical practice guidelines when treating patients with neck pain. One updated clinical practice guideline was identified (Blanpied, 2017), a report from the Task Force on Neck Pain (Guzman et al., 2008) and the IFOMPT International Framework for Examination of the Cervical Region for potential of Cervical Arterial Dysfunction prior to Orthopaedic Manual Therapy Intervention (Rushton et al., 2014). At baseline 1193 patients are included and data with regard to pain, disability, fear avoidance, expectations and applied treatment modalities are gathered. Outcome is measured using the Global Perceived Effect questionnaire. Results show that patients with acute neck pain are treated significantly more often with manipulation compared to patients with sub-acute or chronic neck pain ($p < .000$) and younger patients are treated with manipulation more often than older patients ($p < .000$). In the presence of comorbidity, the preference of spinal manipulation seems to diminish, in favour of mobilization and exercise. Almost every patient receives multimodal therapy (94.3%) and spinal manipulation and mobilization are rarely used as a stand-alone treatment (4.5% and 0.8%). Dutch musculoskeletal therapists choose treatment strategies that correspond with recommendations from international guidelines.

1. Introduction

Neck pain is a common condition with peak prevalence rates up to 6.5% in Western Europe, high costs due to disability, and high recurrence rates (Hoy et al., 2014). Physical therapy is a common treatment option for patients with acute, sub-acute, and chronic non-specific neck pain. Physical therapy is diverse, as it may consist of exercise, massage,

advice, and other modalities. Physical therapists with post graduate qualifications in manual therapy (MT) may additionally apply spinal thrust manipulation or non-thrust mobilization techniques to treat neck pain.

Evidence-based clinical guidelines are systematically developed statements that aim to enhance the quality of treatments and to provide healthcare professionals with evidence-based recommendations to assist

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clinical decision-making and reduce variability in clinical practice and benefits to patients (Levin and Wheeler, 2015; Brouwers et al., 2010).

With regard to the treatment of patients with nonspecific neck pain, one international clinical practice guideline is available (Childs et al., 2008). This guideline was updated in 2017, by Blanpied and colleagues. The guideline recommends clinicians to consider the use of cervical spinal thrust manipulation and mobilization procedures to reduce neck pain. Based on strong evidence, the guideline states that combining cervical spinal manipulation and mobilization with exercise is more effective for reducing neck pain, headache, and disability than spinal manipulation and mobilization alone (Childs et al., 2008). Besides this guideline, other studies underline the added value of multimodal (e.g. spinal manipulation and exercise) treatment of patients with neck pain (Gross et al., 2015; Clar et al., 2014; Gross et al., 2010). For instance, for non-specific neck pain without trauma, recommendations from this report are that spinal manipulation, mobilization, supervised exercises, MT (existing of spinal manipulation, mobilization, massage) plus exercises are likely helpful and worth considering (Guzman et al., 2008).

The duration of neck pain may play an important role in the choice of treatment. For instance, psychosocial factors are an important prognostic indicator of prolonged disability since they contribute to the transition of an acute condition to a chronic, disabling condition. When psychosocial factors are identified and patients suffer from chronic neck pain, the guideline advises the approach to be modified to emphasize active rehabilitation and less 'hands-on' therapy (Childs et al., 2008; Blanpied et al., (2017)).

Although evidence supports the effectiveness of spinal manipulative therapy, its use remains a matter of debate because of the adverse events potentially associated with spinal manipulative therapy. As a result, a consensus document from the International Federation of Orthopaedic Manipulative Physical Therapists (IFOMPT) was published (Rushton et al., 2014). MT interventions for the cervical spine addressed in this framework include spinal manipulation, mobilization, and exercise. The aim of the framework is to provide guidance for the assessment of the cervical region for potential cervical artery dysfunction (CAD) prior to MT intervention. Arterial dissection and other vascular presentations (in their early presentation) may mimic musculoskeletal dysfunction (Arnold et al., 2006) but are fairly recognisable if the appropriate questions are asked during patient history taking. Besides proper history taking, the application of MT should be based on a comprehensive assessment of the patient's neuro-musculoskeletal system and of the patient's functional abilities. An important underlying principle of the framework is that the physical therapist cannot rely on the results of one single test to draw conclusions. A combination of sources of information (history taking, risk factor analysis, pre-manipulative testing) should be used to distinguish those conditions that are indications or contra-indications to MT and/or demand special precautions, as well as those where anatomical anomalies or pathological processes limit or direct the use of MT (Rushton et al., 2014; Kerry, 2008a,b).

The framework considers the following risk factors to be associated with an increased risk of CAD: past history of cervical spine trauma, history of migraine-type headache, hypertension, hypercholesterolemia, cardiac disease, vascular disease, previous cerebrovascular accident or transient ischaemic attack, diabetes mellitus, blood clotting disorders, anticoagulant therapy, long-term use of steroids, history of smoking, recent infection, immediately post-partum, recent head or neck trauma and the absence of a plausible mechanical explanation for the patient's symptoms (Rushton et al., 2014). Evidence shows that general cardiovascular risk factors, with the exception of migraine, do not appear to be important risk factors for CAD, but appear to be risk factors for other vascular pathology such as atherosclerosis (Hutting et al., 2018; Thomas et al., 2011; Debette, 2014). Risk factors for atherosclerosis are often present in older people and thrombotic stroke is typically a disease of the elderly (Hutting et al., 2018; Debette and Leys, 2009). Therefore, age is an important factor in the consideration of applying spinal manipulation because atherosclerotic related factors may be present.

In The Netherlands, physical therapy including spinal manipulation and mobilization is a common treatment option for patients with neck pain, but an evidence-based clinical guideline with regard to the treatment of nonspecific neck pain is lacking. More importantly, it is unknown what comprises physical therapy treatment for patients with neck pain in The Netherlands in the absence of a guideline. Therefore, the aim of the current study is to describe usual care physical therapy in primary care in patients with non-specific neck pain and to compare this with international clinical guidelines and recommendations. Secondly, we aimed to evaluate whether treatment modalities vary in subgroups based on age, duration of complaints, and the presence of risk factors.

2. Methods

2.1. Design

A prospective multi-center cohort study with 12-months follow-up was conducted in a primary care physical therapy setting in the Netherlands. The Medical Ethical Committee of the Erasmus MC Rotterdam approved this study. A complete description of the design is published elsewhere.

2.2. Study population

All participants in this study were physical therapists with post-graduate qualifications in manual therapy (MTs) and registered with the Royal Dutch Society for Physical Therapy (KNGF). They all worked in a primary or secondary healthcare setting. MTs completed data collections as a part of the requirement of their Masters' research course. The MTs were asked to provide usual care MT. Prior to the study, all participants followed a two-day course which explained the registration method of the study. To prevent from bias, the comparison with international guidelines was unmentioned and the stated aim of the study was to gain insight into the 'black box' of usual care MT. Consequently, no effort was made to standardize the number or the content of the treatment sessions. Within a three-month inclusion period, the participating MTs included five consecutive patients with non-specific neck pain.

2.3. Patients

Patients with non-specific neck pain (Haldeman et al., 2010; Nordin et al., 2009) were eligible. Inclusion criteria were non-specific neck pain with or without other complaints (e.g. headache, radiating symptoms) and age between 18 and 80 years. Patients were excluded if there were signs of major pathology, if patients were not able to read and write Dutch language, and if they suffered from specific neck pain due to severe trauma, systemic disorders, or generalized neurologic syndromes. All patients signed an informed consent prior to enrolment in the study.

2.4. Procedure

Self-administered questionnaires were used to collect data from all included patients. During the first consultation, the patient signed an informed consent form and filled out baseline questionnaires. To be able to merge baseline and follow-up data and to ensure anonymity, MTs provided all questionnaires with a unique code. During the treatment episode, the MTs described treatment dates, their process of clinical reasoning, and the modalities applied in a free text box for each treatment. Finally, the reason to stop the therapy was noted. All questionnaires of patients and MTs were returned to the research center using pre-stamped envelopes. A research assistant called the MTs with missing questionnaires within 3 weeks after the turn in deadline. Fig. 1 presents the study design.

Fig. 1. Timeline and design of the study MT = physical therapist with postgraduate qualifications in manual therapy, NRS= Numeric Rating Scale on pain, NDI= Neck Disability Index, NBQ= Neck Bournemouth Questionnaire, FABQ= Fear Avoidance Beliefs Questionnaire, PEL = patients' expectations list, CR = clinical reasoning TM = treatment modalities AE = adverse effects questionnaire, GPE = Global Perceived Effect, T = 0 + 12 months = Follow up.

2.5. Questionnaires

The baseline questionnaires included patients' characteristics (age, gender) and neck pain characteristics (recurrence, localisation, duration of complaints, risk factors, comorbidity). Validated questionnaires were filled out: Numeric Rating Scale (NRS) for pain, functioning by means of the Neck Disability Index (NDI) and the Neck Bournemouth Questionnaire (NBQ), and the Fear Avoidance Beliefs Questionnaire (FABQ). At baseline, patients' expectations regarding recovery were assessed. At the end of the treatment episode, patients' recovery was assessed using the Global Perceived Effect (GPE) scale.

2.6. Analysis

Descriptive statistics (SPSS 24.0) were used to present baseline characteristics of patients and data on treatments applied by the MTs. All authors attended to a consensus meeting where it was determined that recommendations to be followed were: whether multimodal therapy is the preferred treatment, whether patients with chronic pain are treated with a hands-off approach and whether in the presence of risk of adverse events (factors to be measured: age, hypertension, hypercholesterolemia, a history of heart failure and migraine). Chi-square tests were performed to assess for difference in the applied treatment modalities between subgroups based on age, duration, and the presence of risk factors. To prevent from bias, no participating therapists were in attendance.

Duration of complaints was categorized into: acute neck pain (0–6 weeks), sub-acute neck pain (7–12 weeks), and chronic neck pain (>12 weeks). Age was dichotomized into younger (<45 year) and older (≥45 year) based on the occurrence of CAD (Cassidy et al., 2008).

Patients' reported risk factors as described in the IFOMPT screening document included in our study were hypertension, hypercholesterolemia, a history of heart failure and migraine (Rushton et al., 2014; Childs et al., 2008; Ernst, 2007; Tuchin, 2012). Patients with diabetes mellitus,

long term steroid use, anti-coagulant therapy, recent infection, immediately post-partum, or multi-morbidity were assigned to the multiple comorbidity group.

Based upon treatment categories in the literature, treatment modalities were categorized into spinal manipulation, mobilization, exercise, information and advice, and 'other' modalities applied to the cervical spine.

3. Results

3.1. Manual therapists

Of the 287 MTs eligible to participate, 263 joined the study and enrolled patients during the recruitment period. Reasons for dropout of MT's were: pregnancy (n = 2), working in a rehabilitation center (n = 2), working in a foreign country (n = 2), delay in Master's program/missed deadlines (n = 16), stopped Master's program (n = 2). The majority (n = 207, 79%) of the MTs were male. Mean age of participants was 42.2 (8.4) years and mean working experience was 19.3 (7.1) years (Table 1).

3.2. Patients

The MTs recruited 1311 patients with non-specific neck pain, of which 1193 generated baseline data. During the recruitment period, all patients with neck pain who were eligible but refused to participate (for

Table 1
Manual Therapist characteristics (n = 263).

Manual Therapists' characteristics	
Age (years), mean (SD)	42.2 (8.4)
Male, n (%)	207 (79%)
Work experience (years), mean (SD)	19.3 (7.1)
Weekly hours of work, mean (SD)	24.6 (10.2)
Weekly number of neck pain patients, mean (SD)	12.2 (8.0)

whatever reason) or were supernumerary because the MT already included 5 patients, were registered and information on age and gender was collected. This information was used to check the representativeness of the study group. Student T-test showed no differences regarding age and gender between enrolled and non-enrolled patients with neck pain. Participants were predominantly female. Two-third of patients had recurrent neck pain and the majority of patients had one or more concomitant complaints. Almost half of the population at baseline experienced neck pain for more than 12 weeks. With regard to concomitant complaints, 2190 complaints were reported by 1096 patients. Main reported concomitant symptoms were headache (681 patients, 62.1%), low back pain (448 patients, 40.1%), and radiating arm pain (460 patients, 41.9%) (Table 2). Unfortunately, not every MT was able to include 5 patients. Main reasons given were: unpredicted absence of the MT during the inclusion period (e.g. illness), not enough eligible patients and postal failure. A number of questionnaires were returned to the education center without the required (anonymized) patient details, which should have been filled out by the MT in order to merge data.

3.3. Usual care

The MTs recorded in total 5340 visits, with a mean number of treatments of four visits per patient. In our study, spinal manipulation was a regularly chosen treatment modality (33.8%), but only in 4.5% of cases it was used as a stand-alone treatment modality. This was also the case for mobilization which was used (27.9%), but rarely as the only modality (0.8%). Exercise was used less frequently (15.1%) and also rarely as a stand-alone treatment modality (0.4%).

Table 2
Patient characteristics and baseline measurements.

	Study population	Non- participants
Patients' characteristics	Baseline (n = 1193)	Baseline (n = 2618)
Age (n = 1170), mean (sd)	44.7 (13.7)	44.9 (16.6) (n = 2587)
Gender (n = 1186), female (%)	823 (69.4%)	1636 (63.2%) (n = 1856)
Duration (n = 1072) (%)		
Acute 0–6 wks		420 (39.2%)
Sub-acute 6–12 wks		138 (12.9%)
Chronic >12 wks		513 (47.9%)
Concomitant symptoms: n = 1096		
Total reported: 2190**		
Headache yes (%)		681 (62.1%)
Low back pain yes (%)		448 (40.1%)
Radiating pain yes (%)		460 (41.9%)
Disturbed sleep yes (%)		293 (26.7%)
Concentration problems yes (%)		195 (17.8%)
Memory loss yes (%)		113 (10.3%)
Recurrent neck pain (n = 1129) yes (%)		755 (66.9%)
Marital status (n = 1152) yes (%)		889 (77.2%)
Work status (n = 1164) yes (%)		897 (77.1%)
Smoking (n = 1190) yes (%)		300 (25.2%)
Medication use (n = 1189) yes (%)		560 (47.1%)
Sports (n = 1189) yes (%)		783 (65.9%)
Previous experience manual therapy (n = 1169) yes (%)		407 (31.0%)
Baseline measurements		
NRS now (n = 1183), mean (sd, range)		4.8 (2.1; 1–10)
NRS min (n = 1183) mean (sd, range)		3.7 (2.0; 1–10)
NRS max (n = 1183) mean (sd, range)		6.6 (2.2; 1–10)
NDI (n = 1096) mean (sd, range)		13.0 (6.5; 0–42)
NBQ (n = 1171) mean (sd, range)		28.3 (12.9; 0–68)
FABQ (n = 1053) mean (sd, range)		26.6 (16.6; 0–85)
FABQ-W (n = 1103) mean (sd, range)		13.4 (12.2; 0–60)
FABQ-PA (n = 1129) mean (sd, range)		13.2 (7.3; 0–30)
PEL Expected recovery due to:		
1 Total treatment (n = 1190)		1179 (99.1%)
2 Spinal manipulations (n = 1159)		1159 (97.8%)
3 Exercise (n = 1034)		1034 (87.0%)

3.4. Treatment modalities

When analysing the treatment episode, in 94.3% of the included patients the treatment was multimodal implying that the manual therapists used spinal manipulation or mobilization in combination with other treatment modalities such as exercise or advice. The most frequently used combination of modalities was spinal manipulation, mobilization, exercise, information/advice and 'other treatment' (e.g. massage, Transcutaneous electrical nerve stimulation (TENS), frictions). At the start of the treatment episode, spinal manipulation was applied frequently, but as the episode continues, the proportion of exercise increased and the proportion of applied spinal manipulations decreased.

3.4.1. Younger versus older patients

In our study population, MTs chose different treatment strategies in patients with older age, defined as >45 years of age. In patients who were younger than 45 years old, spinal manipulations were slightly more frequently applied: 37.5% vs 30.3% as compared to older patients. Results from a two-tailed chi square test show $\chi^2(1, n = 8222) = 47.528$ $p < .000$ which means a statistically significant difference in the use of spinal manipulation between subgroups based on age, with spinal manipulation applied more frequently in younger patients.

3.4.2. Acute, sub-acute and chronic neck pain

In patients with acute neck pain, MTs applied spinal manipulation (36.9%) slightly more often than in patients with sub-acute or chronic neck pain (31.0% and 31.2%, respectively). Two-tailed chi square test resulted in $\chi^2(1, n = 7768) = 28.4195$ $p < .000$, meaning that there was a statistically significant difference in the use of spinal manipulation between subgroups based on duration of neck pain. The number of mobilization techniques as well as information/advice and 'other treatment modalities' applied was comparable, regardless the duration of neck pain. Exercise was the modality least applied in patients with acute neck pain (13.8%) compared to patients with sub-acute and chronic neck pain (16.9% and 16.1%) (Table 3).

3.4.3. Co-morbidity

In case of presence of comorbidities in patients with neck pain, MTs seemed to prefer other modalities than spinal manipulation techniques. This was seen in patients with hypertension, hypercholesterolemia and in patients with a history of cardiovascular complaints. In case of multiple comorbidities, MTs more often used mobilization (41.8%) instead of spinal manipulation (22.1%). This was not the case in the presence of migraine; spinal manipulations were equally applied in patients with and without migraine (33%). When applying chi-square test on the categories of comorbidity, there was no statistically significant difference in the use of spinal manipulation between the different comorbidities ($\chi^2(4, n = 897) = 6.1128$ $p = .19$).

3.5. Coherence to international guideline

There were differences in modalities applied in patients with acute, sub-acute and chronic neck pain. When treating a patient with acute neck pain, spinal manipulation was used significantly more often than in patients with sub-acute or chronic neck pain. This was in accordance with the recommendations within the guideline by Childs et al., 2008, Blanpied et al., (2017) and the Task Force on Neck Pain (Guzman et al., 2008). The increase of use of exercise when the treatment episode continues and the transition from acute to chronic neck pain is prevalent was in accordance with recommendations as well. Another recommendation was to combine spinal manipulation with exercise. In our cohort, 94.3% of treatments consist of multimodal therapy, in the majority of cases a combination of spinal manipulation, mobilization, exercise, advice and other modalities.

MTs regularly apply spinal manipulation techniques but in the presence of risk factors for cervical artery dissection (older age and

Table 3

Applied modalities in different treatment groups based on age, duration and presence of comorbidity.

			MP	MOB	Exc	IA	OTM	
Age	Younger (<45Y)	n	1514	962	641	551	371	4039
		%	37,5%	23,8%	15,9%	13,6%	9,2%	100%
	Older (≥45Y)	n	1267	1333	602	586	395	4183
		%	30,3%	31,9%	14,4%	14,0%	9,4%	100%
	Total	n	2781	2295	1243	1137	766	8222
		%	33,8%	27,9%	15,1%	13,8%	9,3%	100%
Duration of complaints	Acute	n	1176	851	440	457	260	3184
		%	36,9%	26,7%	13,8%	14,4%	8,2%	100%
	Subacute	n	329	295	179	164	93	1060
		%	31,0%	27,8%	16,9%	15,5%	8,8%	100%
	Chronic	n	1098	1013	566	488	359	3524
		%	31,2%	28,7%	16,1%	13,8%	10,2%	100%
	Total	n	2603	2159	1185	1109	712	7768
		%	33,5%	27,8%	15,3%	14,3%	9,2%	100%
	Migraine	n	55	36	33	23	20	167
		%	32,9%	21,6%	19,8%	13,8%	12,0%	100%
Presence of comorbidity	Hypertension	n	70	105	36	40	29	280
		%	25,0%	37,5%	12,9%	14,3%	10,4%	100%
	Hypercholesterolemia	n	16	18	11	10	7	62
		%	25,8%	29,0%	17,7%	16,1%	11,3%	100%
	Cardiovascular	n	44	62	26	26	17	175
		%	25,1%	35,4%	14,9%	14,9%	9,7%	100%
	Multiple comorbidity	n	47	89	30	27	20	213
		%	22,1%	41,8%	14,1%	12,7%	9,4%	100%
	Total comorbidity	n	232	310	136	126	93	897
		%	25,9%	34,6%	15,2%	14,0%	10,4%	100%

MP = spinal manipulation, MOB = mobilization, Exc = exercise, IA = information and/or advise, OTM = other treatment modalities.

comorbidity), this preference no longer appeared and there seemed to be an alteration in the use of spinal manipulation techniques, to the advantage of mobilization techniques and exercise.

4. Discussion

4.1. Main findings of the study

In The Netherlands, an evidence based guideline for the physiotherapy treatment of patients with neck pain is lacking. In the absence of a Dutch guideline, the MT may rely on evidence from international guidelines, or other high-quality sources that offer guidance to treatment.

The current study is the first large inventory of the treatment of non-specific neck pain patients in physical therapy practice in The Netherlands. Overall, the results of this study demonstrated that most patients with neck pain were treated with multimodal treatment (94.3%). Spinal manipulation was a regularly chosen treatment modality (33.8%), but only in 4.5% of cases it was used as a stand-alone treatment modality. This was also the case for mobilization. In 0.4% of patients, exercise was the stand-alone treatment modality. The literature shows that there is a lack of evidence for the effectiveness of stand-alone modalities (Gross et al., 2015; Gross et al., 2010; Vincent et al., 2013). Even so, the literature emphasizes the effectiveness of multimodal therapy for non-specific neck pain (Gross et al., 2015; Gross et al., 2010; Miller et al., 2010; Vincent et al., 2013). A Cochrane Review shows that a multimodal management approach (exercise, mobilization, and spinal manipulation) is compatible with a 28%–70% treatment advantage over a control, and with a long-term absolute benefit in pain reduction of 25 mm on a numeric rating scale (0–100 mm) from baseline for 1 in 2–5 patients with subacute or chronic neck pain (Gross et al., 2007). Our cohort consisted mainly of patients with sub-acute and chronic neck pain, so they may benefit from the chosen strategy.

In general, it is advocated to use evidence based clinical guidelines. Nevertheless, adherence to guidelines will not ensure a successful outcome in every patient, nor can guidelines be construed including all

proper methods of care or excluding other acceptable methods of care aimed at the same results. The ultimate judgment regarding a particular treatment strategy must be made through shared decision making and in light of the clinical data presented by the patient, the treatment options available, and the patient's values, expectations, and preference.

Our study showed differences in the treatment approach of non-specific neck pain in older and younger patients. The percentage of applied cervical spinal manipulation was significantly lower in older patients than in younger patients ($p < .000$). Serious adverse events (e.g. stroke or arterial dissection) following spinal manipulation are rare (Cassidy et al., 2008) and several risk factors that may play a major role in the occurrence of cervical arterial dissection are described. As discussed in the introduction, some of the risk factors that are described do not appear to be important risk factors for CAD but appear to be risk factors for other vascular pathology like atherosclerosis. Evidence shows that these risk factors for atherosclerosis are often present in older patients. Therefore, in older patients, it is important to address all these atherosclerosis related factors as they may be a contra-indication for spinal manipulation (Hutting et al., 2018).

On the other hand, evidence shows higher incidence rates of CAD in younger patients (<45 years). A review of 134 case reports shows that the mean age of patients suffering from CAD was 44 (range 23–86) years. Vascular pathology as a pre-existing pathology accounted for only 13.3% of these cases (Puentedura et al., 2012). In general, there seems to be a strong association for risk factors with genetic components, while there is only weak association for environmental factors, except for trivial head or neck trauma (Hutting et al., 2018).

4.2. Limitations of the study

A few limitations of this study should be discussed. First, this cohort study consisted of patients with neck pain that might be accompanied with headache. We did not differentiate in headache properties and therefore we are unable to judge whether MTs applied the IFOMPT standard in the right way for this subgroup of patients. Secondly, for the recruitment of patients we depended on the cooperation of the MTs.

Consequently, like in most clinical studies, it was possible that patients were not included consecutively. This may lead to selection bias. Further on, not all questionnaires are completed or returned to the research center which resulted in missing data. We appealed on MT and patient honesty when filling out the treatment modalities and questionnaires.

The MTs population included in our cohort study may have differed in treatment approach from others. The average work experience of the participating therapists was almost 20 years, resulting in substantial experience in clinical reasoning and skills. One pitfall of extensive experience in clinical reasoning and decision making is the appearance of so called cognitive biases. Cognitive biases occur because the number of decisions an MT makes around the choice of treatment strategy is very high, and therapists may appeal to cognitive short cut strategies to simplify decision making (Croskerry, 2002).

Besides data on age and gender, which show no statistical differences ($t = 0.3603$, two tailed p value = .719), we were not able to check on representativeness of the study population regarding other clinical variables.

5. Conclusion

In the absence of a guideline, Dutch physical therapists with post-graduate qualifications in manual therapy chose treatment strategies that corresponded to recommendations from international guidelines. Almost all patients received multimodal therapy and spinal manipulation and mobilization were rarely used as a stand-alone treatment. Risk factors were taken in to account and hands-off approach was more common in case of patients with chronic pain. Whether manual therapists chose their treatment strategies based on sound clinical reasoning or knowledge of international recommendations and guidelines was unclear and should be further investigated.

Ethics approval

The Erasmus Medical Center (Rotterdam The Netherlands) Ethics Committee(s) approved this study. All participants gave written informed consent before data collection began.

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