Factors affecting confidence and knowledge in spinal palpation among International Manual Physical Therapists

Steve Karas¹ , Anthony Schneiders², Duncan Reid³, Victor Talisa⁴

¹Department of Physical Therapy, Chatham University, Pittsburgh, PA, USA, ²Department of Physiotherapy, Central Queensland University, Bundaberg, Australia, ³School of Clinical Sciences, Auckland University of Technology, Auckland, New Zealand, ⁴Department of Biostatistics, Graduate School of Public Health, University of Pittsburgh, Pittsburgh, PA, USA

Objectives: We sought to find if there was a relationship between the confidence in use of static palpation, passive physiological intervertebral motion (PPIVM) and passive accessory intervertebral motion (PAIVM) and the manual therapist's (MTs) knowledge of the literature on these topics. **Methods:** We designed an international survey to achieve our objectives. Each skill was surveyed for the cervical, thoracic and lumbar spines. We also included several other factors that we believed might influence the use of these skills. **Results:** We concluded that familiarity of the literature was significantly associated with a MTs' confidence in the use of static palpation, PPIVM and PAIVM techniques. We also found a relationship with the country of practice of the MT and their confidence using these techniques. **Discussion:** Spinal palpation is an integral part of the MT's evaluation and treatment abilities. The vast majority of MTs use spinal palpation and nearly all entry-level education programmes include it in their training. Knowing what factors influence MTs' confidence assessing and treating the spine may allow for more effective teaching and training, as well as improved patient outcomes.

Keywords: Manual therapy, Spinal palpation, Passive intervertebral motion, Passive accessory motion

Introduction

Manual therapy, specifically mobilization and manipulation, is a commonly used and evidence-based treatment for spinal dysfunction.¹⁻⁶ One of the first steps in assessing spinal dysfunction is palpation of motion in a given vertebral segment to determine where treatment should be directed. While some research has shown that experienced physical therapists and manual therapists (MTs) can reliably repeat static palpation findings in the spine, the inter-therapist reliability is often poor.^{7,8} These inter-therapist discrepancies in static palpation have been measured in some cases to have a mean of 27.8 mm in the cephalocaudal direction, arguably a difference large enough to misidentify a vertebral segment and compromise subsequent dynamic motion assessments.⁹⁻¹¹

Techniques such as passive physiological intervertebral motion (PPIVM) and passive accessory intervertebral motion (PAIVM) are frequently used to allow MTs to dynamically assess spinal motion segments. The results of these assessment techniques, along with a variety of additional information, guide the therapist's clinical decisions.^{12,13} While these techniques are commonly taught

in manual therapy education, their lack of validity and reliability has not gone unnoticed.¹⁴⁻²²

Some journal commentaries and editorials have suggested MTs move away from segment specific motion palpation altogether,²³⁻²⁵ and correspondingly, some studies have found positive results using techniques that were designed to treat a spinal region, not a specific motion segment.²⁶⁻³² However, research that supports the use of regional techniques also often encourages the use of segmental motion palpation as part of the clinical decision-making process.^{27,29,33-35}

Although there is no consensus regarding the overall validity and reliability of static and dynamic spinal assessment, it is widely used clinically and often included in entry level and postgraduate physical therapy education.^{36,37} It has been reported that 98% of MTs use motion assessment as part of their evaluation of spinal pain and a majority believe PPIVM and PAIVM assessments are accurate in assessing spinal segment motion.³⁸ While MTs may vary in their intentions for using spinal segmental motion assessment, its use as an evaluation of quality of motion is considered most important.³⁸

Given the apparent lack of strong evidence regarding the validity and reliability of intervertebral motion

Correspondence to: Steve Karas, Chatham University, Pittsburgh, PA.
Email: skaras@chatham.edu

Table 1 Demographic characteristics of the study cohort (N = 589)

Variable	Frequency	Percent
<i>Experience (years)</i>		
<5	74	12.6
5–10	129	21.9
10–15	139	23.6
>15	247	41.9
<i>Clinical practice (hours/week)</i>		
<10	69	11.7
10–20	145	24.6
20–30	161	27.3
30–40	132	22.4
>40	82	13.9
<i>Education</i>		
Baccalaureate degree	108	18.3
MPT degree	170	28.9
DPT degree	176	29.9
Doctorate level ^a	61	10.4
Other	74	12.6
<i>Country^b</i>		
United States	295	50.1
Canada	127	21.6
Europe	108	18.3
Australasia	59	10.0
<i>Training</i>		
AAOMPT fellowship	184	31.2
Grimsby/COMT	17	2.9
Maitland approach	74	12.6
McKenzie Institute	15	2.6
NAIOMT	32	5.4
Paris/St. Augustine	13	2.2
Physical Therapy School	43	7.3
Other	211	35.8

^aDoctorate level combines the DSc and PhD degrees.

^bEurope includes responses from Belgium, Denmark, Finland, Germany, Italy, Netherlands, Norway, Portugal, Spain and the United Kingdom; Australasia combines Australia and New Zealand.

assessment, it becomes unclear how MTs develop their confidence performing manual clinical skills with the knowledge of the available literature. There is equivocal research in the medical field correlating confidence and performance, and that research focuses mainly on students. However, confidence and ability are not effectively evaluated in self-assessments, which are routinely used in education. Self-assessment has been shown to be ineffective at determining students' clinical abilities.^{39–42}

Improved confidence in MT has the potential to increase self-efficacy. Self-efficacy may be defined as “how a person performs in a situation because of their belief in their capability given their knowledge and skill.”⁴³ Confidence may improve the ability to successfully perform a hands-on task.^{44–47} This has been observed with physicians who report high levels of confidence and also demonstrate greater competence and skill performing such psychomotor skills as basic life support.⁴⁸ Nursing students' clinical skills have been shown to improve when their level of confidence is increased through clinical and work place education and training.⁴⁹ However, the lack of literature on these topics in the medical field minimizes the extent to which meaningful conclusions may be drawn.

The purpose of this study was to achieve a better understanding of the practical and demographic factors (academic training, professional experience, nationality) that may be associated with MTs' confidence in performing

manual spinal techniques. We specifically evaluated two main research questions: (1) Is confidence performing manual spinal assessment associated with a MT's reported degree of familiarity with the literature? (2) Do predictors of confidence depend on the spinal region to which the technique is being applied or the specific technique employed?

Methods

Study participants

Participant recruitment for this study focused on english-speaking manual physical therapists/physiotherapists belonging to member organizations (MOs) of the International Federation of Manual Physical Therapists (IFOMPT). MTs who belonged to MOs between August 2012 and August 2013 were invited to participate through their MO electronic newsletter. Therefore, these MTs were recipients of the MOs electronic newsletters and had an active email with their individual organization. Respondents represented a wide variety of countries, education and experience levels (Table 1).

Study survey

Development

Development of this survey was initiated by the principal investigator after an extensive review of the literature and utilized as part of an initial validation process by

conducting a pilot survey within the American Academy of Orthopedic Manual Physical Therapy organization (AAOMPT). The results of this pilot survey have been presented elsewhere.^{50,51} Based on feedback from survey participants, peers and stakeholders, questions were reworded, content added and a section detailing MTs' demographics included. Both the pilot and the final survey were reviewed and approved by ****University Institutional Review Board and the MOs of IFOMPT. The Qualtrics online survey site was utilized to design both the pilot and final survey. (www.qualtrics.com) Qualtrics is configured to allow only one completed survey per IP address. The survey link along with an invitation to participate in the study was included in the MO's electronic newsletters to members. Each MO included the survey link in consecutive newsletters, giving the MTs three opportunities to participate in the study.

Structure

The survey investigated MTs' perceived confidence performing palpation (confidence) and their knowledge of the literature on motion segment palpation (knowledge). These items assessed confidence and knowledge relative to the specific type of assessment procedure used and the spinal region being assessed. For example, the first confidence question examined whether the MT was confident identifying a specific lumbar spine vertebrae through palpation, and the corresponding knowledge question asked whether the MT was familiar with the literature concerning palpation of lumbar spine segments. Specifically, the survey questions covered three procedures (static palpation, PPIVM and PAIVM) and three spinal regions (lumbar, thoracic and cervical). Items represent each combination of procedure and spinal region; therefore, nine confidence and nine knowledge items are included in total. The MTs chose their answers relative to a five-point Likert scale: strongly disagree, disagree, neither agree nor disagree, agree and strongly agree (Appendix A).

Considering that the quality of motion is the most important finding to a majority of MTs, and motion assessment is part of a multifactorial assessment, it may be that other variables impact confidence in using static palpation, PPIVM and PAIVM. Therefore, we included several other factors in this survey that may be associated with confidence, including years of spinal manual therapy experience (experience), weekly clinical hours requiring spinal manual therapy (hours per week), highest level of education obtained (education) and country of practice (country). The primary organization where the MT received the majority of their manual therapy training (training) was also reported, with an open-ended response allowed for organizations that were not listed.

Statistical analysis

All statistical analyses were performed using STATA ver. 13.0 for Windows 64-bit operating system. Univariate

descriptive statistics, including percent of total responses, were calculated for all variables, and mean scores were calculated for confidence and knowledge variables. Spearman correlations for each of the nine pairs of confidence and knowledge variables were also calculated.

In order to assess potential predictors of confidence as it related to knowledge using spinal palpation techniques, we evaluated several multivariable ordered logistic regression models using confidence as the response variable. Since confidence was measured separately for each combination of palpation technique and spinal region, we fit a separate model for each. For each model, we considered six predictors: familiarity with the literature, experience, hours per week, education, country and training. Items representing familiarity with the literature, hours per week and experience were treated as continuous predictors; education, country, and training were treated as categorical. For comparative purposes, all European countries were combined into the Europe category for analysis, while those from Australia and New Zealand were combined into the "Australasia" category. The reference category for the country was the United States. Likewise, DSc and PhD education level categories were combined into a single "Doctorate level" category, and each education category were compared with the baccalaureate level. Predictors were selected for inclusion into the multivariable model if they were significant at the 0.20 level in univariable models (Appendix A).

Results

A total of 673 individuals participated; however, we analyzed only the 589 individuals for whom complete information was obtained.

Sample descriptives

We first calculated descriptive statistics for the main variables used in our analysis, including the confidence and knowledge variables (Table 2). The most common response for all confidence and knowledge items was "Agree", while the least common was "Strongly Disagree". About 50–85% of all responses to confidence and knowledge items were in the "Agree" or "Strongly Agree" categories. For all three spinal regions, the greatest mean confidence and knowledge scores were observed for palpation compared to the other two procedures. The largest correlations between confidence and knowledge tended to be observed in the cervical region ($\rho = 0.24$ – 0.28), followed by the thoracic region ($\rho = 0.16$ – 0.23) and the lumbar region ($\rho = 0.09$ – 0.77).

Multivariable models

The nine multivariable-ordered logistic regression models are presented in Table 3, one for each combination of procedure and spinal region.

Results indicate that familiarity with the literature was a significant predictor of confidence in all models except

Table 2 Responses to survey questions pertaining to confidence in identifying vertebrae and familiarity with the literature, given a specific spinal region and one of the three manual therapy procedures

	Response (%)					Mean score ^a	Spearman ^b
	Strongly disagree	Disagree	Neither	Agree	Strongly agree		
<i>Cervical vertebrae</i>							
Palpation							
Confidence	0.9	6.8	8.8	43.6	39.9	4.15	0.2443
Knowledge	0.9	11.5	18.3	46.5	22.8	3.79	
PPIVM							
Confidence	2.4	16.0	14.9	42.6	24.1	3.70	0.2332
Knowledge	1.4	14.3	21.1	44.0	19.4	3.66	
PAIVM							
Confidence	2.9	16.8	15.1	41.6	23.6	3.66	0.2777
Knowledge	2.0	14.6	20.2	42.8	20.4	3.65	
<i>Thoracic vertebrae</i>							
Palpation							
Confidence	2.7	11.5	11.5	42.6	31.6	3.89	0.1579
Knowledge	1.0	16.1	20.5	44.1	18.2	3.62	
PPIVM							
Confidence	4.2	23.1	19.0	37.5	16.1	3.38	0.2341
Knowledge	1.9	20.2	23.4	37.5	17.0	3.48	
PAIVM							
Confidence	4.9	21.1	18.2	38.7	17.2	3.42	0.1646
Knowledge	2.7	20.7	23.9	37.0	15.6	3.42	
<i>Lumbar vertebrae</i>							
Palpation							
Confidence	2.0	7.0	7.5	43.1	40.1	4.12	0.0890
Knowledge	0.2	7.1	12.9	55.7	24.1	3.96	
PPIVM							
Confidence	4.8	18.5	17.2	41.6	18.0	3.50	0.1270
Knowledge	0.7	10.2	15.8	49.4	23.9	3.86	
PAIVM							
Confidence	5.6	18.9	17.8	40.6	17.2	3.45	0.1720
Knowledge	1.2	12.1	17.3	45.8	23.6	3.79	

Abbreviations: Confidence, confident in assessing a specific vertebrae; literature, familiar with the literature; PPIVM, passive intervertebral motion; PAIVM, passive accessory intervertebral motion.

^aScores assigned as follows: strongly disagree = 1, disagree = 2, neither = 3, agree = 4 and strongly agree = 5.

^bSpearman correlation between confidence and literature variables. All correlations are significant at the 0.05 level.

the model of confidence using the palpation technique in the lumbar region. A one-unit increase in familiarity with the literature corresponded with a 15–75% greater odds of high confidence, depending on the technique and spinal region. Odds ratios (OR) for familiarity with the literature was highest in the cervical region (OR: 1.58–1.76), and lowest in the lumbar region (OR: 1.14–1.41).

Country of practice was also significant in all models except confidence using PPIVM in the thoracic region. High confidence was often most associated with Australasia (OR: 1.54–2.24) compared to the US, while Europe often displayed the lowest confidence compared to the US (OR: 0.52–0.96).

Regarding professional experience, either hours per week or years of experience were significant in several models, but never simultaneously. Experience was only significant in models of confidence using palpation, and the association was highest in the lumbar region (OR: 1.29). Hours per week were significantly associated with confidence using PPIVM in all spinal regions (OR: 1.13–1.20).

Although education was not significant at the 0.05 alpha level in any univariable models, we did observe significant associations between education and confidence in

performing PAIVM in the cervical region as well as palpation in the thoracic region. We also considered variables describing specific training programmes, but these were not significantly associated with confidence in any models.

Discussion

Static and dynamic spinal assessment techniques are widely used, part of the vast majority of physical therapy education programmes, and regarded as essential tools when assessing spinal pain. However, the lack of consensus on their use and validity might cause many to question their confidence in the utility of such procedures. We surveyed 587 MTs within IFOMPT and found that increased confidence in the use of palpation techniques was significantly associated with familiarity with the literature and country of practice, even after controlling other variables such as experience level and education. In addition, relationships between confidence and familiarity with the literature were strongest in the cervical region and weakest in the lumbar region. In each region, the mean confidence rating was greatest for static palpation, and less for both PPIVM and PAIVM.

Our results suggest that MTs report that they incorporate their findings of the literature into their clinical

Table 3 Multivariable ordered logit models of each of the nine confidence variables, simultaneously evaluating the contribution of predictors from the univariable models significant at the 0.2 alpha level

Procedure	Category	Spinal region					
		Cervical		Thoracic		Lumbar	
Predictor		OR	p-value	OR	p-value	OR	p-value
<i>Palpation</i>							
Knowledge	–	1.620	<.001	1.377	<.001	1.142	0.189
Experience	–	1.162	0.050	1.136	0.091	1.289	0.001
Hours/week	–	1.085	0.232	1.147	0.044	1.100	0.164
Education	MPT degree	–	–	0.820	0.038	–	–
	DPT degree			0.518			
	Doctorate			0.472			
	Other			0.651			
Country	Canada	0.933	<.001	0.659	<.001	0.850	0.011
	Europe	0.522		0.807		0.744	
	Australasia	1.905		2.487		2.043	
Training	–	–	–	–	–	–	–
<i>PPIVM</i>							
Knowledge	–	1.580	<.001	1.494	<.001	1.208	0.032
Experience	–	1.087	0.265	1.079	0.301	1.142	0.077
Hours/week	–	1.130	0.066	1.168	0.017	1.195	0.007
Education	–	–	–	–	–	–	–
Country	Canada	1.686	<.001	1.081	0.418	1.363	0.009
	Europe	0.686		0.809		0.585	
	Australasia	2.110		1.320		0.154	
Training	Grimsby	1.867	0.197	2.428	0.190	2.852	0.420
	Maitland	0.761		1.074		1.012	
	McKenzie	0.442		0.752		0.754	
	NAIOMT	1.526		1.779		1.210	
	Paris	2.267		3.175		1.875	
	PTS	0.594		0.927		0.977	
	Other	0.880		1.170		0.926	
<i>PAIVM</i>							
Knowledge	–	1.781	<.001	1.376	<.001	1.409	<.001
Experience	–	1.067	0.395	0.967	0.643	0.995	0.949
Hours/week	–	1.047	0.489	1.089	0.191	1.139	0.047
Education	MPT degree	0.998	0.037	–	–	–	–
	DPT degree	0.571					
	Doctorate	0.525					
	Other	0.697					
Country	Canada	1.487	<.001	1.545	<.001	1.199	<.001
	Europe	0.577		0.715		0.495	
	Australasia	2.240		2.673		2.010	
Training	Grimsby	1.094	0.177	2.135	0.118	–	–
	Maitland	0.995		1.316			
	McKenzie	0.333		0.605			
	NAIOMT	0.884		1.316			
	Paris	1.493		2.529			
	PTS	0.485		0.635			
	Other	0.652		0.952			

Notes: *p*-values represent the significance of a predictor when adjusting for the others; Abbreviations: OR, odds ratio; *p*, overall model *p*-value. Reference categories: Baccalaureate degree for education was; United States for country; AAOMPT fellowship for training.

practice when utilizing static and dynamic vertebral palpation. Although we did detect a relationship between use of the literature and confidence, in order not to bias the results of the study, we were unable to specifically determine how each respondent interprets the literature, that is, whether they interpret it to support or refute the given technique. In addition, we did not attempt to determine what types of literature the respondents read and were basing their answers upon. It may be that respondents were well read in palpatory models that have not been validated. While this distinction is important, we did not believe we could determine one's ability to critically review and appraise the relevant, current literature. It is also possible that those with greater confidence in their techniques also spend more time reading the MT literature. Still, 60–80%

of the MTs we surveyed felt confident in performing both static and dynamic vertebral palpation.

It appears that confidence is highest when applied to procedures in the cervical spine. This may be a result of the safety concerns relevant to the upper or high cervical spine, and that this topic might constitute the majority of the literature read, or it may suggest that the cervical region is easier for MTs to palpate and interpret movement dysfunction. We did not attempt to differentiate sub-components of each delineated spinal region; for instance, the upper or high cervical spine is not specifically differentiated in the analysis. Although this relationship was also true in the thoracic and lumbar spine, the lumbar spine relationship was the weakest. These results may suggest that clinicians have been moving towards a more regional

approach to the lumbar spine, or simply find the anatomical features of this area less amenable to palpation. Still, we found that MTs with more experience had higher levels of confidence palpating the lumbar area, perhaps from a perceived or actual increase in skill over time.

In addition to the literature, country of the MT was highly associated with spinal palpation confidence, with the MTs in Australasia (specifically Australia and New Zealand) showing higher levels of confidence. We thought this might be due to the influence of Maitland in this region. However, past work showed that Maitland training constituted portions of the advanced training for the majority of practicing clinicians in The United States, The UK and Canada.^{18,52–56} Since education was only significant in two areas in our analysis (cervical PAIVM and thoracic palpation), geographic variation does not appear to be accounted for by the level of academic training received across the countries represented in our study. However, our data do not capture potentially significant variation in the content of the curriculum, which may be driving our results. More investigation into the practice patterns, settings and overall function of MTs in this region, including qualitative analysis, appears to be warranted.

Limitations

We acknowledge several limitations with regards to this study. Our analyses were limited to a convenience sample of those MTs who chose to respond to the electronic survey, rather than a random sample. The distribution of the survey was done via email and we could not determine how current the email addresses were, how many were captured by filters or how many were opened. Furthermore, we do not know what percentage of each organization's members had their active emails on file with their respective MO. Therefore, we cannot accurately determine an overall response rate.

We also recognize that there are a variety of methods of static palpation, PPIVM and PAIVM. We did not differentiate these, and concluded that the respondents likely answered specific to their chosen methodology. While we have cited the large geographical influence of the Maitland concepts, MTs likely have a variety of training and choose the technique that they believe will best address the patients' complaints.

When enquiring about education, there are a wide variety of degree and certification options within the MOs of IFOMPT. These are too extensive to adequately be included in the style of survey we constructed.

The data itself are self-reported and therefore open to reporting bias. We would submit that this self-report method does, however, accurately reflects the practice of individual respondents. So they would answer the questions based on the type of literature they have read and the manner in which they critically analyze it. Further knowledge of selection of literature and appraisal methods by MTs may be valuable. Personal follow-up and additional qualitative data were not feasible given the number and

location of respondents. We do acknowledge that pursuing further qualitative interview data may be beneficial to confirming and refining our results.

Conclusions

Static and dynamic vertebral palpation remains an area of vibrant research and frequent clinical use, yet an overall consensus on the validity of its use has not been reached. There remain a variety of assessment and treatment procedures that are well used between MTs, ranging from the directionally specific to more regionally generalized. Each of these approaches may have the content validity needed to allow for acceptable clinical utility. We found that confidence in the use of spinal MT is related to knowledge of the literature and to country of practice. Further research into the factors that are associated with confidence in the use of these techniques and geographical factors may assist MTs in moving forward and achieving better outcomes for those who seek MT care.

ORCID

Steve Karas <http://orcid.org/0000-0003-2819-1219>

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Appendix A. Exact text used on study survey

Question text	Measurement scale
I am confident that I can identify a specific lumbar spine vertebrae through palpation	5-level Likert item
I am familiar with the literature concerning palpation of specific lumbar spine segments	5-level Likert item
I am confident that I can accurately assess the amount of joint motion in the lumbar spine using passive intervertebral motion (PPIVM)* techniques	5-level Likert item
*(Passive physiological intervertebral motion)	
I am familiar with the literature concerning the accuracy of joint motion assessment using PPIVM techniques in the lumbar spine	5-level Likert item
I am confident that I can accurately assess the amount of accessory joint motion in the lumbar spine using passive accessory intervertebral motion (PAIVM)* techniques	5-level Likert item
*(Passive Accessory Intervertebral Motion)	
I am familiar with the literature concerning the accuracy of accessory joint motion palpation using passive accessory intervertebral motion (PAIVM) techniques in the lumbar spine	5-level Likert item
I am confident that I can identify a specific thoracic spine vertebrae through palpation	5-level Likert item
I am familiar with the literature concerning palpation of thoracic spinal segments	5-level Likert item
I am confident that I can accurately assess the amount of joint motion in the thoracic spine using passive intervertebral motion (PPIVM) techniques	5-level Likert item
I am familiar with the literature concerning the accuracy of joint motion assessment using PPIVM techniques in the thoracic spine	5-level Likert item
I am confident that I can accurately assess the amount of accessory joint motion in the thoracic spine using passive accessory intervertebral motion (PAIVM) techniques	5-level Likert item
I am familiar with the literature concerning the accuracy of accessory joint motion palpation using passive accessory intervertebral motion (PAIVM) techniques in the thoracic spine	5-level Likert item
I am confident that I can identify a specific cervical spine vertebrae through palpation	5-level Likert item
I am familiar with the literature concerning palpation of cervical spinal segments	5-level Likert item
I am confident that I can accurately assess the amount of joint motion in the cervical spine using passive intervertebral motion (PPIVM) techniques	5-level Likert item
I am familiar with the literature concerning the accuracy of joint motion assessment using PPIVM techniques in the cervical spine	5-level Likert item
I am confident that I can accurately assess the amount of accessory joint motion in the cervical spine using passive accessory intervertebral motion (PAIVM) techniques	5-level Likert item
I am familiar with the literature concerning the accuracy of accessory joint motion palpation using passive accessory intervertebral motion (PAIVM) techniques in the cervical spine	5-level Likert item
Please indicate the years of practice you have in spinal manual therapy	Ordinal categorical item
Please indicate the amount of weekly hours spent with patients requiring spinal manual therapy	Ordinal categorical item
Please indicate your highest level of Physical Therapy Education	Nominal categorical item
Please indicate in which country you currently practice Physical/Physio Therapy	Nominal categorical item
Please check the ONE organization where you have received the majority of your manual therapy training	Nominal categorical item