Patient Centered Manual Therapy through the Application of Pain Phenotyping

by:

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Abstract:

Manual Therapy (MT) is a heterogenous, non-pharmacological analgesic treatment approach utilized by healthcare practitioners to manage pain. The utility of MT has been well established; however, developments within the field of MT question how patients should be selected, and by what mechanism(s) MT is providing analgesia. Patient-centered care models emphasize the need to use tailored treatment directed at patients who are most likely to respond. Historically, MT models have utilized clinical exam findings and biomechanics to guide treatment in a 'patient centered' way, recent literature has suggested biomechanical and technique factors to be less important than previously understood. This prompts a shift towards patient-level factors dictating treatment. Pain phenotyping may use patient characteristics to subgroup individuals in an attempt to identify those who are likely to respond to an intervention. The purpose of this dissertation was to establish the concept of pain phenotyping as a step towards patient centered care within Orthopedic Manual Therapy. The concept of pain phenotyping was introduced across several platforms (digital and print). A scoping review was completed to investigate how patient specific phenotypic variables interact with MT treatment effect. An international Delphi study was completed investigating necessary changes within MT training paradigms based on this progressive knowledge. The results of the studies produced within this dissertation support manual therapies transition from a biomedical model to a patient-centered biopsychosocial model for application. Pain phenotyping in orthopaedic manual therapy has enormous potential to improve patient -centered care models. This dissertation framed the concept of pain phenotyping across three different subgrouping methods in several ways and took several steps towards a better understanding of how this concept should influence orthopedic manual therapy clinical practice and research.

Table of contents:

Appendices:

Page:

Preface:

If someone were to tell me when I finished my Doctorate in Physical Therapy that I would return to school and get another doctorate, I would have had no choice but to question that person's sanity. I have always been the person that wants to know 'why' when posed with a theory, therefore it felt natural for me to pursue a philosophy doctorate degree. During the pursuit of this degree, it has become apparent how important support personnel are in making success an option. First and foremost, I must thank my loving wife Cara for putting up with countless hours spent away from the family in pursuit of academic knowledge. I must also thank my sons Rowan and Lincoln, as unbeknownst to them their smiles helped me get through the most challenging of times. Everything I do in life is to allow you a better future.

To my colleagues who were not officially involved within my education, however, acted as mentors and friends to keep me motivated and inspired I thank you. Dr. Kevin Brochetti, Dr. Maria Rufener and Dr. Steve Karas- you all helped to keep me both motivated and grounded throughout this process and it is unlikely success would have been obtained without that guidance - thank you.

Finally, and certainly not least I must thank the three individuals who contributed countless hours, hundreds of emails, and some sanity putting up with my debauchery throughout this educational process. Dr. David Griswold, you are wise beyond your years with guidance that promotes thought and self- development. You helped to keep me on track throughout this process and I thank you. Dr. Kenneth Learman, you were the inspiration for me to pursue this degree when I met you at a continuing education course in 2014, and since that time you have not lost a bit of your inspiring aura. I am thrilled that I was able to be part of the PhD program which you pioneered at Youngstown State University. Your knowledge is inspiring, and I strive to one day be admired by my peers in the way which I and so many other students and clinicians admire you. Lastly, Dr. Chad Cook, my committee chair, you have been the wind that kept this ship moving forward. Your understanding of Orthopaedic Manual Therapy, and furthermore the profession of Physical Therapy is galvanizing. You are a true visionary, leader within our profession, and an exquisite scholar and I strive to achieve a fraction of what you have in my professional career. To my committee – you are mentors, colleagues, and friends, and I thank you.

Chapter 1: Introduction and background

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Introduction:

Non-pharmacological pain management is at the forefront of the opioid epidemic as healthcare providers struggle to find which patients respond to which intervention.[1–3] With limitations in the services approved and paid for by insurers, the days of trial and error have long passed.[4–6] Clinical practice guidelines have assisted clinicians in classifying patients based on symptoms in attempt to provide the best treatment interventions; however, overall the phenomenon of pain continues to baffle the minds of the brightest clinicians.

One analgesic tool utilized to manage pain by healthcare practitioners including osteopaths, chiropractors, massage therapists, and physical therapists is orthopaedic manual therapy (OMT). Manual therapy has been defined as ‘a synergistic application of movement-oriented strategies, including exercise and manually applied joint and soft tissue mobilizations and manipulations, guided by a clinical-reasoning framework that informs dosing and progression of all components’.[7] This includes types of force-based manipulation such as soft tissue mobilization, joint mobilization and manipulation, and dry needling. As with other analgesic treatment options two necessary questions arise: 1.) Which patients benefit from these techniques? 2.) By what mechanism is this intervention working?

Patient-centered care models emphasize the need to use tailored treatment directed at patients who are most likely to respond. Following this trend the National Institute of Health has established the precision medicine initiative which outlines the framework for basing intervention on specific patient needs rather than those of the 'average patient'.[8,9] Pain phenotyping may involve the subgrouping of individuals based on patient characteristics in an attempt to identify those whom are likely to respond to an intervention.[10] This concept directly aligns with the NIH initiative of precision medicine. OMT literature has attempted to differentiate 'responders' from 'non-responders'; however, the reasoning behind 'why' individuals fall into each category is poorly understood.

The experience of pain has shown to be exquisitely complex involving more than the somatosensory cortex, and furthermore the role of nociception in the experience of pain has demonstrated inconsistent correlation.[11–14] Conditions such as those involving spine pain demonstrate complex contributors from brain regions responsible for emotion and psychological status.[15–21] The combination of these factors promote the need to look outside of tissue specific pathology when treating pain complaints. This has become evident in recent literature as OMT techniques have shown the specifics of the technique to be less important than previously thought.[22–25]

Manual therapy has shown to have a positive analgesic effect on individuals dealing with pain complaints; however, the mechanisms behind why this occurs are complex and largely unclear.[26–29] While mechanistic studies have defined neurophysiological, biomechanical, and psychological effects associated with OMT, a lack of translational studies has left a gap in understanding which of these endogenous mechanisms are relevant to clinical pain reduction.

The purpose of this dissertation was to establish the concept of pain phenotyping as a step towards patient centered care within Orthopedic Manual Therapy. To reach the overall purpose of this dissertation several steps were undertaken:

1.) Present the concept of pain phenotyping in OMT including rationale, how it is applied, and how it should be investigated moving forward. (Chapter 2)
2.) Present the literature supporting patient centered (rather than tissue/technique centered) application of OMT. (Chapter 3)

3.) Investigate how patient specific factors (phenotypic factor) influence OMT treatment outcomes. (Chapter 4)

4.) Investigate how progressive understanding of OMT prompts updated paradigms of OMT education and application. (Chapter 5)

Background:

1.1 Pain phenotyping in OMT:

Phenotyping is defined as "the observable characteristics or traits of an organism that are produced by the interaction of the genotype and the environment".[30] Pain phenotyping characterizes patients into subgroups based on their pain experience and may include genetic, biomechanical, psychological and environmental contributors.[10] The goal of phenotyping is to optimize treatment options and prognosis for patients based on these variables.[31] This is of great importance within pain management as patients with similar pain syndromes and presentations demonstrate significant variation in treatment response.[32,33] Pain phenotyping has been investigated in knee osteoarthritis[34,35] and chronic pain.[36–42] As many as nine subgroups have been supported through cluster and latent class analysis. The most frequently used variables to develop these subgroups were patient reported outcomes, findings from physical examination, and diagnostic testing such as pain sensitivity.

Factors which influence OMT analgesia are considered pain phenotypic factors and should be considered when attempting to subgroup. Previous reviews specific to OMT outline these factors as moderators of treatment response; however, their association with outcomes has not been well established.[43,44] Factors influencing treatment response are abundant, however pain management guidelines have outlined those which are known to influence analgesic outcomes in other treatment domains (pharmacological).[10] It could be hypothesized that the influence of these factors on OMT pain outcomes may be even more substantial as OMT relies on modifications in endogenous pain relieving pathways without induction of external agent such as pharmacology.

Subgrouping can be achieved in a number of ways, which is demonstrated by the heterogeneity between the aforementioned studies related to methods and subgroups established. Three forms of subgrouping have emerged within the literature: 1.) phenotyping based on pain mechanism[45–47] 2.) clinical phenotyping based on response to noxious input[48,49] 3.) phenotyping based on clustering of variables known to moderate or mediate treatment effectiveness (phenotypic variables).[10,50–52]

1.2 Pain phenotyping based on pain mechanism:

The shift away from tissue pathology as a causal factor for pain opened the door for a framework of ‘pain mechanisms’ as a means of classification.[47] Three primary pain mechanisms were established and defined: nociceptive pain, neuropathic pain, and nociplastic pain.[47,53] Several subgroups under each of these mechanisms have also been defined; however, that is outside the scope or purpose of this dissertation. Nociceptive pain is defined as “pain that arises from actual or threatened damage to non-neural tissue and is due to the activation of nociceptors.”[54] Neuropathic pain is defined as “pain caused by a lesion or disease of the somatosensory nervous system.”[54] Nociplastic pain is defined as “pain that arises from altered nociception despite no clear evidence of actual or threatened tissue damage causing the activation of peripheral nociceptors or evidence for disease or lesion of the somatosensory system causing the pain.”[54] Subgrouping based on pain mechanism may lead to more targeted pain management; however, its application within the field of orthopedics is within its infancy and needs to be further explored.

1.3 Pain phenotyping based on clinical response:

Literature has established two distinct response phenotypes when presented with a painful stimulus: 1) those who have a reduction in pain over time (pain adaptable) and 2) those whom have an increase or maintenance of pain over time (pain non-adaptable).[48,49] Clinical response to analgesic challenge has been recommended as a measure to assist in guiding treatment intervention[10] Early within session and between session analgesia as response to OMT challenge has shown prognostic value in identifying long term responders versus non-responders to manual therapy techniques.[55] It could be theorized that this study utilized a manual therapy intervention to identify patients whom were adaptable and non-adaptable to pain (those whom demonstrated within session improvements and those whom did not) however this association has not yet been established via translational research. Phenotyping based on clinical response measures are of interest as they utilize actual clinical response as a guiding factor rather than factors attempting to identify what the clinical response may be.

1.4 Pain phenotyping based on clustering of phenotypic variables:

Phenotypic variables to consider have been outlined based on their documented ability to influence analgesic outcomes.[10] The variables recommended by Edwards and colleagues as phenotypic categories are directly reflective of moderating/mediating variables known to influence OMT outcomes that have been outlined in previous models.[43,44] Variables can be characterized under several different domains including psychosocial domain (depression, anxiety, kinesiophobia/fear, catastrophizing, patient expectations), sleep domain (sleep factors and fatigue), pain qualities (intensity, symptoms duration, variability, sensitivity, irritability), and quantitative sensory testing (PPT, temporal summation, conditioned pain modulation. While the concept of utilizing these variables for clinical decision making has been proposed in the literature,[31] trends in clinical responses within subgroups are far from being understood or furthermore applied to clinical practice.

Psychological variables:

Psychological variables demonstrate a complex relationship with not only pain but clinical response to analgesic measures.[10,56] OMT intervention influences psychological variables including depression and anxiety indicating a bidirectional relationship.[57,58] Elevated baseline Hospital Anxiety and Depression Scale (HADS) scores, a reliable and valid measure of depression and anxiety, associates with decreased opioid analgesic effect.[59–61] This is one of many the proposed mechanisms of OMT therefore it can be hypothesized that this may influence analgesic response to OMT.[62]

Pre-treatment pain catastrophizing has also demonstrated ability to moderate effectiveness of pain-relieving interventions.[56] Catastrophizing has demonstrated the ability to make neuroplastic changes in brain structure and alter neurological and neuroimmune response including those induced by OMT.[63–66] This factor has developed into one of the most important pre-treatment variables influencing pain related outcomes including: surgical outcomes,[67,68] pharmacological outcomes (topical analgesic,[69] cortisone injection,[70] Acetaminophen and Tramadol,[71] psychological intervention,[72] Physical Therapy,[73,74] and Transcutaneous Electrical Neuromuscular Stimulation (TENS).[75]

Patient expectations plays a crucial role in the neurophysiological response of treatment (including placebo mediated response) therefore has enormous potential to interact with OMT treatment effectiveness.[76–78] Expectations and beliefs have demonstrated the ability to influence manual therapy outcomes related to acupuncture and OMT.[79–81]

Pain Variables:

Baseline pain qualities, variability, and intensity have been suggested to be prognostic of treatment response.[10] Individuals with lower levels of baseline pain demonstrate more favorable response to OMT than those with higher levels of baseline pain.[82,83] Clinical studies suggest that individuals whom demonstrate high pain variability show more consistent response to placebo mechanisms than those with non-variable pain.[84,85]

Sleep and Fatigue variables:

Experimental studies have established a bidirectional relationship between sleep quality and pain in both pain conditions and healthy controls.[86–91] Sleep deprivation has shown the ability to decrease pain threshold in healthy controls.[92] The mechanism behind this association is multifactorial including alterations in endogenous pain modulation,[93] inflammation,[94] and mood,[95] Several reviews have suggested assessment of sleep factors in predictive pain phenotyping.[10,56,96]

Quantitative Sensory Testing:

Quantitative Sensory Testing (QST) is a method utilized to quantify somatosensory function from response to innocuous or noxious stimuli in a graded and calibrated method which can be measured and recorded. A recent review and meta-analysis demonstrated prognostic value in persistent pain and disability.[97] QST has demonstrated predictive phenotypic value in determining the response to analgesic medications.[98,99] QST at remote sites has shown preliminary value in predicting short term outcomes in patients with acute whiplash injury whom complete a course of PT.[100] Furthermore, a subject's ability to modulate, or adapt to stimuli has its own prognostic value. Conditioned pain modulation (CPM), as a mechanism of pain inhibition, has been described as the reduction of reported pain from a painful stimulus when a second painful stimulus is applied distantly or heterotopically.[48] CPM is thought to represent the net effect of descending modulation and has shown to associate with outcomes in pharmacological, OMT, and exercise based analgesia.[101–104]

1.5 Mechanisms of OMT:

It is apparent in OMT literature that multiple mechanisms contribute to clinical analgesia with hands on intervention.[43,44,105–110] This is reflective of other non-pharmacological analgesic interventions including exercise induced analgesia.[103,111–113] Non-pharmacological pain management interventions are complex and involve various different neurophysiological, psychological, and mechanical mechanisms; however, to understand each of these, we must understand their interactions.

Psychological Mechanisms:

Psychological contributors to analgesia, including placebo response, are strong contributor to OMT response. The psychological domain is challenging to investigate in isolation however as things as simple as talking to patients [114] and putting your hands-on patients [62] stimulate neurological and neuroendocrine changes, [62,115–119] which starts moving into the neurophysiological realm of responses. Furthermore, the perception of touch, without the actual physical stimulus, relates to fMRI changes in the brain [120] contributing to the success of techniques such as graded motor imagery.[121]

Manual therapy has shown to directly influence serotonin and dopamine mediated pathways which are associated with psychological conditions further displaying the interaction between these mechanistic domains.[62] A recent clinical study further identified the neural implications of expectations in relation to touch.[122] A survey of orthopaedic manual therapists has identified that clinicians are largely aware of the role of contextual factors on responses to manual therapy intervention. [123]

Biomechanical Mechanisms:

The biomechanical model of OMT has been questioned over the years, with the general understanding that there is minimal biomechanical/positional correction with OMT techniques. [124–128] The response to OMT intervention, while previously theorized to be related to the mechanical alterations provided with OMT, appears to be associated with the neurophysiological and psychological cascade of events created by these stimuli rather than the stimuli itself making changes to the tissue. This concept is further supported with controlled studies which have shown distant effects from manipulations related to both pain and range of motion.[24,27,129] It has been suggested that the grade of mobilization influences the mechanical response; however intensity of tactile input and the associated perception of touch versus pain influence the neurophysiological response and are more likely the rationale for these findings than differences in technique itself.[130–132] It has been well established that OMT shows immediate effects in improving mobility,[133-136] however, the neurophysiological cascade of events including desensitization and reduction in circuits responsible for tone/guarding are likely the drivers to this response more so than the mechanical facilitation of the joint/tissue. While this concept has been repeated consistently in the literature there is a significant translation gap from research to clinical practice.[29,43,44,137–140] Professions including chiropractic, which previously focused intervention on the biomechanical model including correction of faults and subluxations, have pushed for adoption of a more evidence-based comprehensive model. [141]

Neurophysiological Mechanisms:

The Neurophysiological mechanisms of OMT have been well established in the literature as a significant driver of analgesic response.[29,44,62,138–140] Neurophysiological mechanisms combine to create a peripheral, spinal, and supraspinal modulatory response which is thought to be the cornerstone for pain modulation and pain habituation. Several different mechanisms take a role in this relationship. The first being through the action of pain modulating peptides and neurotransmitter which are influenced by OMT intervention. Serotonin and dopamine have been found to be altered with OMT intervention and has been established as a pain modulating neurotransmitter altering the affective component of pain.[62,142] The proposed sites of action for both dopamine and serotonin are widespread including the dorsal horn of the spinal cord, periaqueductal gray (PAG), thalamus, basal ganglia, insular cortex, and cingulate cortex.[143,144] Oxytocin is another pain modulating peptide is affected by OMT techniques and modulates pain at the brain and spinal cord level.[62,145] The aforementioned neurotransmitters are involved in psychological processes including anxiety and depression, further justifying the relationship between OMT and the psychological domain.

Another proposed mechanism of OMT is the modification in inflammatory mediators both in the peripheral and central nervous system. OMT has been shown to reduce inflammatory mediator expression leading to increased pain pressure threshold and reduction in temporal summation.[107,119]

It is clear that complex multisystem mechanisms contribute to clinical analgesia with OMT. With literature across several different professions, the current literature seems full of gaps. One of the primary limitations/gaps is that while these mechanisms have been established, very little has been done to assess the role of phenotypic factors in modifying these mechanisms, and furthermore which mechanisms correlate with clinical outcomes. Mechanistic studies looking to associate these variables would help to tie some of these theories together for a better understanding of what it is contributing to clinical analgesia with OMT.

Conclusion

The bottom-up approach to pain management focuses on determining which technique is most appropriate for the 'average patient'. This thought process is still prevalent in OMT literature attempting to guide our idea of evidence-based practice by finding the 'best' interventions. On the contrary, a top-down approach to patient management focuses on the patient first and develops a plan of care based on their needs and thoughts. This includes looking at psychological factors, demographic factors, and attempting to determine what this patient may need based on their expectations, beliefs, past experiences, and clinical presentation. The practice of manual therapy has evolved significantly in recent years, and while manual therapy is still a useful tool for clinical analgesia in some patients, clinicians must reconceptualize how to identify patients for manual therapy, and furthermore how it should be applied based on evidence-based models.

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Chapter 2: Time to evolve: the applicability of pain phenotyping in manual therapy

Chapter 2 – Introduction:

The concept of pain phenotyping has been largely studied to date within medical and pharmacological populations. Alternative medicine providers including manual therapists have likely not been exposed to this concept previously in the literature therefore the purpose of this editorial was to expose manual therapists to this concept including: outlining pain phenotyping, outlining theories relating to pain phenotyping in OMT, and frame how future research could further investigate these concepts through responder analyses. This manuscript was published within the Journal of Manual and Manipulative Therapy in March 2022. Permission for dual publication within this dissertation was provided by the publisher.

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EDITORIAL

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Time to evolve: the applicability of pain phenotyping in manual therapy

Physical therapists use a number of tools for pain management, including exercise, education, thermal and electrical agents, and orthopedic manual therapy (OMT). Orthopedic manual therapy comprises a heterogeneous set of interventions such as thrust (TM) and non-thrust manipulation (NTM), soft-tissue manipulation, and neurodynamic movements. The use of OMT in clinical practice is supported across a wide body of literature [1–5] and has been endorsed by clinical practice guidelines (CPGs) [6–11]. Despite this evidential support, it is well known that results differ markedly across patient populations that are treated with OMT [12–18]. Additionally, specific application of OMT techniques may not result in superior outcomes when compared to randomly selected or nonspecific application of said techniques [19–23].

The aforementioned findings involving OMT are similar to those of other efficacious interventions. Clinical studies on chronic pain syndromes such as fibromyalgia and osteoarthritis have shown great inconsistency in therapeutic responses between individuals, even when efficacious interventions such as exercise or medications are used [24–26]. Variability in therapeutic response is partly explained by psychosocial factors and individual differences in how pain is modulated at the patient level27 and the failure to precisely characterize the pathophysiologic mechanisms that influence subgroups of patients [27]. This has prompted researchers to attempt the subgrouping of patients to better identify responders and non-responders to dedicated interventions: this is a concept known as phenotyping.

Phenotyping has been defined as 'the ensemble of observable characteristics displayed by an organism' [28]. Historically, phenotyping was associated with an individual's interactions between their genotype and the environment. Only recently have researchers incorporated the use of *clinical phenotyping*, attempting to define groups of patients who may respond to specifically targeted treatments. Clinical phenotypes are based mainly on observable clinical and physiological measures. Clinical 'pain' phenotyping (whereby described as pain phenotyping) characterizes patients based on their *pain experience* and their response to dedicated interventions [28,29–31].

With respect to OMT, it has historically been assumed that the clinical effectiveness of the approach was associated with the technique selected (specialized training) and the skill of the clinician who applies the technique. We theorize that the differences in responses seen in clinical practice are reflective of variations in *pain phenotypes* and less reflective of techniques used or provider skill. While evidence suggests that higher-level training promotes better outcomes, we propose that this is related to improved ability to identify individuals who will have a favorable response to care rather than improved skill of OMT application [32]. The purpose of this paper is to reinforce the assumption that the likelihood of achieving a positive outcome with an OMT approach depends on selecting a patient with an amenable pain phenotype. To support our theory, we will present work supporting: (1) Different OMT techniques provide similar and consistent mechanisms in preclinical research; (2) current non-OMT pain phenotyping approaches support the assumption that patient-related factors are associated with a given pain response; (3) pain profiling in clinical trials has failed to consistently identify individuals with favorable outcomes to OMT; and (4) with the appropriate research, clinicians have the capacity to identify potential pain phenotype in their clinical assessment.

Different OMT techniques provide similar and consistent mechanisms in preclinical research

The term 'mechanism' reflects the steps or processes through which intervention (independent variable) actually unfolds and produces the change (outcome variable). The *National Institutes of Health* defines mechanistic studies as designed to understand a biological or behavioral process, the pathophysiology of a disease, or the mechanism of action of an intervention [33].

Neurophysiological mechanisms of all OMT forms have been well established as a significant driver of the analgesic response [34–39]. Neurophysiological mechanisms combine to create a peripheral, spinal, and supraspinal modulatory response which is thought to be the cornerstone for pain inhibition [34,40]. Peripheral pain inhibition in response to OMT has been demonstrated with a local increase in pain pressure threshold (PPT) without the same response remotely [41]. It is proposed that this peripheral mechanism is attributed to a modification in inflammatory markers [34,40,42]. All forms of OMT reduce inflammatory mediator expression leading to increased PPT and reduction in temporal summation [43–45].

Changes in PPT locally without remote changes are not consistent; therefore, when congruent changes occur locally and remotely, a central inhibitory effect is suggested [41,46]. This effect is proposed to be related to changes in pain-modulating peptides and neurotransmitters influenced by OMT. Serotonin and dopamine are altered with OMT [35] and act as pain-modulating neurotransmitters altering the affective component of pain [47]. The proposed sites of action for both dopamine and serotonin are widespread, including the dorsal horn of the spinal cord, periaqueductal gray, thalamus, basal ganglia, insular cortex, and cingulate cortex [48,49]. Oxytocin is another pain-modulating peptide affected by OMT [35], mitigating pain at the brain and spinal cord level [50]. At the spinal level, reviews on both humans and animals have established the effect OMT has on improved descending inhibition [35,51,52]. Studies on temporal summation, a measure of dorsal horn excitability, support direct inhibition with OMT [53–55].

Autonomic nervous system (ANS) response to OMT is assessed through measuring skin temperature, skin conduction, heart rate, and cortisol level changes [40]. A recent review concluded that OMT techniques affect the ANS with a combination of sympathetic and parasympathetic nervous system reactions [42]. The same review was not able to find evidence to support any differences in ANS response with differing manual techniques; however, this was not measured in most of the included studies [42].

Pre-clinical research involving TM and NTM produces consistent mechanistic responses across animal and human populations including transient neurophysiological (peripheral and central pain modulation), biomedical (immune and inflammatory systems and musculoskeletal stiffness), and psychological (contextual) mechanisms. These findings are supported by a number of systematic reviews involving preclinical research [35,41,43,51,52,56]. Although it is clear that the translation of these mechanisms to clinical outcomes is woefully understudied, it is unlikely that differences in mechanisms alone account for the great variability we see in clinical outcomes reported by patients.

Current pain phenotyping approaches support the assumption that patient-related factors are associated with a given pain response

Phenotyping studies use cluster and latent class analysis to identify characteristics of those with favorable analgesic response. These analyses identify patterns in multiple dependent variables and correlate them to related outcome variables to develop groups. Pain phenotyping trials have used both *predictors of pain state* (pain intensity, temporal summation, and conditioned pain modulation) and *response* to analgesic management as outcomes within these models.

Cross-sectional designs develop phenotypic groups based on characteristics demonstrated by those with optimal versus impaired pain states [57–62]. Grouping by conditioned pain modulation and temporal summation demonstrates the interaction between pain intensity, locations, and threshold contributing to phenotype, while psychological variables did not contribute [62]. Grouping patients with osteoarthritis based on the persistence of knee pain demonstrates the interaction between PPT and temporal summation contributing to phenotype, while similarly no interaction from psychological variables is demonstrated [59]. Grouping by self-reported functional limitations, pain intensity, gait speed, and health-care utilization demonstrates the interaction between pain intensity, locations, threshold, psychological distress, and number of comorbidities contributing to phenotype [61]. Grouping LBP based on pain intensity and variability demonstrates the interaction between fatigue, pain qualities, and presence of central sensitization contributing to phenotype [60]. Grouping patients with chronic pain based on pain characteristics (intensity, location, and duration) demonstrates the interaction between psychological strain, comorbid fibromyalgia diagnosis, social distress, and gender contributing to phenotype [57]. Grouping based on the presence of somatic widespread symptoms demonstrates the interaction between anxiety, depression, and emotional stability contributing to phenotype [58].

Phenotyping based on responsiveness to analgesic intervention has also demonstrated contributions from patient-specific characteristic [63–64]. Grouping patients with chronic pain receiving multimodal inpatient care based on reported measures of pain burden shows presence of depression, previous pharmacological and psychological intervention, and patient age all interacting to contribute to phenotype [63]. Individuals with high pain burden at baseline demonstrate improved pain outcomes, while those in other subgroups of pain burden show only improvement in depression and anxiety outcomes [63].

Higher baseline pain intensity is phenotypic for treatment effect size following lumbar spinal manipulative therapy (SMT) [65]. Patient expectations of recovery and comfort during treatment are phenotypic for response following thoracic SMT, while biomechanical parameters of SMT do not alter response [66]. Grouping based on local response to sustained noxious stimulation (pain adaptability) has identified two phenotypes both in healthy controls [64] and in patients with musculoskeletal pain67: those who are pain adaptable (demonstrate a reduction in pain over time) and those who are non-pain adaptable (demonstrate no reduction in pain over time). Latency to peak pain was the only variable that significantly correlated with pain adaptability. In these studies [64,67], conditioned pain modulation did not contribute to adaptability phenotype, suggesting another rationale for analgesia independent of central pain modulation.

The use of pain profiling in clinical trials has failed to consistently identify individuals with favorable outcomes to OMT

Clinical trials [68–71] and reviews [72–74] support OMT's direct effect on reducing pain sensitivity locally and remotely. This is consistent regardless of the persistent or episodic nature of pain [75]. These findings are not specific to one technique with similar findings with manipulation, mobilization, and sham procedures [68,69,76]. Increased sensitivity at baseline correlates with larger increases in PPT; however, this association did not translate to between-group difference in clinical pain outcomes [71,72].

Early clinical studies attempted to associate changes in hypoalgesia with clinical response following TM [71,77,78]. Remote and local changes in PPT were not correlated with clinical SMT response in the short and medium term [78]. This corroborates previous work finding minimal correlation between changes in pain sensitivity and clinical outcomes [79]. Improved local hypoalgesia was identified following SMT in individuals with favorable outcomes regardless of the level of TM, while only SMT targeting the most painful segment was correlated with improved hypoalgesia irrespective of response [71]. These findings suggest a segmental reflexive modulation response promoting the hypoalgesia [71]. Current literature has failed to consistently identify factors associated with favorable OMT response. The overall lack of correlation between pain profile and clinical pain outcome suggests that nonspecific underlying factors such as a patient's pain adaptability phenotype contribute to the analgesic response. Clinical research should investigate factors such as pain adaptability in an attempt to better identify those who will have a favorable response to OMT.

With the appropriate research, clinicians have the capacity to identify potential pain phenotypes in their clinical assessment

Preliminary observational work suggests that the early positive response is indicative of better long-term outcomes [12,80,81]. In these studies, the authors have associated clinical characteristics identified early in the examination with improved outcomes at discharge and up to 6 months. Specifically, a 30% reduction of pain from baseline was identified with repeated posterior to anterior mobilizations, and this response led to a 2.5–5.0 increased odds of an improved outcome versus a lack of this finding. In each of the studies, OMT was a focus of the treatment approach, causing the authors to assume a link between the initial 30% and the ultimate clinical outcomes with an OMT treatment, as other influencing variables were not controlled. While these findings may appear promising, the studies failed to distinguish whether or not the early clinical findings are specific to OMT; at this point, the findings are purely prognostic. We hypothesize that the clinical characteristic identified early in the examination is related to the patient's endogenous pain-modulating capacity. In other words, the positive outcome with an OMT approach depended on the individual patient with an amenable pain phenotype, a term known as pain adaptive behavior64,65

To confirm the association of the aforementioned response with pain adaptive behavior, one would need to complete a concurrent validity study that includes both a clinical assessment and a laboratory-based exploration of one's endogenous pain modulation. One can investigate endogenous pain modulation using the cold pressor test, which explores an individual's ability to respond to sustained or repeated noxious stimuli locally by either decreasing sensitivity to the stimuli (adaptable) or increasing sensitivity (non-adaptable) [64,67]. If the adaptability and 30% change with the posterior–anterior mobilization are concurrent and strongly associated, it provides initial evidence of a proxy clinical measure for identifying pain adaptability. However, to explore whether this phenomenon is unique to OMT, one needs to go a step further and perform a responder analysis.

Typically, responder analyses are performed concurrently with a parallel, randomized controlled trial, in which patients are randomized to receive the treatment of interest or a comparator. A res ponder's analysis involves identifying the number of responders in the treatment of interest group and comparing them to the number of responders who are in the comparison group [82]. This design assumes a counterfactual comparator. Historically, researchers have identified percent or point change (or some other clinically important designations) as a milestone to identify whether someone was a responder or not. Unfortunately, this method is fraught with error.

The problem with a comparison of responders in parallel trials is that the counterfactual (the supposed comparison person in a parallel, randomized controlled trial) does not truly exist [83]. A crossover trial, a design in which the same patient receives both treatments (a true counterfactual), is the only true way of determining treatment superiority. In this type of trial (Figure 1), patients are randomized to either manual therapy or exercise as the first intervention, followed by a washout phase to remove the effects of that approach, before assessing the second intervention. An *a priori* determination of how strong of a difference between interventions is needed to determine who truly responded to one intervention and not another.

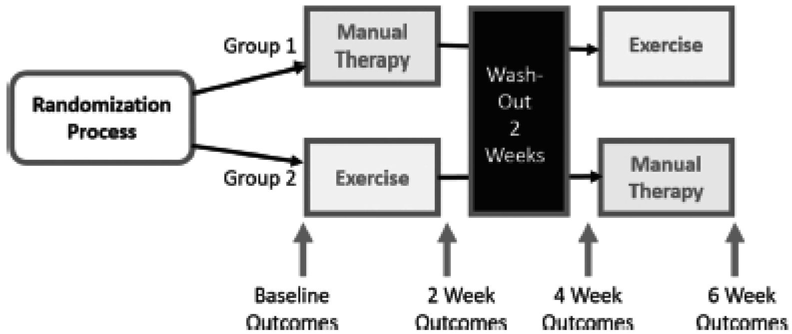

Figure 1. Cross-over trial needed for responder's analyses.

A cross-over trial is extremely difficult to do, and it is especially challenging with musculoskeletal conditions. The greatest change in patient-reported outcomes occurs very early in the care of the patient. Patients assigned to either manual therapy or exercise first will notably change in comparison to those assigned to the interventions second, and it is questionable whether an adequate interventional wash-out can occur. Cross-over trials require careful mathematical adjustments to the data to truly distinguish responders; otherwise, the order effect of the care received is likely the strongest effect that will be identified in the calculations.

Conclusion

We proposed that the likelihood of achieving a positive outcome with an OMT approach depends on the patient having an amenable pain phenotype. We provided evidence that mechanisms associated with an OMT technique are similar across pre-clinical animal and human studies. We identified studies that have characterized pain phenotypes based on treatment response, pain outcomes, and patient characteristics. These findings emphasize the value of patient-specific factors in clinical outcomes. We promote rather than attributing OMT effectiveness to the technique applied clinicians attribute the response to the patient's pain phenotype and therefore modifications to the plan of care should be based on this concept. We proposed two research study designs needed to assess the value of a clinical examination approach toward identifying a pain phenotype construct and then identifying whether OMT leads to unique responses in that specific pain phenotype. Our suggested designs should help control against the well-known moderating and mediating variables of the patient and patient–clinician interactions associated with OMT [11,12]. Further research is needed to verify our suggestions, but we argue that these are the most important questions that require answering for OMT research.

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Chapter 3: Rethinking specificity in Orthopaedic Manual Therapy: It's time for us to move forward

Chapter 3- Introduction:

Manual therapy models have historically applied specific treatment techniques to attempt to correct specific impairments which were discovered during a thorough musculoskeletal exam. This model is flawed in several ways including the lack of ability to identify these impairments consistently, the lack of consistent correlation between impairments identified and pain, and perhaps the most revealing is the lack of specific treatment effects related to OMT. Recent literature supporting the lack of specificity with OMT prompted this blog with the purpose of bringing these findings to light and allowing reflection in a brief and easily accessible viewpoint. This blog was published open access through the Journal of Orthopedic Sports Physical Therapy in June 2022.

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Rethinking specificity in Orthopaedic Manual Therapy: It's time for us to move forward

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You finally did it! After thousands of dollars of continuing education and several months of 'borrowing' your partner's spine, you have finally mastered the elusive C6-C7 right-sided-closing manipulation to improve cervical extension. Your patients will praise your newly developed mastery as your bag of tricks now has techniques to target pain and dysfunction at any region; You will finally be able to hit the right spot. Well done!

Now for the part that you don't want to hear….

Specificity Doesn't Matter…

It is necessary and appropriate to preface this blog with the fact that orthopedic manual therapy (OMT) is a useful tool for clinical pain relief (analgesia) and continues to be recommended by several reviews and guidelines for the management of pain.[2,3] Whereas its clinical utility has been established, the rationale for ***how to apply*** OMT varies significantly across providers, disciplines, and philosophies. One can argue that if you've seen one OMT approach, you've seen one OMT approach.

It has been established that different techniques[1] and different directions of force application (during techniques)[5] do not significantly alter OMT clinical outcomes. More recent literature has identified that the location (specificity) of the technique may also be less important than previously assumed. A review of 6 studies that investigated the benefit of a specifically applied mobilization versus a randomly applied version found little difference in pain outcomes between the two.[9] A recent review of 8 studies found comparable results (no additional clinical benefit with a specifically applied versus a randomly applied technique) with spinal manipulation.[7]

To further derail the theory of OMT specificity, several recent studies on clinically induced pain (via capsaicin) suggest that spinal manipulation away

from the location of pain may be **MORE** effective than a specifically applied version at the level of pain.[4,8,10] Whereas the mechanistic understanding of this phenomenon needs further investigation, the results of these studies suggest spinal manipulation is reliant on a reduction in secondary hyperalgesia (related to central sensitization) versus primary hyperalgesia (related to peripheral sensitization). This current understanding of OMT models supports its use as a tool for clinical analgesia rather than a tool for correcting specific biomechanical faults, realigning vertebra, or adjusting a faulty segment.

The Problem….

Manual Therapy training paradigms often involve a significant amount of focus on a specific application of techniques. Commonly, paradigms are anchored on a series of biomechanical theories and principles, which exist to support the techniques that are affiliated with an approach. However, as aforementioned, the literature suggests that the clinical effect of these techniques is likely not tied to their specificity of application. This understanding begs the question "if the specificity of treatment isn't necessary, do we need the specificity of education"? This gap in knowledge translation has led to a recent editorial questioning the current training paradigm of manual therapy.[6]

The Solution….

When it comes to the role of OMT in the future of physical therapy practice, it does not appear time to throw the baby out with the bathwater. While the evidence is clear that a change in the OMT educational paradigm across philosophies is warranted, this must be done in a manner to promote change in an evidence-based direction. An attempt to reach consensus amongst manual therapy educators at the highest level of our profession would help to identify how these changes should be addressed.

Before the pitchforks are gathered and the torches are lit, I implore the therapists out there who identify as manual therapists to take a moment and reflect. There was a point in time when neurodynamic exercises were 'stretching the nerve'… until they weren't. There was a time when extension exercises helped to 'move the disc' back to the proper position until this was debunked. While the rationale behind why we use certain procedures has changed, the treatments have mostly stood the test of time and continue to be a valued aspect of clinical practice; albeit under different rationalizations. In this same way, this recent evidence does not suggest that the money and time we have invested in OMT training was for naught but rather suggests that the rationale for application must be questioned.

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Key Words: *Specificity, Orthopedic Manual Therapy, Manual Therapy Education*

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Chapter 4: The association between phenotypic variables and treatment effect of orthopaedic manual therapy: A Scoping Review

Chapter 4 - Introduction:

Variables influencing treatment response associated with OMT have been studied in isolation and suggested in previous reviews. To date no review has been conducted investigating the association between these variables and OMT outcomes in a comprehensive and summative manner across all the recommended phenotypic domains. While the breadth of the literature on this topic relates to pharmacological pain management, it is likely that these same phenotypic domains/variables interact with OMT treatment outcomes. Nonetheless, two distinct questions need to be answered: to what degree has this been investigated and what associated strength has been demonstrated? The aim of this scoping review was to identify the association between these pain phenotypic variables and manual therapy pain outcomes.

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The association between phenotypic variables and treatment effect of orthopaedic manual therapy: A Scoping Review

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Abstract:

Orthopedic Manual Therapy (OMT) has demonstrated effectiveness as an analgesic tool however the effects of manual therapy have demonstrated significant variability between individuals with patient specific factors demonstrating more influence on outcomes than specifics of the technique themselves. Pain management guidelines have outlined which specific patient factors (phenotypic variables) psychological, sleep and fatigue, pain characteristics, ability to modulate pain, and response to analgesic challenge have demonstrated the ability to moderate analgesic effect. The aim of this scoping review was to identify the association between pain phenotypic variables and OMT pain outcomes. Five pre-study hypotheses on the strength of association and breadth of literature present on each of the phenotyping variables were developed. Fifty articles were included within the review. We identified none to moderate association between variables and pain outcomes and significant variability in the number of studies performed on each variable. Baseline pain characteristics and analgesic response to OMT challenge demonstrated the strongest association with OMT pain outcomes. Pain phenotyping in OMT has theoretical potential to identify responders, improving precision of OMT application to those who are likely to benefit most; however, further work is necessary to support this assumption. This study supports association between patient specific factors and OMT pain outcomes, and we propose the strength of this relationship when subgrouping (phenotyping) based on these variables would increase this association. Future studies should look to collect phenotypic factors outlined at baseline, and subgroup individuals to allow more precise application of OMT following patient centered care models.

Keywords: Musculoskeletal Manipulations, Manual Therapy, Contextual Factors, Pain Phenotyping

Introduction

Patients with painful musculoskeletal disorders respond differently to efficacious interventions.(Amanzio et al., 2001; Edwards et al., 2016) This is a considerable cause of frustration for clinicians and has been the impetus for the study of pain phenotyping. Pain phenotyping uses patient characteristics and clinical findings to subgroup patient populations that may make them more amenable to a favorable outcome with a precise clinical treatment approach.(Edwards et al., 2016) The concept of 'precise' application of orthopaedic manual therapy (OMT) was historically based on the provider identifying which segments or tissue demonstrate an abnormality, and applying a specific technique to address said abnormality. However, recent clinical trials and reviews on OMT have established that the clinical analgesic response associated with OMT techniques are less reflective of the specifics of the technique(Aquino et al., 2009; Karas et al., 2018; Casper G. Nim et al., 2021; Reed et al., 2018; Slaven et al., 2013) and more reflective of patient factors. (Bialosky et al., 2018; Pasquier et al., 2022) In other words, the reason one sees clinical changes in a patient after the use of OMT is more likely related to the patient's own physical, psychological, and social characteristics, and less to do with the technique selected.

IMMPACT guidelines have outlined the specific patient and clinical characteristics shown to influence outcomes most while organizing these characteristics into several phenotypic domains: 1) psychosocial domain (depression, anxiety, kinesiophobia/fear, catastrophizing, patient expectations), 2) sleep domain (sleep factors and fatigue), 3) initial pain qualities domain (intensity, symptoms duration, variability, sensitivity, irritability), and 4) endogenously driven modifications in pain sensitivity or presentation (quantitative sensory testing, temporal summation, conditioned pain modulation).(Edwards et al., 2016) A patient's early response to analgesic challenge has also been referenced within the IMPAACT guidelines and demonstrates phenotypic value. The summary of these proposed variables and domains are presented in Figure 1.

Understanding the extent that phenotypic variables (a variable that falls within the factors that make up a phenotypic domain) are investigated and what evidence they present in OMT may be a first step toward targeting the correct intervention to the proper patient subtype. The aim of this scoping review was to identify the association between these pain phenotypic variables and manual therapy pain outcomes. We reviewed the current state of the evidence and report the findings based on the following pre-study hypotheses.

1. Psychosocial variables will exhibit consistent medium to strong associations to clinical outcomes associated with OMT treatment in multiple studies.

2. There will be no studies exploring the phenotypic domain of sleep and its association with clinical outcomes associated with OMT treatment.

3. Initial pain quality variables will exhibit inconsistent small to medium associations to clinical outcomes associated with OMT treatment in multiple studies.

4. Pain sensitivity and endogenously driven pain modification variables will consistently exhibit no association with clinical outcomes associated with OMT treatment and will be explored in 10 or fewer studies.

5. Patient response of early pain analgesia when presented with OMT challenge will consistently exhibit small to medium association to clinical outcomes associated with OMT treatment is 10 or fewer studies.

Methods

Protocol and Registration:

This scoping review followed the Preferred Reports Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews checklist.(Tricco et al., 2018) A scoping review format was utilized due to the broad nature of the question being investigated. This study was registered with Open Science Framework prior to data extraction (DOI 10.17605/OSF.IO/ZAYJD).

Eligibility Criteria:

Studies included randomized controlled trials, cohort studies, and case series performed prospectively or retrospectively. This scoping review included both primary and secondary analyses. Reviews were included and were used to screen for additional records. OMT techniques within the scope of physical therapy practice were included (Appendix A). Subjects included patients experiencing pain either with or without underlying primary pain conditions (fibromyalgia etc.) as well as healthy controls. We included studies that analyzed the moderating effect of specific variables outlined by Edwards et al.(Edwards et al., 2016) on OMT pain outcomes. (Figure 1). Moderating variables have been defined as variables measured prior to treatment that interact with a specific intervention and influence an outcome of interest often identified in a randomized clinical trial.(Bialosky et al., 2018)

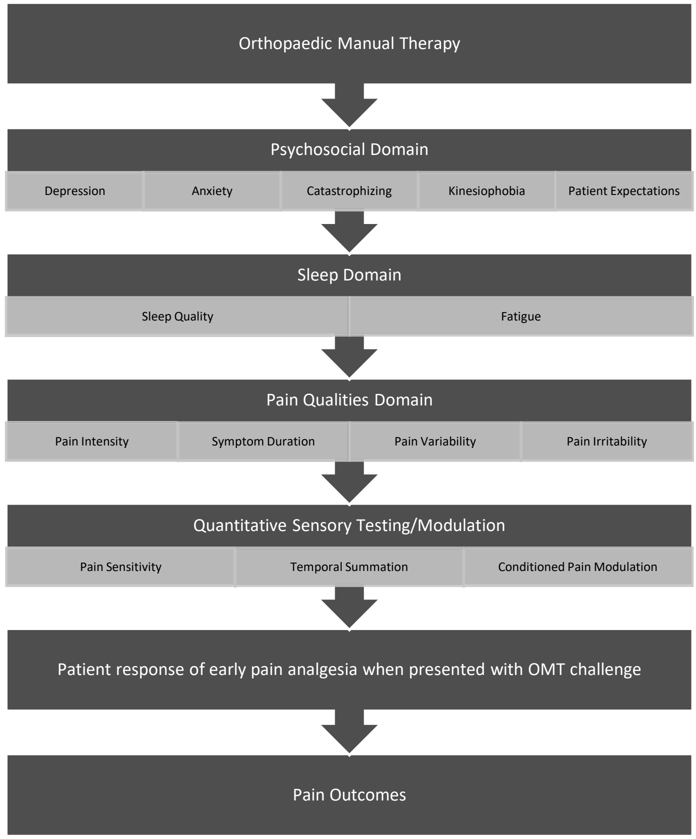

Figure 1: Phenotypic variables influencing analgesic response.

Information Sources:

Four electronic databases were searched including; PubMed, CINAHL, Cochrane Library, and Physiotherapy Evidence Database (PEDro). Studies published from 2005 – February 5, 2021, available in English, and with full text available were included. The search was re-run on November 2, 2022. Studies older than 2005 were excluded due to the progression of knowledge related to the mechanisms of manual therapy. A broad search strategy was applied including the domains that have known influence on analgesic treatments.(Edwards et al., 2016) The comprehensive search strategy is available in Appendix B.

Data Selection:

Two review authors (D.K, D.G) performed title and abstract screenings independently. Inconsistencies between reviewers were resolved by third review author (K.L.). Microsoft Excel

(Microsoft Corporation; version 2211) was utilized to manage and organize the search results throughout the review process.

Data Extraction:

Data were extracted using a self-developed tool that was agreed upon by all reviewers for appropriate variables. The following items were extracted: author, year published, study type, participants, phenotypic domain(s), measurement tool(s), outcome measure(s), and results. Extracted data were reviewed independently by all authors to ensure agreement.

Methodological Quality Appraisal:

Methodological quality appraisal is not recommended for scoping reviews.(Munn et al., 2018; Tricco et al., 2018)

Data Synthesis:

Studies were grouped by phenotypic domains (based on IMMPACT group) and included study type, sample size, measurement tool(s), results, and effect size. When a systematic review was identified, we reviewed references for any additional studies that met inclusion criteria for current review. Full information on study design and measures utilized are available in Appendix C.

Data Analysis:

All studies reporting interaction between phenotypic domains and OMT outcomes were included in data reporting, however only studies reporting measures of association were included in data analysis. Table 1 represents the values used to grade strength of associations based on previous recommendations.(Rosenthal, 1996; Schober et al., 2021; Sharpe, n.d.; Котеров et al., 2019) Reported associative measures were individually graded for strength and a composite score representing the overall strength of association for each domain was calculated with the following formula:

$$\frac{(n1 \times 1) + (n2 \times 2) + (n3 \times 3) + (n4 \times 4)}{n5}$$

n1 = number of measures demonstrating no association: n2 = number of measures demonstrating weak association

n3 = number of measures demonstrating moderate association; n4 = number of measures demonstrating strong association

n5 = total number of associations measured

Table 1: Strengths of Association

Strength of Association	β	r	OR (Inverted OR)	RR (Inverted RR)
Weak	.10	.10	1.5 (.67)	1.2 (.9)
Moderate	.30	.40	2.5 (.40)	1.5 (.7)
Strong	.50	.70	4.0 (.25)	3.0 (.4)

β = Standardized Beta; r = correlation coefficient; OR = Odds Ratio; RR = Relative Risk

Results

Selection of sources of evidence

A total of 1,715 titles were identified after duplicate removal (1426 from original search performed February 5, 2021, 287 from the updated search November 2, 2022, and 3 articles from other sources). After title and abstract screening 485 articles were agreed upon to be reviewed as full text. Kappa coefficients were assessed for agreement between reviewers for title (*k*= .59) and abstract (*k*= .95) screening. Fifty articles assessed the interaction between one or more of the defined variables on OMT outcomes and were included in this review. Thirty-nine of the articles included measures of association and were included in data analysis. A flowchart representing the process for evidence selection is presented in figure 2.

Study Characteristics:

Forty (40) randomized controlled trials and ten cohort studies were included. Twenty-five studies used a prospective design whereas 25 were retrospective. The studies included a total of

8,389 participants ranging from 29 to 1193 per study. Twenty-one studies investigated LBP (n=3,173)(Aspinall et al., 2020; Bialosky et al., 2014, 2009; Mark D Bishop et al., 2011; Burns et al., 2018; Cook et al., 2017, 2012; Cruser et al., 2012; Dissing et al., 2019; Donaldson et al., 2013; Gudavalli et al., 2006; Haas et al., 2014; Hough et al., 2007; Licciardone et al., 2013; Licciardone and Aryal, 2014; Casper Glissmann Nim et al., 2021a, 2021b; Petersen et al., 2015; Thomas et al., 2020; Underwood et al., 2007; Vavrek et al., 2015), 18 studies investigated neck pain (n= 4,244)(Bishop et al., 2013; Castien et al., 2012; Cleland et al., 2007; Groeneweg et al., 2017; Haas et al., 2010; Hill et al., 2007; Jull et al., 2007; Lascurain-Aguirrebeña et al., 2018; Lee et al., 2021; Lopez-Lopez et al., 2015; Palmlöf et al., 2016; Rubinstein et al., 2008; Trott et al., 2014; Tuttle, 2005; Verhagen et al., 2010; Wingbermühle et al., 2021; Yung et al., 2020), 3 studies investigated hip pain (n= 286)(French et al., 2014; Wright et al., 2011, 2010), 3 studies were done on healthy controls (n= 224)(Alonso-Perez et al., 2017; Mark D. Bishop et al., 2011; Wilson et al., 2021), 2 studies were done on shoulder pain (n=151)(Coronado et al., 2015; Riley et al., 2015), 1 on ankle pain (n= 85)(Whitman et al., 2009), 1 on thoracic spine pain (n=107)(Pasquier et al., 2022) and 1 on carpal tunnel syndrome (n= 85)(Fernández-de-las-Peñas et al., 2019).

Summary of findings:

Results are presented in tables 2-6. Significant heterogeneity was present between studies including design, region of pain, OMT technique utilized, pragmatic versus prescriptive nature of technique, outcome measures and associated definition of responder, and statistical analyses. Thirty studies (n= 6,259) investigated the psychosocial domain variables influencing OMT outcomes (table 2). Three studies (n= 1,725) investigated sleep and fatigue variables influencing OMT outcomes (table 3). Twenty-six studies (n= 5,411) investigated pain characteristics influencing OMT outcomes (table 4). Seven studies (n= 623) investigated quantitative sensory testing and pain modulation variables influencing OMT outcomes (table 5). Seven studies (n= 736) investigated early pain reduction when presented with OMT challenge influencing OMT outcomes (table 6). A comprehensive results summary including details on study design, phenotypic measures utilized, outcome measures utilized, and responder criteria are presented in Appendix B.

Psychosocial variables association with OMT pain outcomes:

Association between patient expectations and clinical outcomes was assessed in 12 studies with 26 included measures of association: 5 demonstrating no association, 13 demonstrating weak association, 4 demonstrating moderate association, 4 demonstrating strong association. The association between depression and clinical outcomes was assessed in two studies with a total of five included measures of association: three demonstrating no association, one demonstrating weak association, one demonstrating moderate association, and none demonstrating strong association. The association between kinesiophobia/fear and clinical outcomes was assessed in eight studies with a total of 23 measures of association: 10 demonstrating no association, seven demonstrating weak association, three demonstrating moderate association, three demonstrating strong association. The association between anxiety and clinical outcomes was assessed in two studies with four total measures of association: one demonstrating no association, two demonstrating weak association, one demonstrating moderate association, none demonstrating strong association. The association between catastrophizing and clinical outcomes was assessed in four studies with a total of 13 measures of association: six demonstrating no association, four demonstrating weak association, one demonstrating moderate association, two demonstrating strong association. The association between combined psychological measures was assessed in three studies with three measures on no association, and one measure of weak association identified. Seventy-five measures of association were identified across 20 studies investigating the psychosocial domain: 28 demonstrating no association (37.3%), 28 demonstrating weak association (37.3%), 10 demonstrating moderate association (13.3%), 9 demonstrating strong association (12%) for a composite score of 2.0.

Hypothesis 1: Psychosocial variables will exhibit consistent moderate to strong associations to clinical outcomes associated with OMT treatment in multiple studies. – *Rejected: weak association demonstrated across 20 studies.*

Sleep variables association with OMT pain outcomes:

Two of the three studies investigating sleep variables reported measures of association for a total of three associated measures: none demonstrating no association (0%), two demonstrating weak association (66.6%), one demonstrating moderate association (33.3%), none demonstrating strong association (0%) for a composite score of 2.33.

Hypothesis 2: There will be no studies exploring the phenotypic domain of sleep and its association with clinical outcomes associated with OMT treatment. *Rejected: Weak - moderate association demonstrated across two studies.*

Initial pain quality variables association with OMT pain outcomes:

The association between baseline pain intensity and clinical outcomes was assessed in 17 studies with a total of 32 measures of associations: seven demonstrating no association, five demonstrating weak association, eight demonstrating moderate association, 12 demonstrating strong association. The association between symptom duration and clinical outcomes was assessed in seven studies with a total of 11 measures of association: four demonstrating no association, two demonstrating weak association, none demonstrating moderate association, five demonstrating strong association. The association between pain variability and clinical outcomes was assessed in one study reporting on two measures of association: one demonstrating moderate association, one demonstrating strong association. In total the pain qualities domain included 45 associative measures across 20 studies: 11 demonstrating no association (24.4%), seven demonstrating weak association (15.6%), nine demonstrating moderate association (20%), 18 demonstrating strong association (40%) for a composite score of 2.76.

Hypothesis 3: Initial pain quality variables will exhibit inconsistent weak to moderate associations to clinical outcomes associated with OMT treatment in multiple studies. – *Accepted: weak-moderate association demonstrated across 20 studies.*

Pain sensitivity and endogenous driven pain modulation variables association with OMT pain outcomes:

The association between baseline pain sensitivity and clinical outcomes was assessed in two studies with three measures of association: one demonstrating no association (33.3%), two demonstrating weak association (66.6%), none demonstrating moderate association (0%), none demonstrating strong association (0%) for a composite score of 1.67. No studies were identified reporting association between pain outcomes and baseline pain modulation.

Hypothesis 4:* Pain sensitivity and endogenously driven pain modification variables will consistently exhibit no association with clinical outcomes associated with OMT treatment and will be explored in 10 or fewer studies. – *Rejected: none-weak association demonstrated across two studies.

Pain response to OMT challenges association with clinical outcomes associated with OMT:

The association between early response to OMT challenge and clinical outcomes was assessed in seven studies with 13 measures of association: three demonstrating no association (23.1%), four demonstrating weak association (30.8%), one demonstrating moderate association (8.7%), five demonstrating strong association (38.5%) for a composite score of 2.62.

Hypothesis 5: Patient response of early pain analgesia when presented with OMT challenge will consistently exhibit weak to moderate association to clinical outcomes associated with OMT treatment is 10 or fewer studies. – ***Accepted: weak-moderate association demonstrated across seven studies.***

Discussion

This study aimed to identify the association between variables that have shown phenotypic value and manual therapy pain outcomes. We assessed five hypotheses regarding the breadth of literature available and the strength of association. The strongest association was demonstrated between baseline pain characteristics and OMT outcomes, followed by OMT response of early pain analgesia with OMT challenge, and sleep/fatigue variables- all demonstrating weak to moderate association. Psychosocial factors demonstrated weak association with outcomes and pain sensitivity demonstrated weak to no association with outcomes.

The mechanisms behind OMT analgesia are understudied with significant gaps within the literature including lack of translational research defining which mechanisms correlate most with clinical outcomes. While this review makes it apparent that patient specific factors moderate analgesic response, the mechanism behind their relationship is not well established. Proposed mechanisms of OMT analgesia including placebo,(Rossettini et al., 2020, 2018; Testa and Rossettini, 2016) conditioned pain modulation,(Klyne et al., 2018) and inflammatory marker modulation(Edwards et al., 2008; Heffner et al., 2011; Lazaridou et al., 2018) have all demonstrated influence from variables included within this review. Future mechanistic works should investigate the effect that these phenotypic variables have on specific mechanistic OMT responses as well as attempt to correlate with clinical response.

Within-session and between-session improvements in pain that are present in some individuals and not others when the same technique is applied may represent the ability of a patient to adapt to pain, termed pain adaptability.(Wan et al., 2018; Zheng et al., 2014) This has previously been proposed as a clinical phenotype in OMT response.(Keter et al., 2022) Within-session pain adaptability demonstrated conflicting value however favorable reduction in pain within the first two sessions and furthermore within the first two weeks demonstrated value in identifying positive response to OMT in the medium and long term. These findings are in disagreement with a recent review that found no prognostic value for within and between session changes and pain outcomes however that review only included within first session and prior to second session response therefore the most significant findings from this review (within first 2 weeks) were not included within that review.(Runge et al., 2020)

While this review looked at phenotypic domains as a whole, it is clear that certain individual factors within each domain have different associations with outcomes. This is evident within the psychosocial domain: factors including depression and kinesiophobia trend towards weak to no association while expectations of outcomes trends towards weak to moderate association. Future research should look at breaking down these domains into individual variables to identify those that demonstrate the strongest association with OMT pain outcomes. While these associations were not large and were largely understudied across several of the domains, findings from this review implicate the importance of measures from all defined phenotypic domains on pain outcomes.

Clinical implications:

Clinicians should consider psychological characteristics including patients' expectations, reported fatigue, baseline pain characteristics including pain intensity and symptom duration, and patients' clinical response within and between session in their clinical decision-making process; however, the direction and strength of these relationships is thus far understudied and outside the scope of this review. Care should be taken to not utilize these factors in isolation but rather as part of a thorough musculoskeletal examination. Manual therapy training should emphasize the patient specific factors moderating treatment outcomes as much as they emphasize the technique specifics itself. A recent international Delphi on advanced manual therapy education identified this as an important area of focus within OMT education.(Keter et al., 2023)

Research implications:

None of the included studies attempted to subgroup based on these phenotypic factors but rather looked at these factors in isolation. Several studies utilized multiple logistic regression; however, these studies did not attempt to subgroup to find best fit based on findings. Future studies should use psychometrically sound measures to assess factors across all recommended phenotypic domains(Edwards et al., 2016) and utilize cluster or latent class analysis to subgroup in an attempt to identify responders. Measures such as the Patient Reported Outcomes Measurement Information System (PROMIS) may be useful as it assessed multiple domains reported on within this review.

Most excluded studies did not perform prognostic or associative analysis however obtained baseline measures to assess for homogeneity between treatment arms. These authors have potential to perform secondary analyses to assess for difference in these factors between responders and non-responders. Future reviews assessing within and between session responses should include between session responses up to two weeks as these have demonstrated preliminary value in identifying responders. Future body-region specific clinical practice guidelines should look to grade the evidence on these factors influencing outcomes with both OMT and non-OMT interventions.

Limitations:

Significant heterogeneity between region of pain, chronicity of symptoms, and manual therapy interventions performed limit the generalizability of the results. Furthermore, statistical heterogeneity including outcomes utilized, criteria for responder status, and type of analyses utilized (correlative, associative, prognostic) limit the ability for future studies to perform cumulative analyses. Most of the studies with several treatment arms (RCT) did not differentiate the prognostic or associative values of these phenotypic predictors between groups. While included studies looked at individuals' phenotypic factors, they did not attempt to phenotype based on these factors and did not look for clusters/trends amongst these factors. Limited sample size led to several underpowered studies questioning significance of the proposed relationships and furthermore this study did not exclude studies that did not demonstrate statistical significance.

Conclusion:

Selected phenotypic domains demonstrate association with OMT pain outcomes and we propose the strength of this relationship when subgrouping (phenotyping) based on these variables would likely increase this association. This review tested five hypotheses regarding the strength of association and the number of studies that have investigated the recommended domains. We identified overall none to moderate association between these domains and pain outcomes and significant variability in the number of studies performed in each of the domains of interest. Clear evidence suggests measures of pain modulation and sleep/fatigue were the most understudied domains. Pain phenotyping in OMT has theoretical potential to identify responders, which should improve the precision of OMT application to those who are likely to benefit most; however, further work is necessary to support this assumption. Future studies should look to collect phenotypic factors outlined at baseline, and subgroup individuals to allow more precise application of OMT following patient centered care models.

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Conflict of Interest Disclosures:
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Figure 2: Selection of sources of evidence

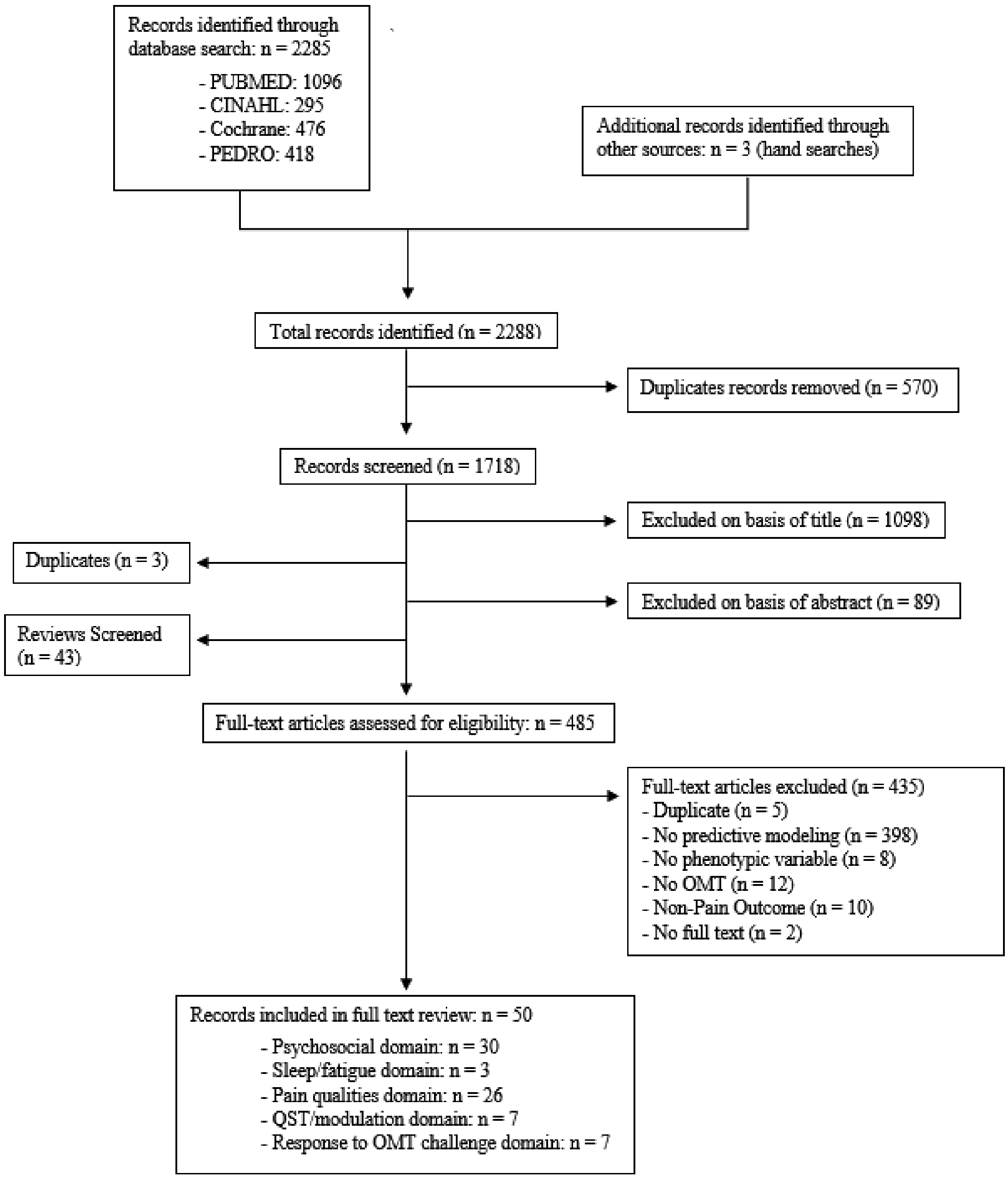

Table 2: Association between psychological domain variables and OMT pain outcomes

Reference, First Author, Date	Sample Size/ Population	Results	Strength of Association			
		Patient Expectations	None	Weak	Mod	Strong
Bialosky et al. 2014	n = 110; LBP	Interaction was not observed for expectations and immediate change in suprathreshold heat response (F(2,107)=0.32, p =0.73, partial eta2= 0.01)				
		Interaction was not observed for expectations and change in LBP (F(2,104)=0.76, p =0.47, partial eta2= 0.01)				
Bishop et al. 2011	n =112 ; LBP	Univariate association between the specific expectation for SMT and a successful outcome was not significant (p >.05, 0.06)		x		
		Weak association between having expectations met (regardless of group) and successful outcome at visit 5 (x2= 11.9, p >.05, 0.07)		x		
Bishop et al. 2013	n = 140; neck pain	Unsure expectations of pain relief lowered odds of reporting a successful outcome vs expecting complete relief (OR = 0.33) at 1-month.			x	
		Unsure expectations of pain relief lowered the odds of success (OR = 0.19) at 6-months after treatment		x		
		Believing that manipulation would help and not receiving manipulation lowered the odds of success (OR = 0.16) vs believing manipulation would help and receiving manipulation.		x		
		Patients who believed manipulation would help and received manipulation reported less disability (NDI) than those who did not believe manipulation would help and both received manipulation (mean difference, –3.8; p = .006) and did not receive manipulation (mean difference, –5.7; p = .014).				
Cruser et al. 2012	n = 63; LBP	Pearson correlation coefficient analysis - no significant relationships between overall improvement, patient satisfaction and expectations				
Dissing et al. 2019	n = 238; spine pain	Positive expectations of recovery (β =-.64) with NPRS change (p = .33)				x
		Negative expectations of recovery (β =.87) with NPRS change (p = .33)				x
		Positive expectations of recovery (OR .38) with Global Perceived effect (p = .93)	x			
		Negative expectations of recovery (OR .33) with Global Perceived effect (p = .93)	x			
Donaldson et al. 2013	n = 149; LBP	Matching patient expectations to treatment numeric pain score (mean change 3.2) Not matching treatment to expectations numeric pain score (mean change 3.6) (p = .22)				
Groeneweg et al. 2017	n= 181; neck pain	Baseline Expectations on NPRS at 7 weeks β = .13 (p.009) and 26 weeks β = .16 (p =.006)		x*		
		Baseline Expectations on NPRS at 26 weeks β = .16 (p =.006)		x*		
Haas et al. 2010	n = 80; cervicogenic headache	Baseline expectations on pain intensity at 4 weeks (β =-.15)		x		
		Expectations at 4 weeks on pain intensity at 8 weeks (β =.06)				
		Expectations at 8 weeks on pain intensity at 12 weeks (β =.10)		x		
Haas et al. 2014	n = 400; cLBP	Expectations- Baseline correlation with LBP-6 weeks (r =.07) and LBP- 12 weeks (r =.07)	x			
Hill et al. 2007	n= 350; neck pain	Low Expectations: OR 3.24 (for poor outcomes) for global change at 6 weeks			x*	
		Low Expectations: OR 4.66 (for poor outcomes) for global change at 6 months				x***
		Low Expectations: OR 2.29 (for poor outcomes) for NPQ at 6 weeks:		x*		
		Low Expectations: Not significant for NPQ at 6 months				
Palmlof et al. 2016	n = 697; neck pain +/- LBP	Moderate (Rating 4-6) expectations of recovery at baseline (RR 1.28) of recovery at 7 weeks as compared with low expectations (Rating 0-3)		x		
		High (Rating 7-10) expectations of recovery at baseline (RR 1.64) of recovery at 7 weeks as compared with low expectations (Rating 0-3)			x	
Pasquier et al. 2022	n = 107; thoracic pain	Expectations in improvement in disability OR 1.62 (p = .026) for pain score at 7 days post SMT.		x*		
Petersen et al. 2015	n = 175; cLBP	Expectation: Both Individuals with high expectations and low expectations of recovery had a 57% success rate with SMT.				
Riley et al. 2015	n = 88; shoulder pain	No statistically significant interaction between expectations and SPADI (p =.713), least pain (p =.192), most Pain (p =.457), and average Pain (p =.114)	x			
Rubinstein et al. 2008	n = 424; neck pain	Expectations on pain outcomes at 12 months: β = .44 (p = .005)				x**
Thomas et al. 2020	n = 108; cLBP	Treatment expectancy scores correlation with NPRS change score: Combined groups- (r = −0.396)		x**		
		Treatment expectancy scores correlation with NPRS change score: Individual Groups- Spinal manipulation (r = − 0.42; p = .002)			x**	
		Treatment expectancy scores correlation with NPRS change score: Individual Groups- Spinal mobilization (r = −0.19; p = .18)		x		
Underwood et al. 2007	n = 273; LBP	Expectations: Helpful: β = .0 (p =.67) at 3 months; β = -.1 (p =.08) at 12 months				

		Expectations: Very helpful: β =1.6 (p =.113) at 3 months; β =1.2 (p =.25) at 12 months				
		Depression	None	Weak	Mod	Strong
Alonso-Perez et al., 2017	n = 74; healthy controls	No significant psychological interaction between baseline depression and outcomes				
Hill et al. 2007	n =350; neck pain	Lower clinical depression: Not significant for any outcome at 6 weeks:	x			
		Lower clinical depression: OR .70 for global change at 6 months	x**			
		Lower clinical depression: OR .71 for NPQ at 6 months.	x**			
Lee et al. 2021	n = 108; neck pain	No significant interaction between differences in pain outcomes and Depression at baseline (p = .79)				
Licciardone et al. 2014	n = 186; cLBP	Diagnosis of comorbid depression absent (RR 1.31) for positive initial response.		x		
		Diagnosis of comorbid depression present (RR 2.46) for positive initial response.			x	
		Kinesiophobia/Fear	None	Weak	Mod	Strong
Alonso-Perez et al., 2017	n = 74; healthy controls	No significant psychological interaction between baseline kinesiophobia and outcomes				
Bialosky et al. 2009	n = 63; LBP	Baseline kinesiophobia and changes in pain sensitivity (47°C; r = -.39; p = .24)(49°C; r = -.40; p = .22)		x		
		Baseline kinesiophobia and changes in temporal summation (r = .08; p = .83)	x			
Bishop et al. 2011 (2)	n = 90 healthy controls	Association between kinesiophobia and PPT: .13		x		
		Association between kinesiophobia and temporal summation: - .07	x			
Cleland et al. 2007	n = 78; neck pain	FABQPA <12: OR 4.30 in identifying responder at discharge				x
		FABQW < 10: OR 2.76 in identifying responder at discharge			x	
Groeneweg et al. 2017	n = 181; neck pain	FABQPA on NPRS at 7 weeks β = - .03 (p =.29)	x			
		FABQPA on NPRS at 26 weeks β = - .07 (p =.06)	x			
		FABQW on NPRS at 7 weeks β = - .017 (p =.98)	x			
		FABQW on NPRS at 26 weeks β = - .026 (p =.12)	x			
Hill et al. 2007	n = 350; neck pain	Fear Avoidance 'most of the time': OR for poor outcomes 2.05 (p<.1) for global change at 6 weeks		x		
		Fear Avoidance 'most of the time': OR for poor outcomes 2.51 for global change at 6 months			x*	
		Fear Avoidance 'most of the time': OR 1.54 for NPQ at 6 weeks		x		
		Fear Avoidance 'most of the time': OR for poor outcomes 2.47 for NPQ at 6 months		x*		
		Fear Avoidance 'some of the time': OR 1.47 for global change at 6 weeks	x			
		Fear Avoidance 'some of the time': OR 1.28 for global change at 6 months	x			
		Fear Avoidance 'some of the time': OR for poor outcomes 1.82 for NPQ at 6 weeks		x*		
		Fear Avoidance 'some of the time': OR for poor outcomes 1.50 (p<.1) for NPQ at 6 months		x		
Lopez-Lopez et al. 2015	n = 48; neck pain	No association between kinesiophobia and pain outcomes				
Rubinstein et al. 2008	n = 424; neck pain	Kinesiophobia X2 = 23.4 with neck pain intensity			x*	
Underwood et al. 2007	n = 273; LBP	FABQ Beliefs β =-.8 for outcomes at 3 months (p =.070)				x
		FABQ Beliefs β =-.4 for outcomes at 12 months (p =.33)				x
Verhagen et al. 2010	n= 397; neck pain	Kinesiophobia OR: 1.08 (p = .0015) on outcomes at 6 months	x*			
Wingbermühle et al 2021	n = 1193; neck pain	FABQ PA no correlation with pain, no correlation with pain or perceived improvement at 1 year. (p< .157)				
		FABQ PA coefficient with perceived improvement = .04 at discharge	x			
		Anxiety	None	Weak	Mod	Strong
Alonso-Perez et al., 2017	n = 74 healthy controls	No significant psychological interaction between baseline anxiety and outcomes				
Aspinall et al. 2020	n = 80; LBP	Anxiety (PROMIS-Anxiety) mean (53.63) in rapid responder group; mean (53.72) in non-rapid responder group				
Bialosky et al. 2009	n = 63; LBP	State anxiety (r = -.62, p =.04) with changes in pain sensitivity in the lower extremity in participants who received SMT			x*	
		State anxiety (r = .06, p =.87) with changes in temporal summation in participants who received SMT	x			

Bishop et al. 2011 (2)	n = 90; healthy controls	Association between anxiety and change in PPT = .20		x		
		Association between anxiety and change in temporal summation = -.18		x		
Lopez-Lopez et al. 2015	n = 48; neck pain	Individuals with low anxiety at baseline showed larger Mean difference in pain intensity in Thrust Manipulation (Mean Diff 4.71, p <.01) and SNAG (Mean Diff 2.26, p<.01) groups than PA Mobilization group (Mean Diff .37)				
		Individuals with baseline High Anxiety showed larger Mean difference in pain intensity in PA Mobilization group (Mean Diff 2.72, p <.001) than SNAG (Mean Diff .63) and Thrust manipulation groups (Mean Diff 1.03)				
Whitman et al. 2009	n = 85; ankle pain post sprain	Individuals with successful outcomes had lower baseline anxiety (mean 6.6) versus those whom did not have a successful outcome (mean 7.1) (p =.56)				
		Catastrophizing	None	Weak	Mod	Strong
Alonso-Perez et al., 2017	n = 74 healthy controls	Catastrophizing interacted with change in local PPT only in the HVLA group: (F = 3.70, p = .03)				
Aspinall et al. 2020	n = 80; LBP	Catastrophizing mean (12.74) in rapid responder group; mean (14.96) in non-rapid responder group				
Bialosky et al. 2009	n = 63; LBP	Pain catastrophizing (r = - .67, P =.02) was significantly associated with changes in pain sensitivity in the lower extremity in participants who received SMT			x*	
		Baseline catastrophizing and changes in temporal summation (r = .32; p = .34)		x		
Bishop et al. 2011 (2)	n = 90; healthy controls	Association between catastrophizing and PPT: .09	x			
		Association between catastrophizing and temporal summation: - .06	x			
Hill et al. 2007	n = 350; neck pain	Catastrophizing 'some of the time': OR 1.37 for poor outcomes on global change at 6 weeks	x			
		Catastrophizing 'some of the time': OR 1.33 for poor outcomes on global change at 6 months	x			
		Catastrophizing 'some of the time': OR 1.25 for poor outcomes on NPQ at 6 weeks	x			
		Catastrophizing 'some of the time': OR 1.52 for poor outcomes on NPQ at 6 months		x		
		Catastrophizing 'most of the time': OR 2.25 for poor outcomes on global change at 6 weeks		x*		
		Catastrophizing 'most of the time': OR 7.43 for poor outcomes on global change at 6 months				x***
		Catastrophizing 'most of the time': OR 1.85 for poor outcomes on NPQ at 6 weeks		x*		
		Catastrophizing 'most of the time': OR 4.01 for poor outcomes on NPQ at 6 months				x***
Lopez-Lopez et al. 2015	n = 48; neck pain	No association between catastrophizing and pain outcomes				
Verhagen et al. 2010	n= 397; neck pain	Catastrophizing OR: 1.04 (p<.0001) on outcomes at 6 months	x***			
		Combined Psychological Measures	None	Weak	Mod	Strong
French et al. 2014	n = 123 (9 wks) and n =112 (18 wks); hip pain	HADS (.91 OR) for response at 9 weeks	x			
		HADS (.95 OR) for response at 18 weeks	x			
Hough et al. 2007	n = 39; LBP	Low Linton & Hallden Score (<106) β =-8.5 (p = .41) with pain at 4 weeks				
Rubinstein et al. 2008	n = 424; neck pain	Concordant Depression/Fear X2 =16.0 with neck pain intensity		x*		
Wingbermühle et al 2021	n = 1193; neck pain	Anxiety/Depression: OR 1.05 predicting recovery from neck pain post treatment	x			
		Anxiety/Depression: no significant interaction with perceived improvement (p> .157)				

cLBP= Chronic Low Back Pain
FABQPA= Fear Avoidance Beliefs Questionnaire-Physical Activity
FABQPA= Fear Avoidance Beliefs Questionnaire-Work
HADS= Hospital Anxiety and Depression Scale
HVLA= High Velocity Low Amplitude
LBP= Low Back Pain
NPQ= Neurophysiology of Pain Questionnaire
NPRS= Numeric Pain Rating Scale
OR= Odds Ratio
PPT= Pain Pressure Threshold
RR= Relative Risk
SMT= Spinal Manipulative Therapy
SNAG= Sustained Natural Apophyseal Glide
SPADI= Shoulder Pain and Disability Index

Table 3: Association between sleep/fatigue domain variables and OMT pain outcomes

Reference, First Author, Date	Sample Size/ Population	Results	Strength of Association			
		Sleep/Fatigue	None	Weak	Mod	Strong
Lee et al. 2021	n = 108; neck pain	No significant interaction between differences in pain outcomes and trouble sleeping due to pain (p = .27)				
		Significant interaction between differences in pain outcomes favoring MT group for pain at baseline that worsens during fatigue (p = .03)				
Rubinstein et al. 2008	n = 424; neck pain	Tiredness on NPRS β = .39			x***	
Wingbermühle et al. 2021	n = 1193; neck pain	Sleeping problems demonstrated no significant interaction with perceived improvement or pain (p> .157) at 1 year				
		Sleeping problems OR.62 with recovery of neck pain (p< .157)		x		
		Sleeping problems OR .67 with perceived improvement (p< .157)		x		

NPRS = Numeric Pain Rating Scale

Table 4: Association between pain characteristics domain variables and OMT pain outcomes

Reference, First Author, Date	Sample Size/ Population	Results	Strength of Association			
		Baseline Pain Intensity	None	Weak	Mod	Strong
Aspinall et al. 2020	n = 80; LBP	Baseline pain intensity (NPRS): mean (3.0) in rapid responder group; mean (2.0) in non-rapid responder group				
Burns et al. 2018	n = 90; LBP	Baseline pain intensity (NPRS) of 4 point or less (OR 4.99) in identifying recovery				x**
Castien et al. 2012	n = 142; tension type headaches	Baseline headache intensity (NPRS) OR: 1.36 for 8-week outcomes (95% CI 1.05–1.78)	x			
Dissing et al. 2019	n = 238; spine pain	Baseline pain intensity (NPRS) < 7 (β =-.05) with NPRS Change at 2 weeks (p = .82)	x			
		Baseline pain intensity (NPRS) >7 (β =.22) with NPRS Change at 2 weeks (p = .82)		x		
		Baseline pain intensity (NPRS) < 7 (OR .46) with Global Perceived effect at 2 weeks (p = .90)			x	
		Baseline pain intensity (NPRS) >7 (OR .40) with Global Perceived effect at 2 weeks (p = .90)			x	
Fernandez-de-las-Peñas et al. 2019	n = 120; carpal tunnel syndrome	Baseline pain intensity (NPRS) β =.63 for pain intensity at 6 months				x
		Baseline pain intensity (NPRS) β =.66 for pain intensity at 12 months				x
French et al. 2014	n = 123 (9 weeks) and n =112 (18 weeks); hip pain	Baseline pain intensity (NPRS) (.85 OR) for response at 9 weeks	x			
		Baseline pain intensity (NPRS) (.89 OR) for response at 18 weeks	x			
Groeneweg et al. 2017	n= 181; neck pain	Baseline pain intensity (NPRS) on NPRS at 7 weeks β = .26 (p = .017)		x*		
		Baseline pain intensity (NPRS) on NPRS at 26 weeks β = .31 (p =.009)			x**	
Haas et al. 2010	n = 80; chronic cervicogenic headache	Baseline pain intensity (mVKPS) on pain intensity at 4 weeks (β =-.54)				x
		Baseline pain intensity (mVKPS) on pain intensity at 8 weeks (β =-.50)				x
		Baseline pain intensity (mVKPS) on pain intensity at 12 weeks (β = -.57)				x
Haas et al. 2014	n = 400; cLBP	Baseline pain intensity (mVKPS) correlation with LBP-6 weeks (r =.44)				x*
		Baseline pain intensity (mVKPS) correlation with LBP-12 weeks (r =.41)				x*
Hill et al. 2007	n=350; neck pain	Severe baseline pain (9-10 NPRS): OR 2.81 for 6-week global change			x*	
		Severe baseline pain (9-10 NPRS): OR 3.58 for 6-month global change			x**	
		Severe baseline pain (9-10 NPRS): OR 3.52 for 6-month NPQ			x*	
Hough et al. 2007	n = 39; LBP	Baseline pain intensity (VAS) β =.28 (p = .09) with pain at 4 weeks		x		
Lascurain-Aguirrebena et al. 2018	n = 40; neck pain	Maximum baseline pain intensity (NPRS) on within session GROC: < 7 (OR 2.16)		x		
		Maximum baseline pain intensity (NPRS) on within session GROC: > 7 (OR 20.52)				x
		Average baseline pain intensity (NPRS) on within session GROC; < 5 (OR 15.00)				x
		Average baseline pain intensity (NPRS) on within session GROC; > 5 (OR 9.38)				x
Lee et al. 2021	n = 108; neck pain	No significant interaction between differences in pain outcomes at 2 weeks and pain intensity at baseline (NPRS) (p =.78)				
Licciardone et al. 2013	n = 455; cLBP	Low baseline Pain (<50 mm VAS) RR (1.15) (p =.29) on >50% reduction VAS score at 12 weeks	x			
		High baseline Pain (>50 mm VAS) RR (2.04) (p =.02) on >50% reduction VAS score at 12 weeks			x*	
Petersen et al. 2015	n = 175; cLBP	Mild LBP at baseline (measure not specified) had 63% success rate with SMT; moderate to severe had a 52% success rate with SMT				
Vavrek et al. 2015	n = 91; low back pain	Baseline pain intensity (mVKPS) OR .64 for identifying responders		x*		
Verhagen et al. 2010	n= 397; neck pain	Severity of pain past week OR: 1.25 (p =.0005) on outcomes at 6 months	x***			
Whitman et al. 2009	n = 85; ankle pain	Individuals with successful outcomes had slightly higher baseline average pain (NPRS) (mean 4.0) versus those who did not have a successful outcome (mean 3.9) (p =.79)				
Wingbermühle et al 2021	n = 1193; neck pain	Baseline pain intensity OR for recovery from neck pain post treatment 1.21; at 1 year 1.14 (p< .157)	x			
		No association with perceived improvement at discharge or at 1 year. (p< .157)				
Wright et al. 2011	n = 93; hip OA	Baseline pain intensity (NPRS) >6/10: OR 7.25 in identifying responders post 9 sessions				x
Yung et al. 2020	n=43; non-chronic neck pain	Average pain intensity (NPRS) at baseline predictive coefficient in determining averaged pain reduction .453 (p = .002)			x**	
		Pain Duration	None	Weak	Mod	Strong

Cleland et al. 2007	n = 78; neck pain	Symptom duration <30 days: OR 9.40 in identifying responder at discharge				x
Gattie et al. 2021	n = 77; neck pain	Duration of symptoms on current pain at 4 weeks: (β = .01; p = .14)	x			
		Duration of symptoms on average pain over 24 hours at 4 weeks (β = .10; p = .14)	x			
		Duration of symptoms on GROC at 4 weeks (β = –.01; p = .32)	x			
Hill et al. 2007	n=350; neck pain	Pain Duration > 3 months: OR 1.94 for 6-week poor outcomes global change		x*		
		Pain Duration > 3 months: OR 2.23 for 6-month poor outcomes global change		x**		
Hough et al. 2007	n = 39; LBP	Baseline Pain Chronicity β =-.03 (p = .65) with pain at 4 weeks	x			
Lascurain-Aguirrebena et al. 2018	n = 40; neck pain	Duration of symptoms on within session GROC: Acute: OR 23.97				x
		Duration of symptoms on within session GROC: Chronic: OR 11.28				x
Lee et al. 2021(Lee et al., 2021)	n = 108; neck pain	No significant interaction between pain outcomes at 2 weeks and chronicity of symptoms (p = .88)				
Rubinstein et al. 2008	n = 424; neck pain	Number of days with neck pain in the preceding year X2 = 84.2 with neck pain intensity				x
Whitman et al. 2009	n = 85; ankle pain	Individuals with successful outcomes had a shorter duration of symptoms at baseline (mean 22.0) versus those who did not have successful outcomes (mean 23.1) (p = .92)				
Wright et al. 2011	n = 93; hip pain	Duration of symptoms <1-year: OR 6.68 in identifying responders post 9 sessions				x
		Pain Variability	None	Weak	Mod	Strong
Gudavali et al. 2006	n = 123 with cLBP	Patients with non-variable (constant) LBP had larger improvement in VAS (n= 91, Mean 23.75) vs patients with variable (recurrent) LBP (n= 17, Mean 16.85)				
Lee et al. 2021	n = 108 with neck pain	No significant interaction between differences in pain outcomes at 2 weeks and pain variability(self-reported) throughout the day (p = .26),				
Wingbermühle et al 2021	n = 1193 with neck pain	Constant pain OR .03 with pain and .07 with perceived improvement post treatment (p< .157)				x
		Constant pain OR .28 with pain and .25 with perceived improvement at 1 year (p< .157)			x	

cLBP = Chronic Low Back Pain
GROC= Global Rating of Change
mVKPS- Modified Von Korff pain scale
NPQ= Neurophysiology of Pain Questionnaire
NPRS= Numeric Pain Rating Scale
OA= Osteoarthritis
OR= Odds Ratio
RR= Relative Risk
VAS= Visual Analog Scale

Table 5: Association between pain sensitivity and endogenously driven pain modification domain variables and OMT pain outcomes

Reference, First Author, Date	**Sample Size/ Population**	**Results**	**Strength of Association**			
		Pain Sensitivity	None	Weak	Mod	Strong
Aspinall et al. 2020	n = 80; LBP	Local PPT mean (4.30) in rapid responder group; mean (4.14) in non-rapid responder group				
		Remote PPT (UE/LE); mean (3.54/2.37) in rapid responder group; mean (3.85/2.55) in non-rapid responder group				
Coronado et al. 2015	n = 63; shoulder pain	Correlation between local PPT and 12-week pain outcomes r =-.12	x			
Fernandez-de-las-Peñas et al. 2019	n = 120; carpal tunnel syndrome	Baseline PPT over Carpal Tunnel β =.23 for mean Pain Intensity at 6 months		x		
		Baseline PPT over Carpal Tunnel β =.27 for mean Pain Intensity at 12 months		x		
Jull et al. 2007	n = 36; neck pain	Normal sensory features at baseline mean change score NPI = 8.5(±13.4) Abnormal PPT at baseline mean change score NPI = 15.3 (±13.4) *Baseline NPI scores were higher in Abnormal PPT group (mean 41.0) vs normal sensory feature group (mean 33.8)				
Nim et al. 2021	n = 132; chronic LBP	Baseline PPT was not statistically significantly different between any of the responder thresholds				
Nim et al. 2021(2)	n = 132; chronic LBP	NPRS change score within session: between-group difference between sensitized and non-sensitized groups = -.16 NPRS change score between session: between-group difference between sensitized and non-sensitized groups = -.21				

Conditioned Pain Modulation			None	Weak	Mod	Strong
Wilson et al. 2021	n = 60 healthy controls with trigger points identified in upper trap musculature	Individuals with efficient CPM at baseline who received pain inducing massage displayed greater increases in pressure pain threshold (mean difference = 20.33 compared to individuals with a less efficient CPM mean difference = 4.90)				

LBP= Low Back Pain
NPI= Neck Pain Index
PPT= Pain Pressure Threshold
CPM= Conditioned Pain Modulation

Table 6: Association between early pain analgesia with OMT challenge and OMT pain outcomes

Reference, First Author, Date	Sample Size/ Population	Results	Strength of Association			
		Response of early pain analgesia when presented with OMT challenge	None	Weak	Mod	Strong
Cook et al. 2012	n = 100; LBP	Correlation between within/between session findings and pain change score: r =.51			x**	
		Correlation between within/between session findings and perceived recovery: r = -.01 (p<.96)	x			
Cook et al. 2017	n = 63; LBP	OR: 6.98 (p =.024; R2 =.183) in identifying > 5 on GROC at 6 months if ≥33% pain reduction by 2 weeks				x*
		OR: 5.98 (p = .008; R2 = .201) if ≥50% pain reduction at 2 weeks				x**
		OR: 1.94 (p =.27; R2 =.052) in identifying > 5 on GROC at 6 months if ≥33% pain reduction by 2 weeks		x		
		OR: 2.39 (p = .11; R2 = .074) if ≥50% pain reduction at 2 weeks		x		
Licciardone et al. 2014	n = 186; cLBP	Early clinical response to OMT (within and between 1 session) OR 4.96 of predicting clinical response at 12 weeks				x
		Early clinical response to sham OMT (within and between 1 session) OR 18.71 of predicting clinical response at 12 weeks				x
Pasquier et al. 2022	n = 107; thoracic pain	Within session pain reduction >30% OR 1.38 (p = .04) on pain outcomes at 7 days post SMT.	x*			
Trott et al. 2014	n = 181; neck pain	Session 1 within session change in pain independently associated (β = 0.2) with the perceived effects of treatment at 3 months after controlling for covariates.		x		
Tuttle et al. 2005	n= 29; neck pain	OR: 4.5 in identifying between sessions reduction in pain if within session reduction in pain				x
Wright et al. 2010	n = 70; hip OA	Correlation of sustained within session change with 12-week GROC r = .06 (p = .69)	x			
		Correlation of sustained within session change with 12-week WOMAC Pain r = .21 (p = .15)		x		

cLBP= Chronic Low back Pain
GROC= Global Rating of Change
LBP= Low Back Pain
OA= Osteoarthritis
OR= Odds Ratio
SMT= Spinal Manipulative Therapy
WOMAC= Western Ontario and McMaster Universities Osteoarthritis Index

Chapter 4- References:

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Chapter 5: Priorities in updating training paradigms in orthopedic manual therapy: an international Delphi study

Chapter 5

Introduction:

Evolution in the understanding of manual therapy promotes change within how manual therapy must be taught to future cohorts and how it is applied. While many manual therapy philosophies have demonstrated a change in their teaching to match current best evidence, it has not been established across philosophies how these changes within our understanding of OMT influence education and application standards The purpose of this study was to establish consensus on modifications/adaptions to training paradigms and OMT application which need to occur within post-graduate OMT education. Given the breadth of knowledge obtained within this study, it was published as two separate manuscripts: The first manuscript on educational concepts was published in the Journal of Educational Evaluation of Health Professionals (JEEHP) January 2023 as an open access publication. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. The second manuscript has been submitted to the journal Musculoskeletal Science and Practice and is under review.

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Priorities in updating training paradigms in orthopedic manual therapy: an international Delphi study

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Purpose: Orthopedic manual therapy (OMT) education demonstrates significant variability between philosophies and while literature has offered a more comprehensive understanding of the contextual, patient specific, and technique factors which interact to influence outcome, most OMT training paradigms continue to emphasize the mechanical basis for OMT application. The purpose of this study was to establish consensus on modifications & adaptions to training paradigms which need to occur within OMT education to align with current evidence.

Methods: A 3-round Delphi survey instrument designed to identify foundational knowledge to include and omit from OMT education was completed by 28 educators working within high level manual therapy education programs internationally. Round 1 consisted of open-ended questions to identify content in each area. Round 2 and Round 3 allowed participants to rank the themes identified in Round 1.

Results: Consensus was reached on 25 content areas to include within OMT education, 1 content area to omit from OMT education, and 34 knowledge components which should be present in those providing OMT. Support was seen for education promoting understanding the complex psychological, neurophysiological, and biomechanical systems as they relate to both evaluation and treatment effect. While some concepts were more consistently supported there was significant variability in responses which is largely expected to be related to previous training.

Conclusion: The results of this study indicate manual therapy educators understanding of evidence-based practice as support for all 3 tiers of evidence were represented. The results of this study should guide OMT training program development and modification.

Keywords: Musculoskeletal manipulations; Health education; Spinal manipulation

Introduction

Background

Clinical research suggests orthopedic manual therapy (OMT) provides comparable or superior effects for reducing pain in individuals with musculoskeletal disorders [1]. Mechanisms research outlines similar effects with all forms of manual therapy techniques [2]. OMT techniques vary per post-graduate training phi-

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losophy; however, frequently the operator targets specific joints, respects biomechanical concepts, and targets the force-based manipulation to the region of dysfunction [3]. Given the focus on specificity, the training time required to gain "mastery" can be significant. Interestingly, a review investigating the specificity of joint mobilization shows a specific versus randomly applied technique provides similar outcomes [4]. Another review demonstrated similar findings with joint manipulation [5]. Moreover, data suggest that a remotely applied manipulation may be more beneficial than a locally applied technique [6]. While technique specificity is proving to be less crucial, literature supports the importance of contextual factors and patient factors on OMT outcomes [7]. Studies have suggested that contextual factors (e.g., patient characteristics, practitioner characteristics, treatment characteristics, therapeutic alliance, and clinical setting) may be more important in determining treatment outcomes than the technique [5]. This new found information highlights the need to investigate whether a modification of a traditional advanced training paradigm for OMT is needed. Whereas customary training strategies such as (1) handling competency and (2) understanding risk of harm will never be outdated, additional training elements such as (3) communication of what to expect with the technique, and (4) recognition of when a technique appears to be beneficial versus not, are skills that deserve consideration.

Objectives

This study aims to establish consensus on modifications to training paradigms within post-graduate OMT education through Delphi study. Once consensus methods are identified, the potential of implementing these methods into training programs may increase.

Methods

Ethics statement

Institutional Review Board approval was obtained through Youngstown State Universities Institutional Review Board (2022-204) prior to data collection. Informed consent was obtained electronically via participants clicking URL to the questionnaire.

Setting

This Delphi was completed electronically from July 2022–November 2022.

Study design

A 3-round Delphi study following recommended guidelines for conducting and reporting of Delphi studies (CREDES) was performed [8].

Respondent group

A priori goal of 30 participants completing all 3 rounds of the instrument was set as this has been recommended to be representative and feasible in qualitative Delphis [9]. A panel of experts included international participants with advanced manual therapy education demonstrated through either completion of an International Federation of Orthopaedic Manipulative Physical Therapists (IFOMPT) recognized fellowship in OMT or completion of an academic doctorate with research specialization related to OMT. Educators were identified through web search of both IFOMPT and associated national fellowship databases. Individuals were sought whom teach advanced manual therapy within fellowship, residency, or other advanced post-doctoral training programs.

Workgroup

Four individuals, including the primary investigator and 3 individuals experienced in qualitative research. All workgroup members were physical therapists with 9 to 33 years of clinical experience. Three workgroup members were mixed-methods researchers with experience in the Delphi method.

Instrumentation: 3-round web-based Delphi using Qualtrics survey system

Round 1 was an open-ended design developed to identify opinions/perceptions on the future of manual therapy training paradigms. Round 1 identified basic demographics including experiences experts had with training programs. Open-ended questions asking participants to identify recommended training paradigms for manual therapy techniques was implored. Face validity was investigated through a pilot survey of 5 individuals with qualifications to participate in the study whom were not included in final data collection [8].

Following Round 1, the workgroup examined each individual response and utilized qualitative thematic coding (Supplement 1). Round 2 included a list of the themes derived from Round 1 questioning. Respondents utilized a 4-point Likert scale (strongly agree, agree, disagree, and strongly disagree) to score each of these themes by level of agreement with the recommended training paradigm.

Round 3 included the same themes and grading scales as Round 2 with the addition of graphs representing the descriptive statistical scores computed from Round 2. With this information available, the respondents were asked to rescore each item on the same 4-point Likert scale. All responses were de-identified before data analysis by removing columns containing identifiable data from report.

Protocol

Protocol information is provided in Supplement 1. Study protocol and summarized in Fig. 1.

Data analysis

IBM SPSS ver. 29.0 (IBM Corp.) was used for all quantitative analyses. Scores for Round 3 were divided into 2 categories based on descriptive identifiers: The tally of ''strongly disagree'' and ''disagree'' represent the percentage of scores in the "not recommended" category, meaning that the proposed training paradigm is not recommended. On the contrary, the tally of "strongly agree" and "agree" represented the percentage of scores in the "recommended" category, meaning that the proposed training paradigm is recommended. Consensus was determined a priori if 75% or greater of the respondents score the component of education as either "not recommended" or "recommended" [8]. When an item did not reach consensus, the decision was made between "near-consensus" and "undecided". Agreement between 60%–75% either for "recommended" or "not recommended" was considered "near consensus" while agreement less than 60% was considered "undecided". The process of determining consensus status is further outlined in Fig. 2. A composite score for each component of training was calculated based on the following formula:

$$[n1 \times (-2)]+[n2 \times (-1)]+[n3 \times 1]+[n4 \times 2]$$

n1: number of respondents answering "strongly disagree" with component of training

n2: number of respondents answering "disagree" with component of training

n3: number of respondents answering "agree" with the component of training

n4: number of respondents answering "strongly agree" with the component of training

Sum of individual composite scores was used to establish a combined composite score. The higher the combined composite score, the more important the training paradigm to manual therapy education. Mann-Whitney U statistics assessed differences in scores between Round 2 and Round 3.

Results

One-hundred sixty-four educators were identified and invited to participate representing 4 countries (United States, Canada, United Kingdom [England], New Zealand). Advanced degrees included Doctor of Science (DSc), Doctor of Philosophy (PhD), and Fellowship training (American Academy of Orthopedic Manual Physical Therapy [FAAOMPT]; Musculoskeletal Association of Chartered Physiotherapists [FMACP]; New Zealand Manipulative Physiotherapists Association [FNZMPA]; Canadi-

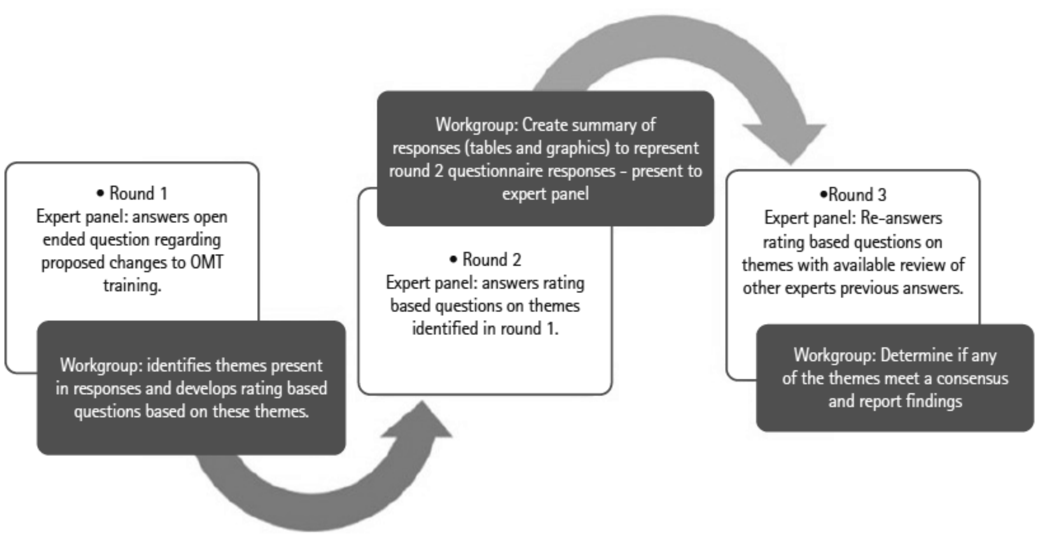

Fig. 1. Flow chart for current study protocol (3-round Delphi) including expert panel and workgroup duties. OMT, orthopedic manual therapy.

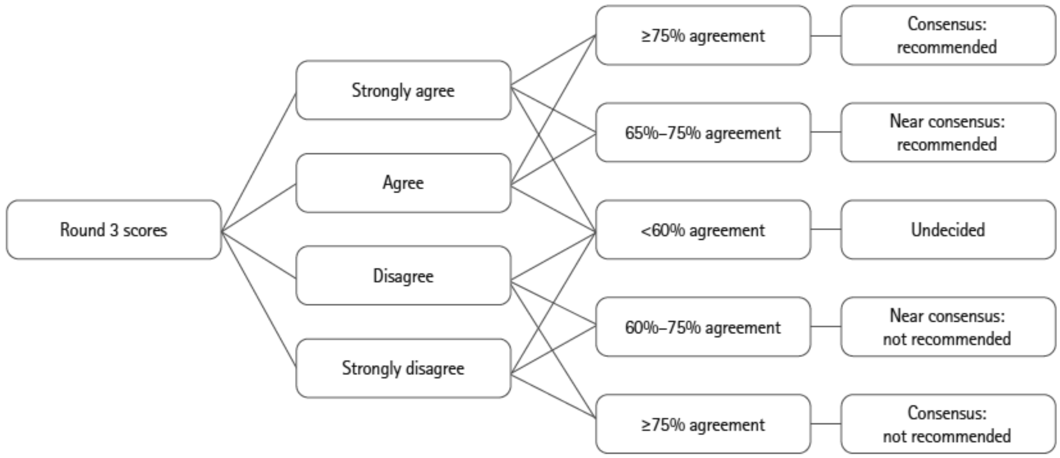

Fig. 2. Flow chart indicating how levels of consensus were obtained following round 3.

an Academy of Manipulative Physiotherapy [FCAMPT]).

Forty-one participants responded to Round 1 for a response rate of 25% (Table 1, Dataset 1). Thematic coding of responses produced 25 themes for OMT training foci (Table 2); 19 themes for what should be omitted from focus within OMT education (Table 3); and 37 themes for foundational knowledge needed to apply OMT (Table 4). The themes were agreed upon by all work-group members. Thirty-three individuals completed Round 2 (80.5% retention rate) for a 20.1% overall response rate (Dataset 2). Results of Round 2 were presented to the same 33 respondents to re-score the same themes with 28 of the 33 respondents completing the third and final round (Dataset 3). Retention rate between Round 2 and Round 3 was 84.8% and 17.1% overall response rate.

Question 1 investigated which areas should be focused on within OMT education with consensus reached supporting all 25 themes (Table 2). Composite scores representing the strength of the recommendations are provided with factors including patient comfort, patient handling, safety, and ability to modify techniques as needed having some of the strongest recommendations. Other patient specific factors including communication and managing patient expectations were also ranked highly. Technique specific factors including ability to grade mobilization, localization of tissue dysfunction, use of OMT for soft tissue dysfunction, and motor control did not have the same strength of recommendation although they did reach consensus. Education on both neurophysiological and psychological mechanisms associated with OMT scored higher than education on the biomechanical mechanisms associated with OMT. Use of OMT as part of multimodal care plan also rated highly amongst the panel of experts. Limited variance was seen between respondents (mean standard deviation [SD] = 0.60, mean variance = 0.38).

Question 2 investigated what areas of focus should be omitted from OMT education with only one of the themes (visceral manipulation) reaching consensus (Table 3). Several other themes including complex reasoning, non-reliable assessment techniques, terminology attempting to differentiate philosophies, rigidly defined non-adaptive techniques, non-evidence-based treatments, and treatment based purely off a research driven model produced near consensus results supporting omitting (60%–75% agreement). Themes including pain neuroscience education, segment localization, and treatment direction based on arthrokinematics produced near consensus results against omitting (60%–75% agreement). Moderate variance was seen between respondents for this question (mean SD = 0.94, mean variance = 0.90).

Question 3 investigated what foundational knowledge is needed to apply OMT. Thirty-four of the 37 themes met consensus supporting (Table 4). Three themes were near consensus supporting including use of grading scales, histology, and understanding the SINSS model (Severity, Irritability, Nature, Stage, Stability), and 1 theme was undecided (ability to lock out joints). Strongest recommendations were towards patient safety, indications and contraindications, patient-centered care, strong communication skills, patient education as an adjunct to OMT, strong assessment and evaluation skills, ability to obtain a good history, ability to adapt techniques to specific patients, utilization of patient response model, following OMT with functional movement and exercise, and understanding of anatomy. Minimal variance was

Table 1. Respondent demographics, years' experience in research and clinical practice, education/training provided, education/training received

Characteristic	No. (%)
Age (yr)	
30–40	6 (14.6)
40–50	16 (29.0)
50–60	14 (34.1)
>60	5 (12.2)
Gender	
Male	31 (75.6)
Female	10 (24.4)
Years' experience in research (yr)	
None	8 (19.5)
0–5	9 (22.0)
5–10	10 (24.4)
10–15	6 (14.6)
15–20	3 (7.3)
>20	5 (12.2)
Years' experience in clinical practice (yr)	
None	0
0–5	0
5–10	2 (4.9)
10–15	6 (14.6)
15–20	8 (19.5)
>20	25 (61.0)
Education/training:	
Post-doctoral degree (DSc, PhD, etc.)	20 (36.4)
Fellow (AAOMPT, etc.)	35 (63.6)
Type of post-doctoral manual therapy training provided	
Residency (OCS, SCS, etc.)	17 (21.0)
Fellowship (FAAOMPT, etc.)	36 (44.4)
Continuing education	28 (34.6)
Philosophies trained under	
Patient response model (Maitland, Mckenzie, Mulligan)	10 (25.6)
Biomechanical/Arthrokinematic Model (Ola Grimsby, NAIOMPT, Paris, Kaltenborn, Osteopathic)	9 (23.1)
Mixed training	18 (46.2)
No response	2 (5.1)

DSc, Doctor of Science; PhD, Doctor of Philosophy; AAOMPT, American Academy of Orthopaedic Manual Physical Therapy; OCS, Orthopaedic Clinical Specialist; SCS, Sports Clinical Specialist; FAAOMPT, Fellow of American Academy of Orthopaedic Manual Physical Therapy; NAIOMPT, North American Institute of Orthopedic Manual Physical Therapy.

seen between respondents for this question (mean SD = 0.53, mean variance = 0.30).

No significant difference was found between Round 2 and Round 3 composite scores for Question 2 assessing themes to omit from OMT education ($P = 0.872$, $U = 175$). Question 1 ($P = 0.013$, $U = 185$) and question 3 ($P = 0.002$, $U = 403$) both showed significant differences between Round 2 and Round 3 composite scores.

Discussion

Interpretation

The Delphi method is a recommended tool for achieving consensus in medical education [10]. The validity of the consensus achieved within Delphi studies largely rests on the quality of the experts, which develop the consensus. The participants demonstrated advanced manual therapy knowledge through appropriate higher-level credentials, and who were involved in training within manual therapy programs.

Manual therapy training should focus on

All 25 themes from Round 1 reached consensus to be included within OMT education. Patient factors all rated highly amongst the participants. This aligns with published clinical trials that have shown the moderating effect of comfort, therapeutic alliance, and expectations on OMT outcomes [11]. A lesser focus on the biomechanical mechanisms was observed with higher scoring for focus on both the neurophysiological and psychological mechanisms. Previous models have outlined these mechanisms as they relate to OMT outcomes [12]. Utilizing OMT as part of a multimodal care plan ranked highly aligning with a recent high-level review finding this to be a consistent recommendation across practice guidelines [13]. The importance of advanced assessment skills and the ability to identify responders and non-responders ranked highly; however, localization of tissue dysfunction had significantly less strength of a recommendation. Themes including biomechanics, arthrokinematics, osteokinematics, neuromuscular training, and pain science all ranked moderately with similar composite scores. The overall high consensus rate of presented themes supports the perceived importance of incorporating education on a vast array of topics within OMT educational paradigms.

Manual therapy training should omit focus on

Nineteen themes were identified in Round 1; however, only 1 of those themes met consensus to omit from OMT education. The contradiction among respondents' answers likely corresponds to differing OMT philosophies. Some were strongly opposed to omitting biomechanical principles (biomechanical effects of OMT [17.9%]; arthrokinematics & osteokinematics [17.9%]; treatment based on biomechanical findings [21.4%]; treatment direction based on arthrokinematics [14.3%]) while others were strongly in favor of omitting these same principles

Table 2. Question 1: Round 2 and Round 3 composite scores, and consensus status

I would recommend that manual therapy training should focus on...	Round 2 composite scores	Round 3 composite scores	Round 3 consensus status
Patient self-reported outcomes and ability for clinicians to assess them	32	28	C-R
Neurophysiological mechanisms associated with OMT including the effect of touch	57	48	C-R
Psychological mechanisms associated with OMT	47	43	C-R
Biomechanical mechanisms associated with OMT	42	33	C-R
Patient-centered care (communication)	59	47	C-R
Patient-centered care (therapeutic alliance)	51	44	C-R
Pain neuroscience education	40	35	C-R
Managing patient expectations	43	48	C-R
Addressing lifestyle behaviors to promote overall wellness	39	40	C-R
Use of OMT as part of multimodal care plan	63	52	C-R
Application of EBP (patient preference, therapist preference/skill, research)	58	45	C-R
Use of OMT for soft tissue and fascial problems	31	26	C-R
Use of OMT for non-pain uses (motor control, tone reduction)	27	21	C-R
Determining candidates for MT (localization of tissue dysfunction)	34	26	C-R
Determining candidates for MT (identification of responders and non-responders)	55	41	C-R
Psychomotor skills	54	47	C-R
Patient handling	56	50	C-R
Advanced assessment skills	56	42	C-R
Patient comfort	56	50	C-R
Safety	59	51	C-R
Ability to modify techniques as needed	59	52	C-R
Ability to grade mobilizations	40	26	C-R
Biomechanics, osteokinematics, and arthokinematics	40	39	C-R
Neuromuscular training	50	37	C-R
Pain science	49	40	C-R

C-R, consensus-recommended; OMT, orthopedic manual therapy; EBP, evidence-based practice; MT, manual therapy.

Table 3. Question 2: Round 2 and Round 3 composite scores, and consensus status

I would recommend that manual therapy training should omit focus on...	Round 2 composite scores	Round 3 composite scores	Round 3 consensus status
Terminological and philosophical considerations of different OMT philosophies	0	7	UN
Biomechanical effects of OMT	-4	-1	UN
Complex reasoning that is not observable/reproduceable	2	17	NC-R
Clinical prediction rules	-1	9	UN
Visceral manipulation	30	24	C-R
Pain neuroscience education	-14	-8	NC-NR
Application of technique without clinical reasoning	3	12	UN
Resetting of nervous system with manipulation techniques	17	3	UN
OMT for treatment of non-pain/motion complaints	7	1	UN
Terminology attempting to differentiate philosophies (school of thought)	20	12	NC-R
Arthrokinematics/osteokinematics	-1	-1	UN
Non-reliable assessment techniques (palpation, sacroiliac joint innominate)	23	15	NC-R
Segment localization	-1	-3	NC-NR
Treatment based on biomechanical findings	-5	-5	UN
Treatment direction based on arthrokinematics	6	-6	NC-NR
Treatment based on clinical prediction rules	9	6	UN
Rigidly defined techniques that are not adaptive to patient needs	12	17	NC-R
Treatment "fads" without evidence supporting	28	21	NC-R
Treatment based purely off research driven model	-3	10	NC-R

OMT, orthopedic manual therapy; UN, undecided; NC-R, near consensus-recommended; C-R, consensus-recommended; NC-NR, near consensus-not recommended.

Table 4. Question 3: Round 2 and Round 3 composite scores, and consensus status

The foundational knowledge I feel is necessary to apply manual therapy is...	Round 2 composite scores	Round 3 composite scores	Round 3 consensus status
Anatomy	62	50	C-R
Neurophysiology	53	47	C-R
Arthrokinematics/osteokinematics	37	30	C-R
Relationship between physiology and neuromuscular system	51	40	C-R
Histology	10	11	NC-R
Epidemiology	20	24	C-R
History of OMT	19	16	C-R
Current state of OMT	30	28	C-R
Philosophies of OMT	20	18	C-R
Grading scales	22	15	NC-R
Understanding of SINSS model	30	18	NC-R
Mechanisms of OMT response	56	46	C-R
Manual therapy application based on pain mechanism (mechanism based OMT)	53	45	C-R
Understanding lack of specificity in OMT	45	39	C-R
Indications/contraindications	64	53	C-R
Patient safety	63	53	C-R
Patient education as adjunct to OMT	61	50	C-R
Following OMT with functional movement/exercise	60	52	C-R
Understanding exercise science	52	42	C-R
Eclectic skill set (fascial, soft tissue, neural, articular)	26	31	C-R
Ability to identify impairments and functional limitations	56	46	C-R
Ability to obtain good history	62	54	C-R
Patient-centered care	63	53	C-R
Patient response model (test-retest)	62	50	C-R
Strong assessment/evaluation skills	62	52	C-R
Strong communications skills	65	53	C-R
Pattern recognition	56	47	C-R
Understanding cognitive and psychological contributors to pain and stiffness	56	46	C-R
Exercise prescription	58	44	C-R
Application of the biopsychosocial model	51	44	C-R
Evidence-based practice	57	46	C-R
Identifying gaps within the literature	43	41	C-R
Ability to critique research methodology	48	40	C-R
Technique	50	47	C-R
Psychomotor skills	52	44	C-R
Ability to adapt techniques to specific patients	61	51	C-R
Ability to lock out joints	13	9	UN

C-R, consensus-recommended; NC-R, near consensus-recommended; OMT, orthopedic manual therapy; SINSS, Severity, Irritability, Nature, Stage, Stability; UN, undecided.

(biomechanical effects of OMT [21.4%]; arthrokinematics & osteokinematics [14.3%]; treatment based on biomechanical findings [17.9%]; treatment direction based on arthrokinematics [14.3%]).

Omitting focus on visceral manipulation education was the only theme to meet consensus with 78% agreement. A recent review suggests a lack of quality unbiased studies demonstrating efficacy in this domain [14]. Some support for omitting focus on treatment without evidence, complex reasoning, application of technique without clinical reasoning, and non-reliable assessment techniques; however, these did not reach a consensus. These results align with the overall response slightly (near-consensus) leaning towards omitting treatment based off a purely research-driven model and show agreement with previous reviews demonstrating limited compliance with research-based guidelines [15]. These findings were further supported by the 94.4% agreement for the evidence-based practice model (research+clinical expertise+patient preference and values) to be a focus within OMT education.

The foundational knowledge necessary to apply manual therapy

Thirty-four of the 37 themes from Round 1 reached a consensus. One undecided theme emerged involving the ability of individuals to lock out joints. The rating of this theme was variable with opposing positions to this requirement. Themes supporting patient-centered care, communication, therapeutic alliance, and patient safety all ranked amongst the strongest recommendations. This aligns with responses to question 1 and with the aforementioned literature supporting the importance of the therapeutic alliance in OMT outcomes.

Limitations

There are limitations related to a true representation of the sample population. With significant variation between manual therapy philosophies, some may not be represented within this sample and others may have differing opinions from this panel of experts. While we attempted to be representative by including international participants, a significant proportion was stationed within the US IFOMPT accredited education programs are represented across 25 countries; however, most of these programs did not report faculty members and contact information on the associated websites; therefore, several countries were not appropriately represented.

Generalizability

Given the international representation of this study along with fair representation of different OMT philosophies these results can be relatively generalized to post-graduate manual therapy education including continuing education, advanced manual therapy certification and fellowship training; however, care should be taken given the above stated limitations related to geographical restrictions.

Suggestions for future studies

Future studies should attempt to understand the reasoning behind the overwhelming consensus related to included themes and the minimal consensus on excluded themes. Furthermore, given the proposed changes in training paradigms future studies should identify if these same principles indicate a shift in the clinical application of OMT.

Conclusion

The combined high consensus rate for themes to focus on within OMT education along with the low consensus rate of themes to omit focus on within OMT education stresses the breadth of knowledge which appears to be pertinent to OMT. Of interest was that while 91% of respondents supported focus on training related to biomechanical mechanisms, 60% supported omitting treatment based on biomechanical findings and 40% supported omitting training on segments localization. This suggests that the biomechanical effect should be more of a focus than the biomechanical rationale for applying the technique. The included themes were developed by the respondents; however, variability in interpretation of the themes, along with differences seen within OMT training paradigms likely contributes to this discrepancy. Future studies should look to differentiate which biomechanical findings are viewed as important versus not in OMT assessment.

Overall support was seen for education promoting understanding the complex psychological, neurophysiological, and biomechanical systems as they relate to evaluation and treatment effect. The support for care based on all aspects of evidence-based practice model supports patient centered care and the understanding of complex interactions surrounding manual therapy intervention.

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Authors' contributions

Conceptualization: DK, DG, KL, CC. Methodology: DK, DG, KL, CC. Data Curation: DK. Validation: DK, DG, KL, CC. Formal analysis: DK. Investigation: DK. Resources DK, DG, KL, CC. Validation: DK, DG, KL, CC. Project administration: CC. Supervision: CC. Writing–original draft preparation: DK. Writing–review and editing: DK, DG, KL, CC.

Conflict of interest

Chad Cook is the Director of the Center of Excellence in Manual and Manipulative Therapy at Duke University and a portion of his salary is supported by that role. Chad published a book on OMT and a course with AGENCE EBP on Manual Therapy in which he receives royalties. Otherwise, no potential conflict of interest relevant to this article was reported.

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Data availability

Data files are available from Harvard Dataverse: https://doi.org/10.7910/DVN/XAMMVU

Dataset 1. Raw response data at the 1st round Delphi survey from 57 participants from which 16 responses were not included due to incomplete response.

Dataset 2. Raw response data at the 2nd round Delphi survey from 36 participants from which 3 responses were not included due to incomplete response.

Dataset 3. Raw response data at the 3rd round Delphi survey from 29 participants from which 1 response was not included due to incomplete response.

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None.

Supplementary materials

Supplementary files are available from Harvard Dataverse: https://doi.org/10.7910/DVN/XAMMVU

Supplement 1. Study protocol.

Supplement 2. Audio recording of the abstract.

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Supplement 1. Study protocol

Invitations for participation were distributed to the identified experts through email including information on the purpose of the study, how they were selected as expert panelists, and information on informed consent. They also received a web-based link to the online survey. Participants who did not respond to the initial request for participation were emailed a second time 14 days after the initial email as a reminder to encourage participation. Respondents consented to participate by following the provided web link to the Round 1 questionnaire through the Qualtrics web-based survey system. The questionnaire was stored on a password-protected server through Qualtrics software. This company is a common vendor used for survey research and has significant data protection policies in place.

The purpose of Round 1 was to allow participants to identify content that they consider to be most important to include or omit from post-graduate manual therapy educational models, along with identifying baseline knowledge that they feel necessary to perform orthopedic manual therapy. This was completed by open-ended free-text questioning. After completion of Round 1, the data were downloaded by the primary investigator and presented to the workgroup for analysis. First, workgroup members analyzed data entries and developed themes by literal thematic coding methods (coding based on related words or phrases) [1]. Qualitative analysis was then performed to place the remaining data within these categories. Data entries that did not fit into previously created categories initiated a new category being developed. Following individual analysis, the group collaborated and with 100% agreement between the 4 workgroup members were able to move forward into the final workgroup categorization. Following the completion of coding, the workgroup developed recommended statements representing the content within each collective theme. These statements were used to develop Round 2 of the Delphi.

The purpose of Round 2 was to allow participants to rate themes by the level of importance to include or omit from manual therapy educational models. Invitations to participate in Round 2 were distributed via email to

those who completed Round 1. Round 2 utilized a 4-point Likert scale to assess agreement with recommendations (Strongly Agree, Agree, Disagree, Strongly Disagree)). The expert panel had 30 days to complete Round 2, with a reminder email at 14 days to promote participation.

After completion of Round 2, the workgroup utilized descriptive statistics to create stacked bar charts to represent all responses. These graphical depictions of Round 2 response along with the same Round 2 questions were re-issued to the participants as Round 3. The purpose of Round 3 was to allow participants to identify themes that they consider to be most important to include or omit from manual therapy educational models while considering the opinions of the other participants.

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Modernizing Patient-Centered Manual Therapy: Findings from an International Delphi Study on Orthopaedic Manual Therapy Application

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Abstract

Recent literature challenges the process by which orthopaedic manual therapy (OMT) has traditionally been applied. Progressive understanding of the complexities surrounding OMT analgesia and the decreased reliance on technique specific characteristics in determining treatment effectiveness promotes an update to training paradigms related to OMT. The purpose of this Delphi study was to establish consensus on how candidates for OMT should be identified, and what should be focused on when demonstrating OMT techniques. Consensus was reached on nineteen themes and eighteen themes respectively. This Delphi presents consensus-based recommendations for how manual therapy should be applied. Results from this Delphi stress patient-centered care within a biopsychosocial pain management model. Representation was seen across all pillars of evidence-based practice. These findings in collaboration with previous consensus recommendations on concepts to focus on within OMT education promote restructuring of OMT curriculum to evidence-based patient-centered care models.

Keywords: Musculoskeletal Manipulations, Health Education, Manipulation, Spinal

Introduction:

Orthopaedic manual therapy (OMT) is an effective tool in the management of pain in certain patient populations.(Alonso-Perez et al., 2017; Cleland et al., 2005; Lopez-Lopez et al., 2015) Hands on interventions have been utilized for non-pharmacological pain management for years; however, the techniques and the application standards have changed notably over time. Historic models of OMT looked to correct positional faults and musculoskeletal impairments with hands on intervention.(Daly et al., 1991) These techniques were based on identified structural faults or mechanical impairments found during a thorough musculoskeletal exam. Whereas patients improved with interventions applied through this philosophy, recent literature suggests this methodology is flawed and may need to be revised across manual therapy practice.

Manual therapy application is known to have psychological, neurophysiological, and biomechanical effects.(Bialosky et al., 2018; Reed et al., 2022) While the specific mechanisms behind why each manual therapy intervention works is thoroughly understudied, it is appreciated that a constellation of these mechanisms interact to produce clinical analgesia. Clinical response differs between patients even with consistent technique application questioning the legitimacy of biomechanical models of OMT application.(Alonso-Perez et al., 2017; Castien et al., 2012; Lopez-Lopez et al., 2015) Contextual factors moderate these treatment effects and at times are more influential on treatment response than technique itself and should be considered within the clinical decision-making process.(Palmlöf et al., 2016; Rossettini et al., 2018; Testa and Rossettini, 2016) Recent clinical trials and reviews have further emphasized the non-specific effects of manual therapy, which further emphasizes the complex mechanistic basis for OMT response which cannot be explained within a solely biomechanical/fault-based model.(Aquino et al., 2009; Izquierdo Pérez et al., 2014; Karas et al., 2018; Nim et al., 2021; Slaven et al., 2013)

With a progressive understanding of the complexities surrounding OMT analgesia, the rationale for application must be updated to reflect the evolving evidence in this area. The purpose of this Delphi study was to establish consensus on manual therapy clinical application including:

1.) How should candidates for OMT be identified?

2.) When demonstrating OMT techniques, what should the trainee be focusing on?

We hypothesize that this consensus will contribute toward the evolution of OMT practice from historical models of application to more modern evidence-based models.

Methods:

Ethics Statement:

Institutional Review Board approval was obtained through Youngstown State University's Institutional Review Board (2022-204) prior to data collection. Informed consent was obtained electronically for each participant via participants clicking URL to the questionnaire during each round.

Study Design:

An international three-round Delphi study following recommended guidelines for conducting and reporting of Delphi studies (CREDES) was performed July 2022 - November 2022.(Jünger et al., 2017) This study was performed in conjunction with a previously published Delphi looking at components of manual therapy education.(Keter et al., 2023) The two Delphi studies had different objectives therefore a planned concurrent analysis was performed.

Respondent Group:

The validity of the consensus research rests on the quality and representation of the experts. Of importance for the current Delphi was that the expert panel represent educators teaching within advanced manual therapy programs who had established credentials justifying their expertise within the area of study. The process of identifying respondents was outlined in a previous publication. (Keter et al., 2023) An *a priori* goal of thirty participants across all three rounds was established as this has been suggestive to be representative within Delphi methodology.(Nasa et al., 2021) Manual therapy philosophy and application differs geographically therefore an international expert panel was sought to allow for generalizability of the results. Philosophies of OMT assessment and application differ between educational groups including but not limited to arthrokinematic & osteokinematic models, biomechanical fault models, patient response models, and mixed models. Recruitment of participants across different training programs with different respective philosophies was important to promote representation of sample and generalizability or results. Experts were identified as educators within accredited *International Federation of Orthopaedic Manipulative Physical Therapists* (IFOMPT) manual therapy programs, or other post graduate manual therapy coursework. Furthermore, experts must have completed a recognized fellowship in OMT or academic doctorate with published research directly related to OMT. Advanced OMT educators were identified through search of the IFOMPT database along with linked national fellowship databases.

Work Group:

The work group was comprised of the four authors including the primary investigator and three individuals experienced in qualitative research. Work group members were physical therapists with nine years of clinical experience or greater and with post-doctoral manual therapy training and publications. Three work group members have published mixed methods researcher with experience in the Delphi Method.

Instrumentation:

A three-round web-based Delphi strategy was utilized. After brief explanation for the rationale for this study being performed, participants were asked to consent via following link provided. Round 1 consisted of two open-ended questions: 1) *How should candidates for OMT be identified?* and 2) *What should trainees within OMT training programs focus on when applying OMT?* Round one also included basic demographic questions and training philosophies which they train under.

Prior to distribution of the survey to the panel of identified experts, the questionnaire was sent to five individuals as a pilot to assess for face validity. These five individuals met the inclusion criteria to participate in the study however were not part of final data collection.

Following completion of Round I, qualitative thematic coding was performed by the work group by analyzing each individual response and extracting themes. This process is further outlined in the protocol below. Round II utilized a 4-point Likert scale (Strongly Disagree, Disagree, Agree, Strongly Agree) for participants to rate their agreement with the themes extracted from Round I. Round III repeated the same rating-based questionnaire presented within Round I, however prior to completing the participants were asked to review the results from Round II voting.

Protocol:

After potential participants were identified via web search of IFOMPT and associated national databases, invitations for participation were distributed to experts through email. The initial invitation included the purpose of the study, the reason they had been selected as experts to participate, and the information on IRB approval and informed consent. Participants agreed to consent with following a URL to the survey. All three rounds of this Delphi were completed using the Qualtrics web-based survey software which is a commonly used vendor for survey-based research with significant data protection protocols in place.

Table 1: 3-Round Delphi Protocol

Round I	Participants were asked open-ended questions identifying factors they feel manual therapist trainees should focus on during application of OMT, and how candidates for OMT should be identified.
Post-Round I	Workgroup was presented blinded data from Round I for thematic coding. Literal thematic coding measures were utilized. (Williams and Moser, 2019) If a theme was presented within a response that did not fit into one of the established themes, then a new theme was created to represent this response. This qualitative analysis was performed across all responses to the two posed questions. Following individual analysis, the workgroup collaborated and only with 100% agreement were able to move the themes into statements for Round II rating. Round II invitations were sent via email to those who completed the Round I questionnaire.
Round II	Participants were asked to rate themes presented in Round I by level of importance with the themes utilizing a 4-point Likert scale (strongly disagree, disagree, agree, strongly agree). The expert panel of participants had 30 days to complete Round II with a reminder email sent at 14 days to encourage participation.
Post- Round II	Workgroup developed stacked bar charts to represent responses to Round II based on descriptive statistics. These depictions of Round II responses were presented to the expert panel for review prior to completion of Round III
Round III	Participants were asked to review the results of Round II. Participants were then asked to re-rate the same themes presented in Round II based on level of agreement utilized the same 4-point Likert scale while considering the results of other participants.

Data Analysis:

SPSS version 29.0 (IBM Corp, Armonk, NY) was utilized for quantitative analysis. Following established guidelines, consensus was determined a priori. (Jünger et al., 2017) Round III scores were separated into categories of agree (tally of 'Strongly Agree' and 'Agree') and disagree (tally of 'Strongly Disagree' and 'Disagree). These respectively represented percentage of agreement with the component of OMT application, and the percentage of disagreement with the component of OMT application. Agreement of 75% or greater either supporting or against the proposed theme was considered reaching consensus. Agreement between 60-75% either supporting or against a theme was considered near consensus. Agreement less than 60% was considered undecided. The composite score represents the strength of the recommendation across participants. A composite score for each component of application was calculated based on the following formula:

$$\mathbf{(n1 \times (-2)) + (n2 \times (-1)) + (n3 \times 1) + (n4 \times 2)}$$

n1 = number of respondents answering "Strongly Disagree" with component of application

n2 = number of respondents answering "Disagree" with component of application

n3 = number of respondents answering "Agree" with the component of application

n4 = number of respondents answering "Strongly Agree" with the component of application.

The higher the combined composite score, the more important the component is in OMT application. This Delphi incorporated rating of components independently (Round II) as well as rating of components while unblinded to other participants responses (Round III). Mann Whitney *U* statistics were utilized to assess difference in responses between blinded (Round II) and unblinded (Round III) ratings.

Results:

One-hundred sixty-four targeted experts were identified for participation across four countries (United States, Canada, United Kingdom (England), New Zealand). Degrees and fellowship credentials across the participants included: Doctor of Science (DSc), Doctor of Philosophy (PhD) Fellowship training- American Academy of Orthopaedic Manual Physical Therapy (FAAOMPT); Musculoskeletal Association of Chartered Physiotherapists (FMACP); New Zealand Manipulative Physiotherapists Association (FNZMPA); Canadian Academy of Manipulative Physiotherapy (FCAMPT).

Forty-one participants responded to Round I of the Delphi (response rate 25%). Demographic details of participants were published previously.(Keter et al., 2023) Respondents reported primary mixed philosophy training (46.2%). Mean years of clinical practice 15-20 years and mean years of research 5-10 years. Sixty-four percent of respondents reported previous completion of fellowship training. Thematic coding identified twenty-one themes manual therapist trainees should focus on when demonstrating techniques (Table 2), and twenty-one themes of how OMT candidates should be identified (Table 3). All themes were agreed upon by all workgroup members. Thirty-three individuals completed Round II (20.1% overall response rate) and twenty-eight individuals completed Round III (17.1% overall response rate). Results of Round II and Round III are presented Table 2 and Table 3.

Question 1 investigated what concepts manual therapy trainees should focus on when demonstrating techniques. The identified themes along with consensus status and composite score representing the strength of the recommendation are presented in Table 2. Eighteen of the twenty-one themes met consensus with two of the remaining themes reaching near consensus status and one not reaching consensus. The strongest recommendations included communication with patients during technique application, ensuring patient comfort, and safety and risks. These were followed by components of modification based on patient feedback and assessment including use of the patient response model (test-retest). Patient and therapist positioning were also ranked highly amongst the themes. Localization of tissue dysfunction and ability to lock out specific segments (near consensus), and techniques based on arthrokinematic principles (consensus not met) ranked the lowest and reached near consensus status.

Question 2 investigated how candidates for OMT should be identified. Nineteen of the twenty-one themes met consensus. The strongest recommendations were for use of patient expectations, and evidence-based practice (research, patient expectations, provider experience) to guide candidate identification. Again, a patient response model ranked highly within this question. Psychosocial factors, and results of a biopsychosocial assessment were ranked highly. Biomechanical findings and pain versus stiffness dominance ranked the lowest among the themes and failed to meet consensus. Detailed results on question 2 are presented in Table 3.

Mann-Whitney *U* statistics did not reveal significant differences between Round II and Round III responses for question 1 (U= 162; P= .14) or question 2 (U= 166; P= .17).

Discussion:

Results of this study promote transition from previously utilized biomedical models within OMT application to multifactorial patient centered models. Biomedical themes were represented; however, the stronger importance of non-biomedical factors was apparent across respondents. These results promote manual therapists and educators re-evaluate their foci during manual therapy application and training to more holistic models.

When Demonstrating techniques, I would recommend trainees focus on:

Eighteen of the themes presented met consensus. Patient factors including safety, comfort, communication, modifications to technique based on patient, and utilizing their clinical response to dictate all ranked amongst the strongest recommendations. This is of interest, as only nine respondents identified training under a patient response model. Technique-specific factors including grade of technique, direction of technique, hand placement, speed of technique, and proper setup of technique all met consensus; however, it was clear that the strength of recommendations supporting technique characteristics was less than those supporting patient specific characteristics. This reflects a recent trend in the literature supporting the importance of patient presentation and contextual factors in moderating treatment effects.(Bialosky et al., 2018; Palmlöf et al., 2016; Rossettini et al., 2018; Testa and Rossettini, 2016)

Of the technique specific factors, therapist and patient positioning was ranked most important, followed by amplitude of technique, speed of technique, proper setup of technique, hand placement, technique proficiency and efficiency, direction of technique, and grade of technique. Assessment techniques including patient response model, identification of patient's comparable signs, and ability to assess based on touch and feel met consensus, whereas localization of tissue dysfunction and ability to lock out specific segments met near consensus recommendation. Techniques based on arthrokinematics principles was the only factor that was undecided. This agrees with a recent review that outlined the localization and specific application of techniques are less important than previously appreciated.(Nim et al., 2021)

I would recommend that trainees attempt to identify candidates for manual therapy based on:

Nineteen of the twenty-one themes presented met consensus. Patient specific factors, such as patient expectations, received the strongest recommendation. Utilizing evidence-based practice including patient expectations, provider experience, and available research to identify candidates received the second strongest recommendation. While overall patient factors including psychosocial factors, biopsychosocial assessment, and patient expectations were among the strongest recommendations for identifying candidates for OMT, biomechanical findings, identification of tissue dysfunction, and joint mobility assessment findings were among the weakest recommendations.

Other models including the SINSS model (severity, irritability, nature, stage, stability), and use of stage of management to dictate OMT application also ranked lower than psychological and patient specific factors. This corresponds with a review across clinical practice guidelines, which outlined the importance of patient centered care including use of psychosocial factors in decision making.(Lin et al., 2020) Treatment based on pain mechanism phenotypes has become a recent theory for OMT application; however, ranked lower than psychosocial variables in isolation.(Chimenti et al., 2018) The overall results of this question support use of the biopsychosocial model and patient response model as the most recommended means to identify appropriate candidates for OMT.

Limitations:

Although international recruitment was targeted in this Delphi process, our respondents were heavily weighted within one geographical location (U.S.). This may limit the generalizability of these findings. This Delphi attempted to reach representatives across different philosophies; however, it is likely that some philosophies were not represented within the expert panel, further limiting the generalizability.

Suggestions for future studies:

Future studies should look to differentiate findings based on philosophy of training. Future studies should also look to identify the understanding of pain mechanism-based models within OMT application. While components of evidence-based practice are seen across both pools of themes, future studies investigating the perceived importance of each of these tiers within clinical decision making would be beneficial in identifying how clinicians tends to make clinical decisions related to OMT application.

Conclusion:

Updated paradigms for application of OMT is essential to rationalize continued use of this analgesic tool. Recent literature discredits previous biomechanical based models and while this does not negate the value of OMT within non-pharmacological pain management, it prompts updates to how it is applied and how candidates are identified. This Delphi follows reporting guidelines (Table 4) presenting consensus-based recommendations for how manual therapy should be applied. Results from this Delphi stress patient-centered care within a biopsychosocial pain management model. Representation across all pillars of evidence-based practice were represented. These findings in collaboration with consensus on recommended concepts to omit vs focus on within OMT education promote restructuring of OMT curriculum to evidence-based patient-centered care models.(Keter et al., 2023) Manual therapy philosophies emphasizing the patient response model (Mulligan, McKenzie, Maitland etc.) were favored amongst participants while more biomechanical models were less favored in guiding application and identification of candidates. We hope that this study outlines a framework for evidence-based manual therapy application that can be applied to current OMT models, as well as developing models.

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Table 2: Question 1: Round II and Round III Composite Score and Consensus Status

When Demonstrating techniques, I would recommend trainees focus on:	Round II Composite Score	Round III Composite Score	Consensus Status
Communication with patient during technique	61	52	C-R
Patient comfort	59	51	C-R
Safety	61	51	C-R
Patient Response Model (test- retest)	56	50	C-R
Modifications to technique based on patient	58	50	C-R
Therapist positioning	54	49	C-R
Patient positioning	55	49	C-R
Identifying patients comparable sign	53	48	C-R
Amplitude of technique	47	48	C-R
Confidence	46	47	C-R
Following OMT with technique to maintain function	53	47	C-R
Speed of Technique	47	46	C-R
Proper setup of technique	50	45	C-R
Hand Placement	48	44	C-R
Technique proficiency and efficiency	41	43	C-R
Direction of technique	38	37	C-R
Ability to assess based on touch/feel	33	31	C-R
Grade of technique	33	30	C-R
Technique Specificity- localization of tissue dysfunction	12	12	NC- R
Technique Specificity- Ability to lock out specific segments	16	11	NC- R
Technique based on arthokinematic principles	8	7	UN

Definitions: C-R = Consensus- recommended; NC-R = Near Consensus- recommended; UN = Undecided; OMT = Orthopedic Manual Therapy;

Table 3: Question 2: Round II and Round III Composite Score and Consensus Status

I would recommend that trainees attempt to identify candidates for manual therapy based on:	Round II Composite Score	Round III Composite Score	Consensus Status
Patient expectations	57	57	C-R
Current best evidence (patient expectations, provider experience, and research)	57	57	C-R
Differential Diagnosis	54	54	C-R
Patient response model	54	54	C-R
Psychosocial factors	53	53	C-R
Biopsychosocial assessment	51	51	C-R
Lack of contraindications	50	50	C-R
Patient tolerance	50	50	C-R
Signs	50	50	C-R
Symptoms	50	50	C-R
Identified impairments	45	45	C-R
Pain mechanism	44	44	C-R
Use of performance-based outcome measures	39	39	C-R
Utilizing test clusters to identify responders	38	38	C-R
Joint mobility findings	33	33	C-R
Stage of management	31	31	C-R
Use of self-reported outcome measures	30	30	C-R
SINSS Model	27	27	C-R
Identification of specific tissue impairment	26	26	C-R
Pain vs stiffness dominance	23	23	NC-R
Biomechanical findings	19	19	NC-R

Definitions: C-R = Consensus- recommended; NC-R = Near Consensus- recommended; SINSS = Severity, Irritability, Nature, Stage, Stability

Table 4: Conducting and Reporting of Delphi Studies (CREDES) Reporting Standards

	Reporting Standard	Met	Location
Transparency and Quality of Reporting	Purpose well defined	yes	Intro- par 3
	Rationale for Delphi	yes	Into- par 1-3
	Selection of experts clearly justified	yes	Methods- Respondent Group
	Clear description of methods	yes	Methods; Table 1
	Flow chart	yes	Table 1
	Clear definition of consensus	yes	Methods- Data Analysis
	Pilot test of instruments	yes	Methods- Instrumentation
	Transparent reporting of results	yes	Tables 2-3
	Data analysis clearly justified and reported	yes	Methods- Data Analysis
	Information of rounds	yes	Table 1
	Discussion of limitations	yes	Discussion- Limitations
	Adequacy of conclusions	yes	Discussion
Selection Criteria Expert Panel	Member of organization	no	
	Recognized authority	yes	Methods- Respondent Group; Results- par 1
	Relevant clinical/academic expertise	yes	Methods- Respondent Group; Results- par 1
	Geographical scope	no	
	Setting/work field	no	
	Profession/ stakeholder	yes	Methods- Respondent Group; Results- par 1

Definitions: par = paragraph

Chapter 6- Conclusion

Conclusion:

The studies involved within this dissertation are the first of their kind framing patient-centered application of OMT through phenotyping. The first purpose was to present the concept of pain phenotyping in OMT, which was addressed by publishing a manuscript outlining the concepts of pain phenotyping, how it specifically relates to OMT, and how studies should be designed to assess phenotypic responses moving forward. The second purpose was to present literature supporting patient centered focus in manual therapy rather than previously used technique specific focus. This purpose was addressed by publishing an open-access blog addressing the status of the literature on this topic in a concise and direct manner. The third purpose was to investigate how patient specific factors (phenotypic factors) influence OMT treatment outcomes. A scoping review was completed identifying fifty trials which investigated this question. Small to moderate association was seen between these variables and clinical pain outcomes. The results of this review support the aforementioned works outlining the importance of patient factors on clinical pain outcomes. The final purpose was to assess how the progressive understanding of OMT should prompt updated paradigms of education and application. A Delphi study was completed reaching consensus regarding concepts which should be taught (or omitted from teaching) within OMT education, as well as how candidates for OMT should be identified clinically.

The overall results of the studies included within this dissertation support manual therapies transition from a biomedical model to a patient-centered biopsychosocial model for application. This supports recent statement papers published across manual therapy disciplines including chiropractors, osteopaths, and physical therapists.(Alvarez et al., 2021; Gliedt et al., 2017; Hutting et al., 2022) The biopsychosocial model focuses on patient and contextual factors influencing the pain experience that should be addressed to improve the pain experience for that individual.(Bevers et al., 2016; Jull, 2017) The results of this dissertation indicate that these factors also act as moderators and/or mediators of analgesic response to treatments including manual therapy. These results align with the historically proposed '*mature organisms' model'* framing pain and analgesia as outputs created by the patient in response to input (interventions included), contextual factors, and central processing.(Gifford, 1998) This model appreciates the clinical value of response to analgesic challenge (within and early between-session response), which is supported by the results of this dissertation as a valuable tool in assessing how the individual processes the provided input (intervention) by assessing what output (analgesia) occurs.

Future works for this author include working on National Institute of Health (NIH) initiatives to assist in identifying the mechanisms of force-based manipulation and completing research to identify gaps within this area of study across disciplines providing these techniques. Furthermore, this author is performing a translational proof of concept to attempt to correlate clinical outcomes with mechanism of adaptability which has been partially funded through a grant by the Ohio Physical Therapy Association.

Summary:

Pain phenotyping in orthopaedic manual therapy has enormous potential to improve patient outcomes and reduce unnecessary application. Transition towards a patient-centered model of care must focus on the biological, psychological, and social characteristics that make up a patient's pain phenotype. This dissertation framed the concept of pain phenotyping across three different subgrouping methods and took several steps towards a better understanding of how this concept should influence orthopedic manual therapy clinical practice and research.

Chapter 6- References:

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Bevers, K., The University of Texas at Arlington, Texas, US, Watts, L., The University of Texas at Arlington, Texas, US, Kishino, N.D., West Coast Spine Restoration Center, Riverside, California, US, Gatchel, R.J., The University of Texas at Arlington, Texas, US, 2016. The Biopsychosocial Model of the Assessment, Prevention, and Treatment of Chronic Pain. US Neurology 12, 98. https://doi.org/10.17925/USN.2016.12.02.98

Gifford, L., 1998. Pain, the Tissues and the Nervous System: A conceptual model. Physiotherapy 84, 27–36. https://doi.org/10.1016/S0031-9406(05)65900-7

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Jull, G., 2017. Biopsychosocial model of disease: 40 years on. Which way is the pendulum swinging? Br J Sports Med 51, 1187–1188. https://doi.org/10.1136/bjsports-2016-097362

Appendices

OSF REGISTRIES

The Role of Pain Phenotyping in Manual Therapy Practice: A Scoping

Contributors

Damian Keter

Description

Review of the literature on the relationship of variables which have shown to modify analgesic effects and manual therapy outcomes to assist in future subgrouping (pain phenotyping) to optimize manual therapy outcomes.

Registration type

OSF Preregistration

Date registered

February 12, 2021

Date created

February 12, 2021

Associated project

osf.io/zayjd

Internet Archive link

https://archive.org/details/osf-registrations-x9tbe-v1

Category

Project

Registration DOI

https://doi.org/10.17605/OSF.IO/X9TBE

Subjects

- Physical Therapy
- Rehabilitation and Therapy
- Medicine and Health Sciences

License

No license

Citation

osf.io/x9tbe

Study Information

Hypotheses

Phenotypic domains and variables which have shown in the literature to effect pharmacodynamic principles of analgesic treatment will also modify the analgesic effects of manual therapy interventions.

Design Plan

Study type

Other

Blinding

No blinding is involved in this study.

Is there any additional blinding in this study?

No response

Study design

Scoping Review of the Literature following the guidelines previously set forth regarding Preferred Reports Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews checklist (Tricco et al 2018- attached)

- Prisma Scoping Reviews.pdf

Randomization

No response

Sampling Plan

Existing Data

Registration prior to analysis of the data
Explanation of existing data

No response
Data collection procedures

Studies include randomized controlled trials, cohort studies, and case series performed in prospective or retrospective nature. Studies will included utilizing patients and healthy controls. Manual therapy techniques within the scope of Physical Therapy Manual Therapy practice will be included in the study. Electronic Databases including Pubmed, CINAHL, Cochrane Library, and Physiotherapy Evidence Database (PEDro) will be searched from 2005 to February 1, 2021

No files selected
Sample size

Scoping Review- n/a
Sample size rationale

No response
Stopping rule

No response

Variables

Manipulated variables

n/a

No files selected
Measured variables

Variables to include type of type of study, sample size and type, intervention performed, outcomes, effect size and significance.

No files selected
Indices

No response

No files selected

Analysis Plan

Statistical models

Extracted data will be summarized using descriptive statistics including type of manual technique utilized as well as other adjunctive treatments included. Given heterogeneity between studies no between study analysis will be performed.

No files selected

Transformations

No response

Inference criteria

No response

Data exclusion

No response

Missing data

No response

Exploratory analysis

No response

Other

Other

No response

Appendix II: Scoping Review Search Strategy

Appendix A: Manual Therapy techniques included in physical therapy practice and operational definitions

Technique	**Operational Definition**
Thrust Manipulation - spinal or peripheral	Application of high velocity, low amplitude passive force through joint(s) or tissue(s).
Non-thrust Manipulation (ie. mobilization) - spinal or peripheral	Application of passive force of varying velocity and amplitude through joint(s) or tissue(s).
Soft tissue mobilization	Application of force (static or dynamic) into soft tissue structures with varying types of manipulation.
Dry Needling	Insertion of monofilament needle into soft tissue structure with varying types of manipulation.
Light touch	Any therapeutic touch involving contact between therapist to the patient.
Passive Range of Motion	Skilled passive physiological movement of joint(s) and tissue(s).

*All above with the goal of promoting neurophysiological, psychological, and biomechanical changes to promote analgesia

Appendix B: Search Strategy

PubMed	(Manual Therapy[MeSH Terms]) AND ((Depressive Disorders[MeSH Terms]) OR (Anxiety Disorder[MeSH Terms]) OR (Catastrophisation[MeSH Terms]) OR (Attitude[MeSH Terms]) OR (Sleep Deprivation[MeSH Terms]) OR (Pain Threshold[MeSH Terms]) OR (Habituation Psychophysiology[MeSH Terms]) OR (Beliefs[MeSH Terms]) OR (Fatigue[MeSH Terms]) OR (Perception) OR (Pain Variability)OR (Within session changes) OR (Quantitative Sensory Testing) OR (QST) OR (Pain Modulation) OR (Patient Expectation) OR (Pain Adaptability))
CINAHL	MW Manual Therapy AND (Depression OR Anxiety OR Catastrophizing OR MW Attitude OR Expectations OR Fatigue OR Baseline Pain OR Pain Modulation OR Predictors)
Cochrane	(MeSH descriptor [Musculoskeletal Manipulations] explode all trees) AND (MeSH descriptor [Depressive Disorders] explode all trees OR MeSH descriptor [Anxiety Disroders] explode all trees OR MeSH descriptor [Catastrophizing] explode all trees OR MeSH descriptor [Attitude] explode all trees OR MeSH descriptor [Sleep Deprivation] explode all trees OR MeSH descriptor [Pain Threshold] explode all trees OR Pain Variability OR Pain Adaptability)
PEDro	Manual Therapy and Depression Manual Therapy and Anxiety Manual Therapy and Psychological Manual Therapy and Catastrophizing Manual Therapy and Attitudes Manual Therapy and Beliefs Manual Therapy and Sleep Manual Therapy and Pain Threshold Manual Therapy and Pain Modulation Manual Therapy and Pain Variability Manual Therapy and Fatigue Manual Therapy and Within session Manual Therapy and Baseline Pain

Filters: Full text, Clinical Trial, Meta-Analysis, Randomized Controlled Trial, Review, Systematic Review, Humans, English, from 2005-11/2/2022

Appendix III: Scoping Review- Cumulative Results Table

Appendix C: Results from included studies: population, manual intervention/treatment arm(s), phenotypic variables and measures, outcomes and criteria for responder status, and results.

Reference, First Author, Date, Study Design	Sample Size/ Population	Manual Technique	Phenotypic Variable & Measure	Outcome	Results
Patient Expectations					
Bialosky et al. 2014 RCT	n = 110 with LBP	Lumbar SMT	Expectations- Self-Developed questionnaire	PPT- Thermal (local) NPRS Oswestry Disability Index	Interaction was not observed for immediate change in suprathreshold heat response (F=0.32; p =0.73, partial eta2= 0.01) Interaction was not observed for change in LBP (F=0.76; p =0.47, partial eta2= 0.01)
Bishop et al. 2011 Retrospective Cohort	n = 112 with LBP	Lumbar SMT vs Lumbar Mobilization	Expectations- Self-Developed questionnaire	Oswestry Disability Index	Univariate association between the specific expectation for SMT and a successful outcome was not significant (P >.05, 0.063) Weak association between having expectations met (regardless of group) and experiencing successful outcome at visit 5 (x2= 11.9, p >.05, 0.065)
Bishop et al. 2013 Retrospective Cohort	n = 140 with neck pain	Thoracic SMT	Expectations- Self-Developed questionnaire	NDI GROC	Unsure expectations of pain relief lowered odds of reporting a successful outcome vs patients expecting complete relief (OR = 0.33) at 1-month. Unsure expectations of pain relief lowered the odds of success (OR = 0.19) at 6-months after treatment Believing that manipulation would help and not receiving manipulation lowered the odds of success (OR = 0.16) vs believing manipulation would help and receiving manipulation.
Cruser et al. 2012 RCT	n = 63 active-duty personnel with acute LBP	Pragmatic OMT including soft tissue mobilization, myofascial release, counter strain, muscle energy, sacroiliac articulation, thrust manipulation	Expectations- Self-Developed Likert rating of 4 statements	VAS	Pearson correlation coefficient analysis found no significant relationships between overall improvement, patient satisfaction and treatment expectations
Dissing et al. 2019 Secondary analysis of RCT	n = 238 children (aged 9-15) with complaints of spinal pain	Soft tissue mobilization, exercise, advice vs same with pragmatic spinal thrust manipulation	Expectations- Expected outcome vs baseline: 5-point scale	NPRS change Global Perceived Effect (7-point Scale)	Positive expectations of recovery (β =-.64) versus negative expectations of recovery (β =.87) with NPRS change (p = .33) Positive expectations of recovery (OR .38) versus negative expectations of recovery (OR .33) with Global Perceived effect (p =.93)
Donaldson et al. 2013 Secondary Analysis of RCT	n = 149 with low back pain	Thrust manipulation vs non-thrust manipulation	Expectations- Patient selection of technique which they thought would be more beneficial to them	NPRS	Matching patient expectations to treatment numeric pain score (mean change 3.2) Not matching treatment to expectations numeric pain score (mean change 3.6) (p =.22)
Groeneweg et al. 2017 Secondary analysis of RCT	n= 181 with neck pain	Pragmatic cervical spine mobilization vs pragmatic exercise, manual traction, and soft tissue mobilization	Expectations- Credibility Expectancy Questionnaire	NPRS	Baseline Expectations on NPRS at 7 weeks β = .127 (p =.009) and 26 weeks β = .158 (p =.006)
Haas et al. 2010 RCT	n = 80 with chronic cervicogeni c headache (CGH)	Prescriptive Cervical and CTJ Thrust Manipulation (Experimental) Soft Tissue Massage (Control)	Expectations- 6-point Likert scale	mVKPS	Baseline expectations on pain intensity at 4 weeks (β =-.15) Expectations at 4 weeks on pain intensity at 8 weeks (β =.06) Expectations at 8 weeks on pain intensity at 12 weeks (β =.10)

Appendix III: Scoping Review- Cumulative Results Table

Haas et al. 2014 RCT	n = 400 with cLBP	Pragmatically applied Thrust Manipulation (experimental) Soft Tissue Massage (Control)	Expectations- 6-point Likert scale	mVKPS	Expectations- Baseline correlation with LBP-6 weeks (r =.07) and LBP- 12 weeks (r =.07)
Hill et al. 2007 Secondary Analysis of RCT	n=350 with neck pain	Exercise vs Exercise and pragmatic OMT vs Exercise and Diathermy	Expectations- 5-point self-reported scale	Global Change (1-5 scale)- "much better' or "better" defined as responder Northwick Park Neck Pain Questionnaire (MCID-NPQ)	OR's for association between prognostic indicators and poor outcomes at 6 weeks/6 months: Univariate Low Expectations: OR 3.24 (p<.05) for global change at 6 weeks: OR 4.66 (p<.001) for global change at 6 months: OR 2.29 (p<.05) for NPQ at 6 weeks: Not significant for NPQ at 6 months
Palmlof et al. 2016 Secondary Analysis of RCT	n = 697 with neck pain +/- concurrent LBP	Spinal manipulation, spinal mobilization, muscle stretching, and soft tissue massage	Expectations- 11-point scale anchoring at 0: 'Not at all likely that I will be completely recovered', and 10: 'Very likely that I will be completely recovered'.	Global Perceived Recovery Question -'Which of the following statements is most consistent with your perception of the change in your neck/neck and back complaint since joined this study?'	Moderate (Rating 4-6) expectations of recovery at baseline (RR 1.28, CI 95%) of recovery at 7 weeks as compared with low expectations (Rating 0-3) High (Rating 7-10) expectations of recovery at baseline (RR 1.64, CI 95%) of recovery at 7 weeks as compared with low expectations (Rating 0-3)
Pasquier et al. 2022 Cohort	n = 107 with thoracic pain	Pragmatic thoracic SMT	Expectations- Modified patient Global Impression of Change Scale	NPRS	Expectations in improvement in disability OR 1.62 (p = .026) for pain score at 7 days post SMT.
Petersen et al. 2015 Secondary analysis of RCT	n = 175 with cLBP	Pragmatic Lumbar Thrust Manipulation	Expectations- (measure not specified)	RMDQ: 15% improvement was considered successful outcome	Expectation- Both Individuals with high expectations and low expectations of recovery had a 57% success rate with SMT.
Riley et al. 2015 Secondary Analysis of RCT	n = 88 with shoulder pain	Prescriptive thoracic thrust manipulation vs sham thrust manipulation (scapular thrust) *both with either positive or negative educational set	Expectations- Self-developed: 5-point Likert regarding the effect of thrust manipulation on shoulder pain.	Shoulder Pain and Disability Index (SPADI) NPRS (Least, Most, Average, Present)	No statistically significant interaction between expectations and SPADI (p =.713), least pain (p =.192), most Pain (p =.457), and average Pain (p =.114)
Rubinstein et al. 2008 Prospective Cohort	n = 424 with neck pain	Pragmatic intervention at discretion of chiropractor	Expectations- Self reported	Perceived recovery- 6-point Likert scale: "completely improved" or "much better" were defined as "recovered."	Expectations on pain outcomes at 12 months: $\beta = .44$ (p = .005)
Thomas et al. 2020 Single Blinded RCT	n = 108 with cLBP	Technique prescriptive (Sidelying Lumbar) location pragmatic spinal thrust manipulation Technique prescriptive (Sidelying Lumbar) location pragmatic spinal non-thrust mobilization	Expectations- Credibility and expectancy questionnaire.	NPRS- 2-point reduction in NPRS score indicating positive response	Combined groups- treatment expectancy scores inversely correlated with the change in pain ratings(r = −0.396; P < .01) – those with higher expectations of treatment success reported larger decreases in pain with treatment. Individual Groups- Spinal manipulation (r = − 0.423; P = .002); Spinal mobilization (r = −0.188; P = .18).

Underwood et al. 2007 Secondary analysis of RCT	n = 273 with low back pain	Prescriptive Lumbar Spinal Manipulation over 8 sessions	Expectations- 3 -point Likert scale: very helpful, helpful or not helpful?	Roland Morris Disability Questionnaire (RMDQ)	Expectations: Helpful: β = .0 (p =.669) at 3 months β = -.1 (p =.083) at 12 months Expectations: Very helpful: β =1.6 (p =.113) at 3 months and β =1.2 (p =.250) at 12 months
Depression					
Alonso-Perez et al. 2017 RCT	n = 74 healthy controls	Cervical SMT vs Cervical Lateral Glide Mobilization vs Cervical Central PA Mobilization	Depression- Beck depression Inventory (BDI-II) (Spanish)	PPT: Local and Global	No significant psychological interaction between baseline depression and outcomes
Hill et al. 2007 Secondary Analysis of RCT	n = 350 with neck pain	Exercise vs Exercise and pragmatic OMT vs Exercise and Diathermy	Depression- SF12- Mental Component Score (MCS)	Global Change (1-5 scale)- "much better' or "better" defined as responder Northwick Park Neck Pain Questionnaire (MCID-NPQ)	OR's for association between prognostic indicators and poor outcomes at 6 weeks/6 months: Univariate Lower clinical depression: Not significant for any outcome at 6 weeks: OR .70 (p<.01) for global change at 6 months: OR .71 (p<.01) for NPQ at 6 months.
Lee et al. 2021 RCT	n = 108 with neck pain	Pragmatic Chuna Manual Therapy vs oral medication and electrotherapy	Depression- Medical Outcomes Study 12-Item Short-Form General Survey (SF-12)	VAS	No significant interaction between differences in pain outcomes and Depression at baseline (p = .79),
Licciardone et al. 2014 RCT	n = 186 with high severity cLBP (>50 mm on a 100-mm VAS)	Specific vs non-specific OMT	Depression- Presence as comorbidity (yes/no)	100-mm VAS: > 50% pain reduction indicating positive response	Diagnosis of comorbid depression absent (RR 1.31) vs comorbid depression present (RR 2.46) for positive initial response.
Kinesiophobia/Fear Avoidance					
Alonso-Perez et al. 2017 RCT	n = 74 healthy controls	Cervical SMT vs Cervical Lateral Glide Mobilization vs Cervical Central PA Mobilization	Kinesiophobia -Tampa Scale for Kinesiophobia (TSK)	Pain Threshold (PPT)- Local and Global	No significant psychological interaction between baseline kinesiophobia and outcomes
Bialosky et al. 2009 RCT	n = 63 with LBP	Prescriptive Lumbar Spinal Manipulative Therapy	Kinesiophobia- Tampa Scale for Kinesiophobia (TSK)	PPT- Thermal (local) Temporal Summation (local)	No significant correlation between baseline kinesiophobia and changes in pain sensitivity (47°C; r = -.39; p = .24)(49°C; r = -.40; p = .22) or temporal summation (r = .08; p = .83)
Bishop et al. 2011 (2) RCT	n = 90 healthy controls	Prescriptive upper thoracic SMT vs prescriptive exercise vs rest (control)	Kinesiophobia- Tampa Scale for Kinesiophobia (TSK) Fear of Pain Questionnaire (FPQ-9)	PPT UE and LE Temporal Summation	Association between variable and change in PPT: Kinesiophobia = .132; Fear = .162 Association between variable and change in temporal summation: Kinesiophobia = - .074; Fear = -.061
Cleland et al. 2007 Prospective Cohort	n = 78 with mechanical neck pain	Prescriptive- 3 thoracic thrust manipulation techniques: seated "distraction" manipulation, supine upper thoracic manipulation and	Fear Avoidance- FABQ (W and PA)	GROC- score of > +5 or greater at the second session indicating positive response	FABQPA <12: Pos Likelihood Ratio 3.4 (1.05–11.20) in identifying responder at discharge FABQW < 10 Pos likelihood 1.8 (1.02–3.15) in identifying responder at discharge

		middle thoracic manipulation			
Groeneweg et al. 2017 Secondary analysis of RCT	n= 181 with neck pain	Pragmatic cervical spine mobilization vs pragmatic exercise, manual traction, and soft tissue mobilization	Fear Avoidance- FABQ (Dutch)	NPRS	Fear Avoidance (Physical Activity) on NPRS at 7 weeks β = - .033 (p =.293) and 26 weeks β = - .07 (p =.061) Fear Avoidance (Work) on NPRS at 7 weeks β = - .017 (p =.983) and 26 weeks β = - .026 (p =.125)
Hill et al. 2007 Secondary Analysis of RCT	n=350 with neck pain	Exercise vs Exercise and pragmatic OMT vs Exercise and Diathermy	Fear Avoidance- Single question taken from Tampa Kinesiophobia Index	Global Change (1-5 scale)- "much better' or "better" defined as responder Northwick Park Neck Pain Questionnaire (MCID-NPQ)	OR's for association between prognostic indicators and poor outcomes at 6 weeks/6 months: Univariate Fear Avoidance 'most of the time': OR 2.05 (p<.1) for global change at 6 weeks: OR 2.51 (p<.05) for global change at 6 months: Not significant for NPQ at 6 weeks: OR 2.47 (p<.05) for NPQ at 6 months Fear Avoidance 'some of the time': Not significant for global change at 6 weeks or 6 months: OR 1.82 (p<.05) for NPQ at 6 weeks: OR 1.50 (p<.1) for NPQ at 6 months Not significant for any outcome at 6 weeks: OR .70 (p<.01) for global change at 6 months: OR .71 (p<.01) for NPQ at 6 months.
Lopez-Lopez et al. 2015 RCT	n = 48 with neck pain	Pragmatic Cervical Thrust Manipulation Unilateral cervical PA Mobilization (location pragmatic- technique prescriptive) Cervical Sustained Natural Apophyseal Glide (SNAG) (location and direction pragmatic, reps prescriptive)	Kinesiophobia -Tampa Scale for Kinesiophobia (TSK)	100-mm VAS	No association between kinesiophobia and pain outcomes
Rubinstein et al. 2008 Prospective Cohort	n = 424 with neck pain	Pragmatic intervention at discretion of chiropractor	Kinesiophobia- Tampa Scale for Kinesiophobia (TSK)	Perceived recovery- 6-point Likert scale: "completely improved" or "much better" were defined as "recovered."	Kinesiophobia X2 = 23.4 with neck pain intensity (p< .05)
Underwood et al. 2007 Secondary analysis of RCT	n = 273 with low back pain	Prescriptive Lumbar Spinal Manipulation over 8 sessions	Fear Avoidance- FABQ	RMDQ	FABQ Beliefs on RMDQ β =-.8 (P =.070) at 3 months and β =-.4 (P =.328) at 12 months
Wingbermühle et al. 2021 Prospective Cohort	n = 1193 with neck pain	Pragmatic OMT, advice, and exercise	Fear Avoidance- FABQ	NPRS Global Perceived Effect	FABQ PA no correlation with pain, coefficient with perceived improvement = .04 at discharge; no correlation with pain or perceived improvement at 1 year. (p< .157)
Anxiety					
Alonso-Perez et al. 2017 RCT	n = 74 healthy controls	Cervical SMT vs Cervical Lateral Glide Mobilization vs Cervical Central PA Mobilization	Anxiety- State-Trait Anxiety Inventory (STAI) (Spanish)	PPT: Local and Global	No significant Psychological interaction between baseline anxiety and outcomes
Aspinall et al. 2020 Secondary analysis of RCT	n = 80 with LBP	Prescriptive lumbar SMT vs sham (mobilization)	Anxiety- PROMIS Anxiety T-Score	Modified Global Back Recovery Scale: > +2 indicating responder status	Anxiety (PROMIS-Anxiety) mean (53.63) in rapid responder group; mean (53.72) in non-rapid responder group

Bialosky et al. 2009 RCT	n = 63 with LBP	Prescriptive Lumbar Spinal Manipulative Therapy	Anxiety- State-Trait Anxiety Inventory (STAI)	PPT: Thermal (local) Temporal Summation (local)	State anxiety (r = -.62, p =.04) was significantly associated with changes in pain sensitivity in the lower extremity in participants who received SMT Psychological variables were not correlated with the change in temporal summation in the lower extremity observed in participants who received the SMT (P>.05)
Bishop et al. 2011 (2) RCT	n = 90 healthy controls	Prescriptive upper thoracic SMT vs prescriptive exercise vs rest (control)	Anxiety- Anxiety Sensitivity Index (ASI)	PPT UE and LE Temporal Summation	Association between variable and change in PPT: Anxiety = .20 Association between variable and change in temporal summation: Anxiety = -.18
Lopez-Lopez et al. 2015 RCT	n = 48 with neck pain	Pragmatic Cervical Thrust Manipulation Unilateral cervical PA Mobilization (location pragmatic- technique prescriptive) Cervical Sustained Natural Apophyseal Glide (SNAG) (location and direction pragmatic, reps prescriptive)	Anxiety- State-Trait Anxiety Inventory (STAI) (Spanish)	100-mm VAS	Individuals with low anxiety at baseline showed larger Mean difference in pain intensity in Thrust Manipulation (Mean Diff 4.71, p <.01) and SNAG (Mean Diff 2.26, p<.01) groups than PA Mobilization group (Mean Diff .37) Individuals with baseline High Anxiety showed larger Mean difference in pain intensity in PA Mobilization group (Mean Diff 2.72, p <.001) than SNAG (Mean Diff .63) and Thrust manipulation groups (Mean Diff 1.03)
Whitman et al. 2009 Cohort	n = 85 with ankle pain post inversion ankle sprain	Prescriptive manual therapy intervention including thrust and non-thrust manipulation and exercise program	Anxiety- Beck Anxiety Index (BAI)	GROC: score of > +5 indicating positive response	Individuals with successful outcomes had lower baseline anxiety (mean 6.6) versus those whom did not have a sucessful outcome (mean 7.1) (p =.56)
Catastrophizing					
Alonso-Perez et al., 2017 RCT	n = 74 healthy controls	Cervical SMT vs Cervical Lateral Glide Mobilization vs Cervical Central PA Mobilization	Catastrophizing- Pain Catastrophizing Scale (PCS) (Spanish)	Pain Threshold (PPT)- Local and Global	Catastrophizing interacted with change in local PPT only in the HVLA group: (F = 3.70, p = .03) No significant Psychological interaction between baseline kinesiophobia and outcomes
Aspinall et al. 2020 Secondary analysis of RCT	n = 80 with LBP	Prescriptive lumbar SMT vs sham (mobilization)	Catastrophizing- Pain Catastrophizing Scale (PCS)	Modified Global Back Recovery Scale: > +2 indicating responder status	Catastrophizing (PCS) mean (12.74) in rapid responder group; mean (14.96) in non-rapid responder group
Bialosky et al. 2009 RCT	n = 63 with LBP	Prescriptive Lumbar Spinal Manipulative Therapy	Catastrophizing- The Coping Strategies Questionnaire (CSQ-R) catastrophizing subscale	PPT- Thermal (local) Temporal Summation (local)	Pain catastrophizing (r = - .67, P =.02) was significantly associated with changes in pain sensitivity in the lower extremity in participants who received SMT Psychological variables were not correlated with the change in temporal summation in the lower extremity observed in participants who received the SMT (P>.05)
Bishop et al. 2011 (2) RCT	n = 90 healthy controls	Prescriptive upper thoracic SMT vs prescriptive exercise vs rest (control)	Catastrophizing- Pain Catastrophizing Scale (PCS)	PPT UE and LE Temporal Summation	Association between variable and change in PPT: Catastrophizing: .088 Association between variable and change in temporal summation: Catastrophizing: - .061
Hill et al. 2007 Secondary Analysis of RCT	n = 350 with neck pain	Exercise vs Exercise and pragmatic OMT vs Exercise and Diathermy	Catastrophizing- Single question taken from pain catastrophizing scale	Global Change (1-5 scale)- "much better' or "better" defined as responder Northwick Park Neck Pain Questionnaire (MCID-NPQ)	OR's for association between prognostic indicators and poor outcomes at 6 weeks/6 months: Univariate Catastrophizing 'Some of the time': not significant for any outcomes at any timeframe Catatrophizing 'most of the time': OR 2.25 (p<.05) for global change at 6 weeks: OR 7.43 (p<.001) for global change at 6 months: OR 1.85 (p<.1) for NPQ at 6 weeks: OR 4.01 (p<.001) for NPQ at 6 months

Appendix III: Scoping Review- Cumulative Results Table

Lopez-Lopez et al. 2015 RCT	n = 48 with neck pain	Pragmatic Cervical Thrust Manipulation Unilateral cervical PA Mobilization (location pragmatic- technique prescriptive) Cervical Sustained Natural Apophyseal Glide (SNAG) (location and direction pragmatic, reps prescriptive)	Catastrophizing- Pain Catastrophizing Scale (PCS) (Spanish)	Pain- 100-mm VAS	No association between catastrophizing and pain outcomes
Verhagen et al. 2010 Secondary Analysis of Cohort	n = 397 with neck pain	Pragmatic OMT (region not specified) vs exercise without OMT	Catastrophizing- Coping Strategies Questionnaire Catastrophizing subscale (6 item)	Perceived recovery: 7-point Likert scale	Higher catastrophizing increased chances of recovery with MT over Exercise with score of 12 on the catastrophizing scale MT = Exercise; Score <12 favoring exercise; Score > 12 favoring MT
Combined					
French et al. 2014 Secondary analysis of RCT	n = 123 (9 weeks) and n =112 (18 weeks) with hip pain and confirmed hip OA	Non-manipulative manual therapy vs Exercise vs control	Anxiety and Depression- Hospital Anxiety and Depression Scale	OMERACT/OARSI criteria- measure of pain function, and global assessment	HADS (.91 OR) for response at 9 weeks, (.95 OR) for response at 18 weeks HADS <9 (+LR1.61) in predicting response at 9 weeks *Results based on combined (OMT + non-OMT) groups
Hough et al. 2007 Secondary analysis of RCT	n = 39 with LBP	Pragmatic OMT with HEP vs Active Rehabilitation without OMT	Depression, Anxiety, Expectations, Sleep - Linton & Hallden Psychosocial questionnaire	100mm VAS	Low Linton & Hallden Score (<106) β =-8.5 (p = .41) with pain at 4 weeks *Results based on combined (OMT + non-OMT) groups
Rubinstein et al. 2008 Prospective Cohort	n = 424 with neck pain	Pragmatic intervention at discretion of chiropractor	Depression/Fear- 11 pt numerical rating scale	Perceived recovery- 6-point Likert scale: "completely improved" or "much better" were defined as "recovered."	Concordant Depression/Fear X2 =16.0 with neck pain intensity (p<.05)
Wingbermühle et al. 2021 Prospective Cohort	n = 1193 with neck pain	Pragmatic OMT, advice, and exercise	Depression and Anxiety- (Neck Bournemouth Questionnaire-DV (NBQ-DV) anxiety and depression subscale	NPRS Global Perceived Effect	Anxiety/Depression OR 1.05 for predicting recovery from neck pain post treatment; no interaction with perceived improvement. (p< .157)
Sleep/Fatigue					
Lee et al. 2021 RCT	n = 108 with neck pain	Pragmatic Chuna Manual Therapy vs oral medication and electrotherapy	Sleep/Fatigue- European Quality of Life–5 Dimension 5 Levels	VAS	No significant interaction between differences in pain outcomes and trouble sleeping due to pain (p = .27), Significant interaction between differences in pain outcomes favoring MT group for pain at baseline that worsens during fatigue (p = .03)
Rubinstein et al. 2008 Prospective Cohort	n = 424 with neck pain	Pragmatic intervention at discretion of chiropractor	Fatigue- 11 pt numerical rating scale	NPRS	Tiredness on NPRS β = .39 (p<.001)
Wingbermühle et al. 2021 Prospective Cohort	n = 1193 with neck pain	Pragmatic OMT, advice, and exercise	Sleep/Fatigue- Self reported sleeping problems (yes/no)	NPRS Global Perceived Effect	Sleeping problems demonstrated no statistical prognostic value post treatment related to pain or perceived improvement; at 1 year sleeping problems OR with recovery of neck pain .62 and with perceived improvement .67 (p< .157)
Baseline Pain Intensity					

Appendix III: Scoping Review- Cumulative Results Table

Aspinall et al. 2020 Secondary analysis of RCT	n = 80 with LBP	Prescriptive lumbar SMT vs sham (mobilization)	Baseline Pain- NPRS	Modified Global Back Recovery Scale: ≥ +2 indicating responder status	Baseline pain intensity (NPRS): mean (3.0) in rapid responder group; mean (2.0) in non-rapid responder group
Burns et al. 2018 Secondary analysis of RCT	n = 90 with LBP	Pragmatic LBP intervention including OMT vs Same plus Non-thrust mobilization to hips	Baseline Pain- NPRS	ODI/NPRS: >10% improve ODI, ≤2 on the NPRS at discharge, GROC score ≥+4 at 2 weeks and discharge *all 4 criteria met = recovered	Baseline NPRS of 4 point or less (OR 4.99 (p = .01)) in identifying recovery
Castien et al. 2012 Retrospective Cohort	n = 142 with headaches (Tension type only)	Joint and soft tissue mobilization, SMT Cervical and Thoracic	Baseline Pain- NPRS	NPRS	Prognostic at 8 weeks: Multiple-site pain present odds ratio: 0.18 95% CI 0.06–0.6 Headache intensity (NPRS) Odds Ratio: 1.36 95% CI 1.05–1.78
Dissing et al. 2019 Secondary analysis of RCT	n = 238 children aged 9-15 with complaints of spinal pain	Soft tissue mobilization, exercise, advice vs same with pragmatic spinal manipulation	Baseline Pain- NPRS	NPRS Global Perceived Effect (7-point Scale)	Baseline pain intensity ≤ 7 (β =-.05) versus baseline pain intensity >7 (β =.22) with NPRS Change at 2 weeks (p = .82) Baseline pain intensity <7 (OR .46) versus baseline pain intensity >7 (OR .40) with Global Perceived effect at 2 weeks (p = .90)
Fernandez-de-las-Peñas et al. 2019 Secondary analysis of RCT	n = 120 women with carpal tunnel syndrome	Soft tissue mobilization along median nerve pathway, lateral glides to cervical spine, and tendon and nerve gliding exercises targeting the median nerve HEP	Baseline Pain- NPRS	NPRS	For mean Pain Intensity at 6 months: Baseline Mean Pain Intensity β =.631 For mean Pain Intensity at 12 months: Baseline Mean Pain Intensity β =.660
French et al. 2014 Secondary analysis of RCT	n = 123 (9 weeks) and n =112 (18 weeks) with hip pain OA	Non-manipulative manual therapy vs Exercise vs control	Baseline Pain- NPRS	OMERACT/OARSI criteria- measure of pain function, and global assessment	NPRS (.85 OR) for response at 9 weeks, (.89 OR) for response at 18 weeks NPRS <6 (+LR 1.44) in predicting response at 9 weeks *Results based on combined (OMT + non-OMT) groups
Groeneweg et al. 2017; Secondary analysis of RCT	n= 181 with neck pain	Pragmatic cervical spine mobilization vs pragmatic exercise, manual traction, and soft tissue mobilization	Baseline Pain- NPRS	NPRS	Baseline NPRS on NPRS at 7 weeks β = .264 (p = .017) and 26 weeks β = .311 (p =.009)
Haas et al. 2010 RCT	n = 80 with chronic cervicogenic headache	Prescriptive Cervical and CTJ Thrust Manipulation (Experimental) Soft Tissue Massage (Control)	Baseline Pain - Modified Von Korff pain scale	mVKPS	Baseline pain intensity on Pain intensity at 4 weeks (β = -.54), 8 weeks (β = -.50), and 12 weeks (β = -.57)
Haas et al. 2014 RCT	n = 400 with cLBP	Pragmatically applied Thrust Manipulation (experimental) Soft Tissue Massage (control)	Baseline Pain - Modified Von Korff pain scale	mVKPS	LBP-Baseline correlation with LBP-6 weeks (r =.44*) and LBP- 12 weeks (r =.41*)

Appendix III: Scoping Review- Cumulative Results Table

Hill et al. 2007 Secondary Analysis of RCT	n=350 with neck pain	Exercise vs Exercise and pragmatic OMT vs Exercise and Diathermy	Baseline Pain- NPRS	Global Change (1-5 scale)- "much better' or "better" defined as responder Northwick Park Neck Pain Questionnaire (MCID-NPQ)	Severe baseline pain (9-10 NPRS): OR 2.81 (p<.05) for 6 week global change; OR 3.58 (p<.01) for 6 month global change: not significant for 6 week NPQ; OR 3.52 (p<.05) for 6 month NPQ
Hough et al. 2007 Secondary analysis of RCT	n = 39 with LBP	Pragmatic OMT with HEP vs Active Rehabilitation without OMT	Baseline Pain- VAS (100mm)	VAS	Baseline Pain Score β =.28 (p = .09) with pain at 4 weeks *Results based on combined (OMT + non-OMT) groups
Lascurain-Aguirrebena et al. 2018 RCT	n = 40 with neck pain	Pragmatic mobilization to cervical spine: Grade II-III Placebo- hand placement per above without glide	Baseline Pain- NPRS (maximum and average)	GROC: score of ≥ +3 indicating positive response	Maximum Baseline Pain: < 7 OR 2.16; ≥ 7 OR 20.52 on within session improvement Average Baseline Pain; < 5 OR 15.00; ≥ 5 OR 9.38 on within session improvement *All favoring mobilization over placebo
Lee et al. 2021 RCT	n = 108 with neck pain	Pragmatic Chuna Manual Therapy vs oral medication and electrotherapy	Baseline Pain- NPRS	VAS	No significant interaction between differences in pain outcomes and pain intensity at baseline (p =.78), pain variability throughout the day (p = .26),
Licciardone et al. 2013 Secondary analysis RCT	n = 455 with LBP	Specific vs non-specific (sham) OMT	Baseline Pain- 100-mm VAS	100-mm VAS: > 50% pain reduction indicating positive response	Low baseline Pain (<50 mm VAS) RR (1.15) (p =.29) on >50% reduction VAS score at 12 weeks High baseline Pain(≥50 mm VAS) RR (2.04)(p =.02) on >50% reduction VAS score at 12 weeks
Petersen et al. 2015 Secondary analysis of RCT	n = 175 with cLBP	Pragmatic Lumbar Thrust Manipulation	Baseline Pain- (measure not specified)	RMDQ: 15% improvement was considered successful outcome	Pain Intensity- Individuals with mild LBP at baseline had 63% success rate with SMT while those with moderate to severe had a 52% success rate with SMT
Vavrek et al. 2015 RCT	n = 91 with low back pain	SMT, hot pack, ultrasound (exp) Massage, hot pack, ultrasound (cont)	Baseline Pain- Modified Von Korff pain scale	NPRS	Baseline pain intensity β coefficient= 4.77 (P<.001) on future pain intensity (52-week follow-up)
Verhagen et al. 2010 Secondary Analysis of Cohort	n= 397 with neck pain	Pragmatic OMT (region not specified) vs exercise without OMT	Baseline Pain- 11-point NPRS	Perceived recovery: 7-point Likert scale	Higher pain severity increased chances of recovery with MT over Exercise with score of 6 on the NPRS MT = Exercise; Severity score > 6 increased chance to recover from manual therapy more than exercise
Whitman et al. 2009 Cohort Study	n = 85 with ankle pain post inversion ankle sprain	Prescriptive manual therapy intervention including thrust and non-thrust manipulation and exercise program	Baseline pain- NPRS	GROC: score of ≥ +5 indicating positive response	Individuals with successful outcomes had slightly higher baseline average pain (mean 4.0) versus those who did not have a successful outcome (mean 3.9) (p =.79)
Wingbermühle et al 2021 Prospective cohort	n = 1193 with neck pain	Pragmatic OMT, advice, and exercise	Baseline pain – NPRS	NPRS Global Perceived Effect	Baseline pain intensity OR for recovery from neck pain post treatment 1.21; at 1 year 1.14 (p< .157) No association with perceived improvement at discharge or at 1 year. (p< .157)
Wright et al. 2011 Secondary analysis of RCT	n = 93 with hip OA	OMT vs Exercise vs OMT and Exercise vs usual care	Baseline Pain- NPRS	OMERACT/OARSI criteria- measure of pain function, and global assessment	Baseline Pain >6/10 Positive LR 4.71 in identifying responders post 9 sessions *Results based on combined (OMT + non-OMT) groups
Yung et al. 2020 RCT	n=43 with non-chronic neck pain	Anterior to posterior vs lateral cervical non-thrust manipulation	Baseline Pain- NPRS	NPRS	Average pain at baseline predictive coefficient in determining averaged pain reduction .453 (p = .002)

Appendix III: Scoping Review- Cumulative Results Table

Symptom Duration					
Cleland et al. 2007 Prospective Cohort	n = 78 with mechanical neck pain	Prescriptive- 3 thoracic thrust manipulation techniques: seated "distraction" manipulation, supine upper thoracic manipulation and middle thoracic manipulation	Symptom Duration- Self-reported	GROC: score of ≥ +5 or greater at the second session indicating positive response	Symptom duration <30 days: Pos likelihood ratio of 6.4 (1.60–26.3) in identifying responder at discharge
Gattie et al. 2021 RCT	n = 77 with neck pain	Pragmatic dry needling vs sham needling along with OMT and exercise	Symptom Duration- Self- reported	VAS GROC	Duration of symptoms was not a significant predictor of outcome in any of the measured outcomes at 4 weeks: current pain (β = .007; 95% CI: –0.002, 0.017; P = .14, R^2 = 0.03), average pain over 24 hours (β = .100; 95% CI: –0.003, 0.023; P = .14, R^2 = 0.03), GROC C (β = –.006; 95% CI: –0.019, 0.006; P = .32, R^2 = 0.01)
Hill et al. 2007 Secondary Analysis of RCT	n=350 with neck pain	Exercise vs Exercise and pragmatic OMT vs Exercise and Diathermy	Symptom Duration- Self- reported	Global Change (1-5 scale): "much better' or "better" defined as responder Northwick Park Neck Pain Questionnaire (MCID-NPQ)	OR's for association between prognostic indicators and poor outcomes at 6 weeks/6 months: Univariate Pain Duration > 3 months: OR 1.94 (p<.05) for 6 week global change: OR 2.23 (p<.01) for 6 month global change: not significant for NPQ at 6 weeks or 6 months
Hough et al. 2007 Secondary analysis of RCT	n = 39 with LBP	Pragmatic OMT with HEP vs Active Rehabilitation without OMT	Symptom Duration- Self-reported	VAS	Baseline Pain Chronicity β =-.03 (p = .65) with pain at 4 weeks *Results based on combined (OMT + non-OMT) groups
Lascurain-Aguirrebena et al. 2018 RCT	n = 40 with neck pain	Pragmatic mobilization to cervical spine: Grade II-III Placebo- hand placement per above without glide	Symptom Duration- Self-reported	GROC: score of ≥ +3 indicating positive response	Baseline duration of symptoms on within session GROC: Acute: OR 23.97 Chronic: OR 11.28
Lee et al. 2021 RCT	n = 108 with neck pain	Pragmatic Chuna Manual Therapy vs oral medication and electrotherapy	Symptom Duration- > 2 years vs < 2 years	VAS	No significant interaction between differences in pain outcomes and chronicity of symptoms (p = .88)
Rubinstein et al. 2008 Prospective Cohort	n = 424 with neck pain	Pragmatic intervention at discretion of chiropractor	Symptom Duration- Self-reported number of days with neck pain in the past year	Perceived recovery: 6-point Likert scale: Those "completely improved" or "much better" were defined as "recovered."	Number of days with neck pain in the preceding year X^2 = 84.2 with neck pain intensity
Whitman et al. 2009 Cohort Study	n = 85 with ankle pain post inversion ankle sprain	Prescriptive manual therapy intervention including thrust and non-thrust manipulation and exercise program	Symptom Duration- Self-reported	GROC: score of ≥ +5 indicating positive response	Individuals with successful outcomes had a shorter duration of symptoms at baseline (mean 22.0) versus those whom did not have successful outcomes (mean 23.1) (p = .92)
Wright et al. 2011 Secondary analysis of RCT	n = 93 with hip OA	OMT vs Exercise vs OMT and Exercise vs usual care	Symptom Duration- Self-reported	OMERACT/OARSI criteria- measure of pain function, and global assessment	Duration of symptoms <1-year Positive LR 4.88 in identifying responders post 9 sessions *Results based on combined (OMT + non-OMT) groups
Pain Variability					
Lee et al. 2021 RCT	n = 108 with neck pain	Pragmatic Chuna Manual Therapy vs oral medication and electrotherapy	Pain Variability- Self reported constant vs episodic	VAS	No significant interaction between differences in pain outcomes at 2 weeks and baseline pain variability throughout the day (p = .26),

Appendix III: Scoping Review- Cumulative Results Table

Gudavali et al. 2006 RCT	n = 123 with cLBP	Flexion-Distraction Thrust manipulation (experimental) Pragmatic HEP (control)	Pain Variability- Chronic constant vs chronic recurrent nature of LBP	Pain- 100-mm VAS	Patients with non-variable (constant) LBP had larger improvement in VAS (n= 91, Mean 23.75) vs patients with variable (recurrent) LBP (n= 17, Mean 16.85)
Wingbermühle et al 2021 Prospective cohort	n = 1193 with neck pain	Pragmatic OMT, advice, and exercise	Pain Variability- self reported constant vs intermittent	NPRS Global Perceived Effect	Constant pain OR .03 with pain and .07 with perceived improvement post treatment (p< .157) Constant pain OR .28 with pain and .25 with perceived improvement at 1 year (p< .157)
Pain Irritability					
Burns et al. 2018 Secondary analysis of RCT	n = 90 with LBP	Pragmatic LBP intervention including OMT vs Same plus Non-thrust mobilization to hips	Baseline Pain Irritability- Irritable defined as "yes" or "no" by the treating therapist	ODI NPRS Considered improved if ≤10% improve ODI and ≤2 on the NPRS at discharge and record a GROC score ≥+4 at both 2 weeks and discharge *all 4 criteria had to be met to be considered recovered	Baseline irritability status (OR 3.63 (p = .03)) in identifying recovery
Pain Sensitivity					
Aspinall et al. 2020 Secondary analysis of RCT	n = 80 with LBP	Prescriptive lumbar SMT vs sham (mobilization)	Pain Sensitivity- Local and distal PPT	Modified Global Back Recovery Scale: ≥ +2 indicating responder status	Local PPT mean (4.30) in rapid responder group; mean (4.14) in non-rapid responder group Remote PPT (UE/LE))mean (3.54/2.37) in rapid responder group; mean (3.85/2.55) in non-rapid responder group
Coronado et al. 2015 RCT	n = 63 with shoulder pain	Prescriptive cervical and shoulder thrust manipulation and HEP	Pain Sensitivity- Local PPT	NPRS	Correlation between local PPT and 12 week pain outcomes r =-.12
Fernandez-de-las-Peñas et al. 2019 Secondary analysis of RCT	n = 120 women with carpal tunnel syndrome	Soft tissue mobilization along median nerve pathway, lateral glides to cervical spine, and tendon and nerve gliding exercises targeting the median nerve HEP	Pain Sensitivity- PPT bilaterally over the C5–C6 joint, carpal tunnel, and tibialis anterior	NPRS	For mean Pain Intensity at 6 months: Baseline PPT over Carpal Tunnel β =.225 For mean Pain Intensity at 12 months: Baseline PPT over Carpal Tunnel β =.265
Jull et al. 2007 RCT	n = 36 with persistent neck pain post motor vehicle accident	Exercise (cervical and thoracic) and pragmatic non-thrust manipulation	Pain Sensitivity- Local and distal PPT	NPI change score	Normal sensory features at baseline mean change score NPI = 8.5(±13.4) Abnormal PPT at baseline mean change score NPI = 15.3 (±13.4) *Baseline NPI scores were higher in Abnormal PPT group (mean 41.0) vs normal sensory feature group (mean 33.8)
Nim et al. 2021(2) Secondary Analysis of RCT	n = 132 with chronic LBP	Lumbar spinal manipulation to most painful segment vs most stiff segment	Pain Sensitivity- Local (lumbar PPT)	NPRS	NPRS change score within session: between-group difference between sensitized and non-sensitized groups = -.16 NPRS change score between session: between-group difference between sensitized and non-sensitized groups = -.21

Appendix III: Scoping Review- Cumulative Results Table

Nim et al. 2021 Secondary Analysis of RCT	n = 132 with chronic LBP	Lumbar spinal manipulation to most painful segment vs most stiff segment	Pain Sensitivity- Local (lumbar PPT)	NPRS	Baseline PPT was not statistically significantly different between any of the responder thresholds
Other QST/Modulation					
Wilson et al. 2021 RCT	n = 60 healthy controls with trigger points identified in upper trap musculature	Pain-inducing massage vs pain-free massage vs cold-pressor	Conditioned Pain Modulation- Cold pressor test PPT change score Temporal Summation- NPRS rating	PPT local	Individuals with efficient CPM at baseline who received pain inducing massage displayed greater increases in pressure pain threshold (mean difference = 20.33(95% CI) compared to individuals with a less efficient CPM (mean difference = 4.90 (95% CI)
Response of early pain analgesia when presented with OMT challenge					
Cook et al. 2012 Secondary Analysis of RCT	n= 100 patients with mechanical LBP	Pragmatically applied thrust or non-thrust manipulation and home exercise program	Response to OMT challenge- NPRS change score	ODI ≥ 50% improvement	OR: 5.0 in identifying 50% reduction of pain at discharge if 2 pt or greater reduction in pain from baseline to end of seconds session
Cook et al. 2017 Secondary Analysis of RCT	n= 63 with LBP	Prescriptive v pragmatic lumbar spine non-thrust manipulation	Response to OMT challenge - NPRS change score	NPRS GROC ≥ 5	OR: 6.98 (p =.024; R2 =.183) in identifying ≥ 5 on GROC at 6 months if ≥33% pain reduction by 2 weeks; 5.98 (p = .008; R2 = .201) if ≥50% pain reduction at 2 weeks OR: 1.94 (p =.27; R2 =.052) in identifying ≥ 5 on GROC at 6 months if ≥33% pain reduction by 2 weeks; 2.39 (p = .11; R2 = .074) if ≥50% pain reduction at 2 weeks
Licciardone et al. 2014 RCT	n = 186 with high severity cLBP	Specific vs non-specific OMT	Response to OMT challenge - VAS Change Score	100-mm VAS: > 50% pain reduction indicating positive response	Early clinical response (within and between 1 session) PPV .82 (95% CI) of predicting favorable clinical response at 12 weeks
Pasquier et al. 2022 Cohort	n = 107 with thoracic pain	Pragmatic thoracic SMT	Response to OMT challenge- NPRS change score	NPRS	Within session pain reduction >30% OR 1.38 (p = .04) on pain outcomes at 7 days post SMT.
Trott et al. 2014 Secondary Analysis of RCT	n = 181 with acute neck pain	Pragmatic thrust manipulation vs pragmatic non-thrust mobilization	Response to OMT challenge - NPRS change score	Global Perceived Effect Scale (GPE)	Session 1 within session change in pain independently associated (β = 0.2, 95% CI 0.01-0.4) with the perceived effects of treatment at 3 months after controlling for covariates.
Tuttle et al. 2005 Cohort	n= 29 patients with subacute neck pain	Pragmatically applied physical therapy program	Response to OMT challenge - VAS change score	VAS	OR: 4.5 in identifying between sessions reduction in pain if within session reduction in pain (r =.06)
Wright et al. 2010 Secondary Analysis of RCT	n = 70 patients with hip OA	Pragmatically applied OMT	Response to OMT challenge - NPRS change score	GROC WOMAC (Pain)	Correlation of sustained within session change with same 12-week outcomes GROC r = .06 (p = .69) WOMAC Pain r = .21 (p = .15)

cLBP = Chronic Low Back Pain
CPM= Conditioned Pain Modulation
FABQPA= Fear Avoidance Beliefs Questionnaire-Physical Activity
FABQPA= Fear Avoidance Beliefs Questionnaire-Work
GROC= Global Rating of Change
HEP= Home Exercise Program
mVKPS- Modified Von Korff pain scale
NDI= Neck Disability Index
NPI= Neck Pain Index
NPRS= Numeric Pain Rating Scale
ODI= Oswestry Disability Index
PPT= Pain Pressure Threshold
SMT= Spinal Manipulative Therapy
TSK= Tampa Scale of Kinesiophobia
VAS= Visual Analog Scale

IRB #: 2022-204
Title: Updated Training Paradigms in Orthopedic Manual Therapy: An International Delphi Study
Creation Date: 4-26-2022
Status: Approved
Principal Investigator: Ken Learman
Decision: Exempt

About Youngstown State University IRB and Cayuse IRB
All research projects conducted under the auspices of Youngstown State University that involve the use of living human subjects, samples or data obtained from them, directly or
indirectly, with or without direct consent, must receive approval from the Institutional Review
Board before the project can begin.
Cayuse IRB is an interactive web application. As you answer questions, new sections relevant to the type of research being conducted will appear on the left-hand side. Therefore
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complete training through the CITI Program (INSTRUCTIONS for registering and completing
training).
New investigators should consider beginning the online training course up to two weeks prior
to the submission of an IRB Protocol or grant application, and prior to beginning the planned
research project
Throughout the submission, you will be required to provide the following:
Research instruments (surveys, questionnaires, or other instruments)
Detailed Study Information
Informed Consent Forms, if applicable
Waiver of Informed Consent Form, if applicable
Study Recruitment Information
Approval letters from other sites where research will be conducted, if applicable
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You may not begin your research project and recruitment of subjects until a formal approval letter from the chair of the IRB has been received.
The IRB meets as needed during the regular academic year. Please submit the application as soon as possible.

I have read the information above and I am ready to begin my submission.
✓ Yes

Is this a student-conducted study /project?
All students conducting a study/project are required to list their faculty advisor(s)/Principal
Investigator (PI) in the YSU study personnel section.
✓ Yes
No

What is your status at Youngstown State University?
Faculty
✓ Student

Undergraduate Student
✓ Graduate Student
Staff

Youngstown State University Study Personnel
List all YSU study personnel involved in the conduct of this study.
If you cannot find a person in the people finder, please contact the IRB Office immediately at
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Provide the name of the Principal Investigator or the Faculty Advisor for student-conducted studies.
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✓ Yes

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Name of Affiliation of non-YSU personnel
Duke University
Additional non-YSU personnel
List all the names, phone numbers, email addresses and names of affiliations of additional non-YSU personnel.
No

Sponsor
Will this study be supported by an external agency?
Yes
✓ No
Study Dates
Provide the anticipated study start and end dates.

Start Date
06-01-2022

End Date
12-31-2022

Where will this study/project take place?
Location of research
✓ Youngstown State University
Other facility
Multiple other facilities

What type of study/project is this submission ?
Type of research
✓ Research Study/Creative Investigation
A research study or creative investigation is a project that uses systematic investigation, including research development, testing and evaluation, designed

to develop or contribute to generalizable knowledge (45 CFR 46.102(d)).
Clinical Trial
Single Patient, Treatment Use, Continued Access Drug/Device Study
Emergency (or Compassionate) Use of Investigational Drug or Device

Will this study/project ONLY use pre-existing data?
Pre-existing data means the data existed before or was collected prior to the study/project
was proposed for a purpose other than the proposed study/project. (For purposes of a grant,
this refers to data collected prior to the time the study/project was proposed.)
Select no if the study includes a combination of pre-existing and new data.
Yes
✓ No

Does the study/project meet the exemption criteria?
The study/project involves: (check all that apply)
pregnant women, fetuses, prisoners, mentallyill or incapacitated subjects
survey or interview procedures with children, minors less than 18 years old
observation of children in settings where the investigator(s) will participate in the activities being observed
deception
more than minimal risk to the human subject
potential harm to subjects if the data or identifiable information is revealed or disclosed
Harm to subjects means that any disclosure of the human subject's responses outside this study/project could reasonably place the subjects at risk of criminal or civil liability or can be damaging to subjects? financial standing, employability, or reputation.
collection of sensitive data (illegal activities, or sensitive themes such as sexual orientation, sexual behavior, undesirable work behavior, or other data that may be painful or very embarrassing to reveal, such as death of a family member, memories of physical abuse)
collection of data, documents, records or specimens from subjects after the submission of this study/project
collection of data, documents, records, or specimens labeled or recorded in such a manner that subjects can be identified, directly or indirectly through identifying links ((i.e., demographic information that might reasonably lead to the identification of subjects' name, phone number, or an code number that can be used to link the investigator's data to the source record, medical record number or hospital admission number)?
✓ none of the above

The study/project meets the exemption criteria
Provide a description of the study/project, including:
- how the participants will be identified and recruited,
- the procedures to which human subjects will be exposed,
- the method for data collection and analysis,
- the method for obtaining informed consent that will minimize coercion or undue influence.

Clinical research supports the use of Orthopedic Manual Therapy (OMT) for positive pain outcomes, and although OMT techniques vary significantly per philosophy, a consistent pattern is present throughout all training paradigms: target specific joints, respect biomechanical concepts and attempt to focus the force-based manipulation to the region of dysfunction. Interestingly, recent reviews on both thrust manipulations and non thrust mobilizations have shown that a specifically applied technique (direction, force, location) does not provide better outcomes that a randomly applied version. At the same time that literature is supporting that the specificity of the technique may be less important than previously thought, it is also supporting that contextual factors and patient specific factors do influence OMT outcomes. These factors have shown to be more important in determining treatment outcomes than the characteristics of the technique itself. The combination of these findings, along with the known regional neurophysiological effects associated with OMT question the appropriateness of current educational models in OMT. The purpose of this study is to establish consensus on modifications/adaptions to training paradigms which need to occur within OMT education.

Material and Methods:

Study Design:

A Delphi survey will be utilized following recommended guidelines for conducting and reporting of Delphi studies (CREDES). This Delphi will include 3 rounds of questionnaires further detailed below. This design has been recommended in educational design and development incorporating a respondent group comprised of experts within the area of study, and a work group comprised of investigators who work to thematically code responses from the respondents between the three rounds.

Respondent Group:

A priori goal of at least 30 participants completing all three rounds of the instrument will be sought as this has been recommended to be representative and feasible in qualitative Delphi instruments. To ensure generalizability of the results the panel of experts will include international participants with varying OMT backgrounds including higher level manual therapy education through either completion of an accredited fellowship in orthopedic manual therapy (FAAOMPT) or completion of an academic doctorate with research specialization directly related to OMT. Given the purpose of this study individuals will be sought whom teach advanced manual therapy within fellowship, residency, or other advanced post-doctoral training programs.

Work Group:

The work group will consist of four individuals, including the primary investigator and three individuals experienced in qualitative research. All work group members are physical therapists with at least 9 years of clinical experience.

Instrumentation:

This study will utilize a three-round web-based Delphi survey instrument developed by the investigators specifically for this study. Round I of the instrument is an open-ended design with the goal of identifying opinions/perceptions on the future of training paradigms for manual therapy programs. This round of the instrument will identify basic demographics including training programs which the experts are currently involved. After brief explanation of the rationale for this question being posed including looking at recent reviews on the lack of specificity of OMT, an open-ended question asking participants to identify recommended training paradigms for manual therapy techniques will be implored. As recommended by guidelines this questionnaire will be assessed for face validity through a pilot survey of at least 5 individuals with qualifications to participate in the study whom will not be involved in final data collection.

The work group will examine each individual response to Round I and will utilize qualitative thematic coding to identify themes which are present (further detailed below). Round II of the instrument will include a list of the themes presented in responses to Round 1 questioning.

Respondents will utilize a 4-point Likert scale (table 1) to score each of these themes by level of agreement with the recommended training paradigm.
Round III of the instrument will include the same themes and grading scales as Round II with the addition of graphs representing the descriptive statistical scores computed from Round II of the instrument. With this information available, the respondents will be asked to rescore each item on the same 4-point Likert scale.

Protocol:
IRB approval will be obtained through Youngstown State Universities Institutional Review Board. Invitations for participation will be distributed to the identified experts through email in which they will receive information on the purpose of the study, how they were selected as expert panelists, and information on informed consent. They will also receive a web-based link to the online survey. (see attached document which will be emailed including link to survey) Participants who do not respond to the initial request for participation will be emailed a second time 7 days after initial email as a reminder to encourage participation.
Respondents will consent to participate by following the provided web link to the Round I questionnaire through the Qualtrics web-based survey system. The questionnaire will be stored on a password protected server through Qualtrics software. This company is a common vendor used for survey research and has significant data protection policies in place.
After completion of Round I, the data will be downloaded by the primary investigator and presented to the workgroup for analysis. First, workgroup members will analyze data entries and develop themes by literal thematic coding methods (coding based on related words or phrases). Following development of themes, qualitative analysis will be performed to place the remaining data within these categories. Data entries that do not fit into previously created categories will initiate a new category being developed. Following individual work group analysis the group will collaborate their findings and only with 100% agreement between the four work group members will the entry move forward into the final workgroup categorization. Following completion of group coding, the workgroup will develop recommendation statements representing the content within each collective theme. These statements will be used to develop Round II of the Delphi instrument.
The Purpose of Round II is to allow participants to identify themes which they consider to be most important to include or omit from manual therapy educational models. Invitations to participate in Round II will be distributed via email to those whom completed Round I of the instrument. Round II of the survey will utilize a 4-point Likert scale to assess agreement with recommendations (table 1). The expert panel will have 30 days to complete Round II of the instrument, with a reminder email at 15 days to promote participation.
After completion of Round II, the workgroup will tally the total of each response in column charts. These graphical depictions of previous response along with the same Round II questions will be re-issued to the participants as the Round III instrument. The purpose of the Round III instrument is to allow participants to identify themes which they consider to be most important to include or omit from manual therapy educational models while being aware of the opinions of other participants.

Table 1: 4-Point Likert Scale of Agreement
Strongly Agree- Strong agreement with recommended component of OMT Education
Agree- Agreement with recommended component of OMT Education
Disagree- Disagreement with recommended component of OMT Education
Strongly Disagree- Strong disagreement with recommended component of OMT Education
Delphi consent and Survey Link.docx

Data Analysis:
SPSS (version) will be utilized for all quantitative analysis. Scores for Round III will be divided

into two categories based on descriptive identifiers: The tally of ‘‘Strongly Disagree’’ and ‘‘Disagree’’ will represent the percentage of scores in the ‘not recommended’ category, meaning that the proposed component of training is not recommended to be included in manual therapy education. On the contrary the tally of “Strongly Agree” and “Agree” will represent the percentage of scores in the ‘recommended’ category, meaning that the proposed component of training is recommended to be included in manual therapy education. As recommended by established guidelines consensus will be established if 75% or greater of the respondents score the component of education as either ‘not recommended’ or ‘recommended’. When an item does not reach consensus, meaning ‘recommended’ or ‘not recommended’ with percentages between 50-75%, the decision will be made between ‘near-consensus’ and ‘undecided’. Agreement between 60-75% either for ‘recommended’ or ‘not recommended’ will be considered ‘near consensus’ while agreement less than 60% will be considered ‘undecided’. A composite score for each component of training will be calculated based on the following formula:

$(n1 \times (-2)) + (n2 \times (-1)) + (n3 \times 1) + (n4 \times 2)$

n1 is the number of respondents answering “Strongly Disagree” with component of training, n2 is the number of respondents answering “Disagree” with component of training, n3 is the number of respondents answering “Agree” with the component of training, and n4 is the number of respondents answering “Strongly Agree” with the component of training.

The composite scores for individual participants will be added to establish a combined composite score. The higher the combined composite score the more important the training component is in manual therapy education. The larger the negative value the more important the training component is to exclude from manual therapy education. Mann Whitney U Statistics will be utilized to assess statistical difference between experts with academic doctorates vs fellowship trained participants. This Delphi incorporates rating of agreement with training components both without (Round II) and with (Round III) graphics depicting other participants responses therefore the Wilcoxin Sign Ranks test Statistics will also be utilized to assess difference in scores between Round II and Round III.

Study Instruments

If applicable, attach all instruments (i.e. surveys, questionnaires, evaluation blanks, etc) to be used in the study.

Informed Consent procedures/methods and forms

Identify the procedures/methods and consent forms to be used in your study:

Written consent/assent form which contains all elements of the informed consent

A short form written consent/assent form summarizing orally presented consent information

✓ Written consent document but waiver of study participant or legal guardian's signature

Explain your rational for requesting waiver of documentation of consent and include a mechanism for documenting that informed consent was obtained.

Waiver of consent can be granted for studies with no more than minimal risk IF:

the only record linking the subject and research is the consenting signature

and the study's principal risk is harm from a breach of confidentiality

the subjects are members of a distinct cultural group or community in which signing forms is not the norm

All elements of informed consent will be presented to the participant in emailed invitation to participate (previously attached). Prior to them clicking on the link to survey the invitation states:

"If you would like to participate, please click the button below. Completion and submission/return of this online survey will be taken as your consent to participate."

the documentation that informed consent was obtained must be
securely kept by the researcher for 3 years
the IRB may approve waiver of documentation of consent, IRB may
require a written (but unsigned) consent document with all elements of
consent to be provided to the study participant or legal guardian
Not applicable

Do you or any investigator(s) participating in this study have a financial interest related to this
research project?
✓ Yes

Please explain.
Chad Cook is the Director of the Center of Excellence in Manual and Manipulative Therapy at Duke University and a portion of his salary is supported by that role. Chad published a book on OMT and a course with AGENCE EBP on Manual Therapy in which he receives royalties. Ken Learman has taught paid OMT continuing education courses over the past 25 years. Dave Griswold has taught paid OMT and therapeutic dry needling continuing education courses for 12 years. Damian Keter has taught paid OMT continuing education and residency courses for 4 years.

Provide the name(s) of the person(s) with financial interests to disclose.
If you do not find the person you are looking for, please contact the IRB Office immediately at YSUIRB@ysu.edu
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No

This section is an overview of all the attachments in your application.
Attach outside IRB records in this section under Outside IRB of Record.
Other Facility
If applicable, include the Letter of Cooperation.
Other facilities
If applicable, include all the Letters of Cooperation.
Study Procedures

If applicable, attach the following documenttion
Study Documents
If applicable, this includes flyers used for recruitment.
Delphi consent and Survey Link.docx
Delphi consent and Survey Link.docx
Study Instruments
If applicable, attach all instruments (i.e. surveys, questionnaires, evaluation blanks, etc) to be used in the study.
Existing data (archives/databases,..)
If applicable, include permission to access.
FDA Letter
If applicable, attach FDA Letter.
Participant Protection
Attach applicable forms
Written consent/assent form
Short form written consent/ ascent form
Outside IRB of Record
If applicable, attach outside IRB records
Study Protocol
Attach the protocol for this study that was reviewed by the Outside IRB.
Outside IRB Approval
Attach the IRB Approval from the Outside IRB.
Outside IRB Review Meeting Minutes
Attach the minutes from the outside IRB meeting(s) for the review of this study.
Outside IRB Correspondence
Attach all correspondence concerning the review of this study by the Outside IRB.

Requirements for Evidence-Based Orthopaedic Manual Therapy Education: A Delphi Survey

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Requirements for Evidence-Based Orthopaedic Manual Therapy Education: A Delphi Survey

You are invited to participate in the research project identified above which is being conducted by Damian Keter PT, DPT, OCS, Physical Therapists at the Cleveland VA Medical Center and PhD Candidate from the College of Graduate Studies at Youngstown State University, Prof Kenneth Learman, Assoc Prof David Griswold, and Prof Chad Cook. The research is part of Damian Keters PhD studies at the Youngstown State University, supervised by Prof Kenneth Learman and Assoc Prof David Griswold from Youngstown State University and Prof Chad Cook from Duke University.

Why is the research being done?
To establish consensus on modifications/adaptions to training paradigms which need to occur within Orthopedic Manual Therapy (OMT) education.

Who can participate in the research?
We have identified you as an expert in the area of interest based on higher level manual therapy education through either completion of an accredited fellowship in orthopedic manual therapy (FAAOMPT) or completion of an academic doctorate with research specialization directly related to OMT. Given the purpose of this study we are seeking manual therapists who teach advanced manual therapy within fellowship, residency, or other advanced post-doctoral training programs.

What would you be asked to do?
This research is based on the principles of the Delphi method, which is a method for consensus building by using a series of questionnaires. In the first round you will be given a series of open-ended questions regarding manual therapy education, along with basic demographic questions. In the second round you will asked to rate your agreement with the suggestions which were presented by the participants in round one. In the third round you will be supplied with the group responses, along with a version of the questionnaire where you are given the opportunity to revise your responses in view of the findings of the group. A general consensus will be considered when there is little disagreement between the respondents (>75% agreement). Typically, three rounds of questionnaires are completed to obtain consensus.

How much time will it take?
Round one of the questionnaires takes approximately fifteen minutes to complete. You will be asked to complete the following two rounds of the questionnaire over the next 8-10 weeks. The subsequent questionnaires (Round Two and Round Three) should take less time due to the rating style questions being utilized.

What choice do you have?
Participation in this research is entirely your choice. Only those people who give their informed consent will be included in the project. Whether or not you decide to participate, your decision will not disadvantage you. If you do decide to participate, you may withdraw from the project at any time.

What are the risks and benefits of participating?
There are no anticipated risks associated with participating in this research.
While there are no anticipated benefits to you personally in participating in this research, the findings will contribute to the available literature on the subject which may lead to indirect benefits for your practice and knowledge as a physical therapist and your future patients.

How will your privacy be protected?
The collected data will be stored securely on password protected computers of the research team. Data will be retained for a minimum of 5 years as per Youngstown State University policy. The data file will be deleted at that time. Due to the nature of a Delphi survey, the response you provide will be identifiable only to one investigator (Damian Keter). The responses will be de-identified before presentation to workgroup for analysis. Only group level responses will be reported on dissemination/publication. The survey will be stored on a password protected server through Qualtrics software. This company is a common vendor used for survey research and has significant data protection policies in place. Please see the Qualtrics security statement here: http://www.qualtrics.com/security-statement/. Following the data collection period, the data will be downloaded from the Qualtrics server and securely stored on password-protected computers that are only accessible by the research team. The computer and your data will be within locked-offices of the research team. Your results will be destroyed in accordance with Youngstown State University policy. To the extent allowed by law, we limit the viewing of your personal information to people who are required to review it. The institutional review board (IRB) of Youngstown State University and other representatives of this organization may inspect and copy your information.

How will the information collected be used?
The collected data will contribute towards Damian Keter's PhD Dissertation and may be presented in peer-reviewed publications or conferences. Individual participants will not be named or identified in any reports arising from the project. Only group level responses will be reported.

What do you need to do to participate?
A computer with internet access is required to participate in this study. Please read this Information Statement and be sure you understand its contents before you consent to participate. If there is anything you do not understand, or you have questions, please contact the research team. If you would like to participate, please click the button below. Completion and submission/return of this online survey will be taken as your consent to participate.

Further information
If you would like further information, please contact the research team below

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Complaints about this research
This project has been approved by Youngstown State Universities Institutional Review Board, Approval No 2022-204. Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researchers: Damian Keter at 216-791-3800 ext. 61113, Kenneth Learman at 330-941-7125 or the Office of Research Services, Compliance and Initiatives at Youngstown State University at 330-941-2377 or at YSUIRB@ysu.edu

<Click here for survey>

Appendix VI: Delphi Questionnaire

Clinical research supports the use of Orthopedic Manual Therapy (OMT) for positive pain outcomes with consistent mechanisms across all forms of techniques. OMT techniques vary significantly per philosophy, however a consistent pattern is present throughout all training paradigms: target specific joints, respect arthrological (biomechanical) concepts and attempt to focus the force-based manipulation to the region of dysfunction.

Given this specificity, the training time required to learn the philosophies and to practice the techniques to gain 'mastery' is significant. Reviews on both mobilization and manipulation have concluded that specific joint mobilization and manipulation does **not** provide better outcomes than a randomly applied version. Furthermore, literature supports that patient specific factors are more important in determining treatment outcomes than the characteristics of the technique itself. In other words, there is a lack of clinical evidence suggesting a specifically applied approach is any better than an indiscriminately applied approach.

This has called in to question the inordinate time and effort that is put into training specificity of OMT techniques. **In this Delphi study, we are interested in determining whether a new training paradigm is needed by asking experts to provide recommendations for training.** Please use the following space below to identify your recommended training paradigm for manual therapy techniques. Please consider the following training concepts when identifying your suggestions:

- Arthrokinematics/Osteokinematics
- Specificity of techniques (location)
- Grade/Direction of forces
- Adequate length of training
- Patient specific vs technique specific factors
- Identifying candidates for OMT
- Neurophysiological based vs biomechanical based models
- Suggestions for spine and peripheral training
- Incorporation of non-OMT concepts within training (PNE etc)

1.) I would recommend that manual therapy training should focus on………

2.) I would recommend that manual therapy training should omit focus on………

3.) When demonstrating techniques, I would recommend that the trainees focus on………

4.) The foundational knowledge I feel is necessary to apply manual therapy is………

5.) I would recommend that trainees attempt to identify candidates for manual therapy based on………

6.) Do you have any other comments or suggestions related to manual therapy education?

What is your age?

- <20
- 20-30
- 30-40
- 40-50
- 50-60
- >60

What gender do you identify with?

- Male
- Female
- Other

How many years have you been in Research?

- None
- 0-5
- 5-10
- 10-15
- 15-20
- 20 or more

How many years have you been in clinical practice?

- None
- 0-5
- 5-10
- 10-15
- 15-20
- 20 or more

What level of post-doctoral manual therapy do you currently educate in?

- Residency (OCS, SCS, etc)
- Fellowship (FAAOMPT)

- Continuing Education

Check all that apply related to your own education/training

- Post-Doctoral Degree (DSc, Phd etc)
- Fellow (FAAOMPT)

What philosophy(s) of manual therapy are you trained?

Appendix VI: Delphi Questionnaire

Thank you message displayed upon completion:

Thank you for your response. Your response will be utilized to improve health care providers understanding of recommended changes to manual therapy curriculum.

If you have any questions regarding this survey please contact Damian Keter at 216-791-3800 ext 61113 or Damian.Keter@va.gov.

<Link to Survey>

Appendix VII: Delphi Round I Results with Thematic Coding

End Date	Q1 I would recommend that manual therapy training should focus on………	Coding:	Q2 I would recommend that manual therapy training should omit focus on………	Coding:	Q3 When demonstrating techniques, I would recommend that the trainees focus on………	Coding:	Q4 The foundational knowledge I feel is necessary to apply manual therapy is………	Coding:	Q5 I would recommend that trainees attempt to identify candidates for manual therapy based on………	Coding:	Q6 Do you have any other comments or suggestions related to manual therapy education?
7/12/2022 8:40	mechanisms of efficacy of MT; developing therapeutic alliance/communication; managing expectations; confidence in handling/psychomotor skills	- Mechanism - Communication - EBP (Patient Expectations) - Psychomotor skills	perhaps the very specifics of individual philosophies of manual therapy could be avoided during the "introductory" training in manual therapy. If someone develops a penchant for a particular "flavour" of MT then they could pursue it more in depth at that time?	- Specifics of individual philosiphies	patient/client communication; confidence in handling; hand contact	- Communication - Confidence in application - Technique (hand placement)	Anatomy; theoretical biomechanical constructs that underpin the major philosophies/ history of the manual therapies; physiological responses to force and movement (cellular to macrolevel); cognitive and psychological factors that influence perception of sensations like pain, stiffness, etc; indications and contraindications	- Anatomy - Biomechanics - Phiolosophies/ History of OMT - Neurophysiology (OMT) - Cognitive and Psychological contributors (Pain, stiffness) - Indications/Contraindications	Presuming this is candidates for MT care and not MT training? Select candidates for care based on signs, symptoms, contraindications; expectations and preferences; provider confidence to make a difference based on provider's particular examination preferences	- Clinical signs/symptoms - Lack of Contraindications - Patient Expectations - Provider skill/preferance	I think these first phase is still pretty broad. There are elements common to all the body based therapies that could be distilled as the introductory/beginner level training related to why MT works so well for some people.
7/12/2022 11:19	Skill acquisition separated from clinical reasoning at first and then	- Psychomotor Skills - Clinical Reasoning - Identifying	Arthrokinematics, osteokinematics, assessments that have no reliability, decision aids that are not reliable,	- Arthrokinematics/Osteokinematics - Non-reliable assessment	Body position of both patient and clinician. Direction, speed, set up.	- Proper setup - Technique (therapist position, patient position,	Entry level. It is not rocket science. Students have the requisite	-Clinical reasoning	Symptoms NOT signs, use of test-treat-retest.	- Patient Symptoms - Patient	We don't need to dumb it down as there is cognitive

	combine the two. When trying to learn a skill at the same time trying to determine who to apply it on is a lot. Develop the skills (easy part - lots of repetition, and get confident) and then spend a LOT of time on the reasoning.	appropraite patients	paradigms that are outdated, specificity and false narratives.	techniques - Outdated Philosophies - Specificity? (assessment or treatment?)		direction, speed, setup)	knowledge and are capable. Reasoning takes time and that needs to be covered. Skill acquisition happens at different speeds for different people.			Response Model (Test-Retest)	depth required especially for reasoning. Skills need to be taught just like any other skill. And we need to allow for reps and many forms of media as some learners have different ways they learn.
7/12/2022 11:21	patient centered outcomes, functional limitations, CNS involvement, joint function	- Patient centered care focusing on functional outcomes - Mechanisms (Neuro) - Biomechanics/ joint motion	arthrokinematics	- Arthrokinematics	modifications for specific patients	- Patient specific modifications	basic technique and function with education on incorporation into self treatment	- Technique - Patient Education - Following OMT with self treatment (function?)	patient perspective, impairment level, clinical experience	- Patient Expectations - Patient Impairment level - Provider skill/preferance	we should focus more on technique modification, clinical application, and patient education instead of theorized joint kinematics

Appendix VII: Delphi Round I Results with Thematic Coding

7/12/2022 18:14	person-centered care integrating the use of manual therapy, exercise and addressing poor lifestyle behaviors to empower people to have optimal health behaviors that enhances one's ability to move.	- Patient Centered Care - Use of OMT as part of care plan (Therex, Education) - Addressing lifestyle behaviours (possible with above?)	specificity of biomechanical motion as the sole reasoning approach.	- Arthrokinematics/Osteokinematics (as guide for technique selection)	confident and comfortable application that matches the person's presenting pain mechanism(s) and functional goals.	- Confidence in application - Patient Comfort - Patient specific modifcations	related to understanding one's pain mechanism(s), pathoanatomic background, presenting impairments and functional limitations and one's complicating/ influencing factors such as one's beliefs, cognitions, and socioeconomic factors.	- Neurophysiology (Pain) - Anatomy - Ability to identify impairments and functional limitations - Cognitive and psychological contributors (and social)	their willingness to respond to feedback in order to prescribe manual therapy, exercise and address lifestyle factors needed for optimal movement.	*Looked at question the wrong way	There needs to be a larger consistent focus on person-centered care across programs that is integrates manual therapy with exercise and lifestyle behaviors within a biopsychosocial framework.
7/12/2022 20:25	above all, sound clinical reasoning in it's application	- Clinical Reasoning	a cook book approach	- A specific approach?	soft, highly proprioceptive hands	- Technique (comfort) - Ability to assess based on touch/feel	anatomy, neurology, biomechanics, post-technique integration into function	- Anatomy - Neurophysiology - Biomechanics - Link to function	a thorough exam, identification of pain mechanism	- Clinical signs/symptoms - Pain Mechanism	Manual therapy doesn't suck; nor is there evidence that it does!
7/13/2022 6:38	psychosocial and neurophysiological factors	- Mechanisms (Neurophys) - Psychological factors (with above under mechanisms?)	biomechanical effects of manual therapy	- Biomechanical effects of OMT	communication between patient and PT, comfortable positioning for both patient and PT	- Communication - Patient comfort	aligining mechanisms of pain and treatments	- Mechanism based manual therapy	absence of red flags, interest/preference in recieving manual therapy as a treatment	- Lack of Contraindications - Patient expectations	decreased focus on specific techniques or performing a desired number of techniques

Appendix VII: Delphi Round I Results with Thematic Coding

7/13/2022 7:33	The application of technique with the best available evidence. Get rid of the mentality that MT is a "fix all" and is the best way to "heal" someone. IT is not. It is a short-moderate term pain modulator that builds rapport with your client so they are comfortable with you and trust your plan of care making abilities.	- EBP- Use of OMT as part of care plan (Therex, Education)- Communication/Alliance	specific targeting of "repositioning" of joints or "re-aligning" of joints or "releasing" fascia/ tissue	- Specific techniques- Biomechanical effects of OMT	Hand placement, practitioner positioning, client positioning, KNOWING indications and contraindications first and foremost.	- Technique (hand placement, practioniner positioning, client positioning)- Clinical reasoning- Safety?	based on the best available evidence, MT is typically non-specific, and relies currently and unfortunately on a large amount of provider-given expectations. There is likely placebo in manual interventions, especially those without foundations in the literature, but accurate education to the client through an understanding of best-available evidence is ABSOLUTELY required.	- Patient Education- EBP	thorough assessment of the "why not's". In other words, MT is a strong patient-provider bonding tool. Though it is a short-mod term pain modulator, it can build solid rapport. It can be used on ALMOST anyone, but they need to know the patients that SHOULD not have specific MT techniques for specific reasons.	- Lack of Contraindications	No
7/14/2022 6:15	more emphasis in touch, comfort of techniques and patient handling	- Patient Handling - Touch/Comfort	assessment of SIJ, palpation diagnosis	- Non reliable assessment techniques (Palpation) - SIJ assessment (I think this may be meant to go with the palpation diagnosis theme?)	comfort of patient and education to patient on the purpose of the technique	- Patient Comfort - Communication	arthrokinematics, osteokinematics, anatomy, exercise prescription	- Arthrokinemtatics/Osteokinematics - Anatomy - Exercise Prescription	a combination of biopsychosocial variables, tissue irritability, goal of technique	- Combinations of biopsychosocial variables - Tissue Irritability - Treatm	I believe further emphasis in exercise prescription post manual therapy is lacking in some of the training. With evidence that manual therapy is

					ent goal	transient, skillful self directed treatment after manual therapy is needed. I believe much of the hands on assessment, the detailed palpation, assessment of movement are a large reason why manual therapy by those trained heavily in it creates superior results vs a clinician with quickly performs thrust manipulation w/o detailed assessment. This assessment enhances the clinician-patient bias.

Appendix VII: Delphi Round I Results with Thematic Coding

7/14/2022 20:48	As traditional, the 'art' of influencing the body, especially joint motion, through manual therapies. Established knowledge, built up over 100+ years of modern experience and research. Quality of the manual therapy, which anyone in the field knows is important, yet is often neglected in favor of more knowledge of scientific evidence..	- Biomechanics/ Joint motion	Recent fads, either un-researched or preliminary ideas that have not been rigourously explored or reproduced. Also complex chains of reasoning that move away from observable or reproducible phenomena. Over-emphasis on scientific knowledge, which for clinicians is of less value than the art of good manual therapy. The science is essential for researchers/academics.	- Non Evidence based techniques/Fads - Complex reasoning that is not observable/reproducable - Over-emhpasis on research	Closely observing what is occuring in the region of interest. The success of techniques should be apparent from observation, not just client report. Developing excellent feel and handling. Practice, repetition.	- Clinical reasoning? - Technique (patient handling)	Some historical context. An understanding of mechanisms, and how our understanding of these has evolved over time. Note that doesn't mean over-emphasis on psycho-social mechanisms, just because they are fashionable currently. A clear sense of where manual therapy sits with relation to other forms of therapy, such that clinicians have the confidence to select clients/conditions appropriately. Basic science - anatomy, physiology.	- Philosophies/history of OMT - Evolution of OMT and current state - Mechnisms of OMT - Indications/contrindications - Anatomy - Physiology	Once people have met the requirements for professional study, personal interest seems the most important factor.	*Looked at question the wrong way	Both the art and science of manual therapy are important. The science has dominance currently, particularly with manual therapy taught in universities. However, the art should not be neglected. Founders of forms of manual therapy refined their art (e.g. Brian Mulligan, Robin McKenzie) first, based on observation and a deep understanding of basic science. Evidence (science), explaining what they had discovered came later. Notably,

Appendix VII: Delphi Round I Results with Thematic Coding

											science is not typically a source of innovation in manual therapy. I consider it perfectly reasonable to teach a technique-based course with less 'evidence', for example, in the appropriate context.
7/19/2022 14:03	Clinical Reasoning, specific tissue diagnoses along with the neuromuscular underlying causes of the current tissue in injury, arthrokinematics, rationale behind use of techniques such as target tissues in pathology (cartilage, versus bone, versus capsule, versus tendon, versus muscle)	- Clinical Reasoning-Identifying location/tissue of dysfunction-Arthrokinematics	basic PT school information, Clinical Prediction Rules,	- Basic PT school information-CPR's	the touch, the ability to feel what's under the hand/fingers, positioning of the PT's body and the pt's body structures, the feel for the grading of motion and the grading of the technique	- Technique (Grades)-Ability to assess based on touch/feel	Clinical Reasoning/rationale for the treatment intervention. Why is it that we are performing X, how are we dosing the exercise and for what clinical and functional outcomews?	- Clinical Reasoning-Link to function	Clinical Reasoning/rationale, orthopedic manual physical therapy diagnoses, and desired result.	- Clinical Reasoning-Clinical diagnosis-Treatment Goal	Do not dumb it down simply because current research is showing what it is. That simply means that those research articles may not have targeted the correct subject pool. My patients are those who have failed other physical therapists

Appendix VII: Delphi Round I Results with Thematic Coding

											who are not residency nor fellowship trained OMPTs. My reputation is such that I am the one the physicians who own their own PTs send to when their patients are not successful. I work as a team with referral sources. We problem solve together if through my training I cannot find an optimal result.
7/20/2022 21:18	development of high level skills of assessment, localization and precise thrust.	- High level assessment skills - Identifying location/tissue of dysfunction - Psychomotor Skills	Clinical Prediction rules	- CPR's	the art of effective OMT and how to focus on the intension for precision and preciseness	- Focus on intention for precision	Knowing when to apply and development of hand skills	- Indications - Psychomotor skills	Passion to learn the skills and recognition of how effective MT is!!	*Looked at question the wrong way	More educators who recognize the functional and symptomatic benefits of MT interventions

Appendix VII: Delphi Round I Results with Thematic Coding

7/22/2022 14:08	neurophysiologic effects, patient handling, contraindications	- Mechanism (neurophys) - Patient Handling - Safety	excessive emphasis on biomechanical relevance to the results of the thrust. Biomechanics is critical to understand the technique, but not necessarily the outcome.	- Biomechanical effects of OMT	Safety! Focus on force in terms of the direction, speed, power.	- Safety - Technique (force, direction, speed, power)	Anatomy, biomechanics, and clinical reasoning	- Anatomy - Biomechanics - Clinical Reasoning	appropriate indications	?? Indications
7/26/2022 6:21	Advanced problem solving. Typecasting manual therapy as just doing joint mobilizations/manipulations is too narrow of a focus. Manipulations should be part of the solution, not just the solution.	- Clinical Reasoning - Use of OMT as part of care plan (Therex, Education)	Hmmm, that is not a good question. There is no such thing as superfluous information. This questions is geared to simple answers like like yes getting rid of specificity in joint manipulations is where it needs to go. Or all that shit about arthrokinematics needs to be thrown out. It doesn't work that way. It all matters: arthrokinematics, pain science, palpation skills	Nothing	Everything we have taught prior. It all matters.	??	It needs to consist of a good history taking, knowledge in biomechanics, and advanced problem solving skills. It is more important to figure out who is not a good candidate for joint manipulation.	- Ability to obtain good history - Biomechanics - Clinical reasoning - Indications/contraindications	Not a simple black and white answer. It is based on expert history taking, chronicity of the problem, biomechanics, clinical picture, joint mobility, pt's previous experience.	- Thorough subjective exam - Stage of management - Biomechanical findings - Joint mobility findings - Patient expectations

Appendix VII: Delphi Round I Results with Thematic Coding

7/26 /2022 7:17	physiology and neuromusculoskeletal relationships, pain science, movement analysis and kinematics, biomechanics	- Pain Science - Biomechanics	"winding up/locking out segments", comparison of technique (UPA vs CPA vs mulligan, etc)	- Segment localization - Comparing different techniques of different philosiphies?	feeling for tissue response (change in texture, resistance, muscle guarding, etc) and patient experience, intent of the technique (painful or painfree, adressing pain vs addressing movement), test-retest based on intent	- Ability to assess based on touch/feel - Clinical reasoning - Patient Response Model (Test-Retest)	physiology and neuromusculoskeletal relationships, pain science, movement analysis and kinematics, biomechanics	- Relationship between physiology and neuromusculoskeletal system - Pain Science - Kinematics - Biomechanics	approproate identified impairment, abilities (or inabilities) of patient, goals of patient	- identified impairments - Patient expectations	Consider that much of PT research as cited in this study inro does not subcategorize patients (ie does manual therapy improve patients with LBP vs does manual therapy improve mobility deficits or a patient's pain experience with nociplastic pain mechanisms, etc)... it is possible that specificit may or may not be warranted in manual therapy based on the goal (impairment being targeted)... or not??

Appendix VII: Delphi Round I Results with Thematic Coding

7/26/2022 7:58	Appropriate set up and force — emph high velocity.. low appliitude	- Psychomotor Skills?	Arthrokinenatics / localizing segments .. we really can't do that so why teach	- Arthrokinematics - Segment localization	Set up and force	-Technique (setup, force)	Know anatomy but not huge focus /physiological effect.. insuring safety of patient	- Anatomy - Physiology - Patient Safety	The patient's expectations and understanding of physiological effect of applying MT	- Patient Expectations - Physiological effect of OMT	It needs to be a must for all schools to teach.
7/26/2022 9:09	clinical reasoning with evaluation and treatment techniques	- Clinical Reasoning	a specific technique or treatment	- Specific techniques	patient safety and proficiency	- Patient Safety- Technqiue (proficiency)	patient centered care and clinical reasoning	- Patient Centered Care- Clinical Reasoning	patient values	- Patient Expectations	
7/26/2022 10:08	arthrokinematics, neuromuscular training, neuromodulation, patient education, neuropain science	- Arthrokinematics - Neuromuscular/neuromodulation training - PNE	Just the biomechanical model	- Biomechanical basis for the application of OMT?	hand position and force	- Technique (Hand position, Force)	anatomical knowledge, biomechincal/ kinesiology, neuropathways	- Anatomy - Biomechanics - Kinesiology - Neurology	their current patient approach and willingness to learn	*Looked at question the wrong way	Focus should be placed on thrust/ versus non thrust and audible versus no audible and the clinical significance
7/26/2022 10:14	Psychomotor skill acquisition and clinical reasoning on appropriate situations to use manual therapy. Additional emphasis should be on exercise to enhance manual therapy	- Psychomotor Skills - Clinical Reasoning - Identifying appropraite patients - Use of OMT as part of care plan (Therex, Education) - Mechanisms (Biomechanical and neurophys)	Nothing in particular. While I wouldn't recommend specifically diving into modalities (US, e-stim, etc.) or other such interventions, there is likely still a place for discussion of how manual therapy and exercise can supplement for patients who are preferential toward modalities. Specific to manual therapy	- Visceral manipulation	Direction of force, amplitude, body position, hand placement and patient comfort, as well as the rationale as to when/why to use that technique.	- Technique (Direction, Force, Amplitude, Body position, hand placement) - Patient Comfort - Clinical Reasoning	Understanding the fidelity (or lack thereof) of specific manual therapy interventions - recognizing the gaps in the literature and knowing the benefits as well as the limitations. Basic	- Understanding lack of specificity in OMT - Identifying gaps in literature - SINSS Model - Patient Response Model (Test-Retest)	Synthesis of data from the subjective exam, objective exam with mechanical movement exam and palpation/joint mobility assessments, and then assessing response to manual	- Thorough subjective exam - Biomechanical findings - Joint mobility finding	None at the moment.

	effects, improve carryover between sessions, and promote long term health and management of patient complaints. Additionally, understanding of mechanisms, both biomechanical and neurophysiological should be emphasized.		and physical therapy, things like visceral manipulation are likely better served for different continuing education opportunities.				understanding of the SINSS model, patient response models (e.g. test-treat-retest), etc.		therapy interventions with test-treat-retest methods.	s - Patient Response Model (Test-Retest)
7/26/2022 10:35	educating patient beforehand on intent of intervention, clinician handling skills and communicating with the patient about what is being done while manual therapy is being performed, patient and clinician position, choosing appropriate technique(s) based on patient preferences, clinician	- Patient Education - Communication/Rapport - Psychomotor Skills - EBP (Patient preferance, Clinician exp, Research)	specificity of palpation because inter-rater reliability is poor, specificity of technique (i.e. targeting L4), concave/convex rule to determine appropriate technique, prescriptive patient position (i.e. step 1 do this, step 2 do that, etc.) because although patient position is important there needs to be some give and take based on the patient in front of youu	- Specificity (Assessment and treatment) - Technique application based on arthokinematics - step by step technqiues?(cook book with above?)	developing a rapport with their patient, listening to them and making them comfortable with manual therapy which in part is good, gentle, soft hands but also strong communication, determining the appropriate technique based on the patient presentation, using a comparable sign and incorporating the test-retest (or some	- Communication - Clinical Reasoning - Patient specific modifications - Patient Response Model (Test-Retest) - Comparable Sign?	anatomy-you do need to know your anatomy of what you are trying to treat, solid examination/evaluation skills to determine the appropriate technique(s) to incorporate into a treatment plan, contraindications/indications, red flags, biopsychosocial model, patient/clinician communication	- Anatomy - Strong Evaluation/Examination skills - Indications/Contraindications (red flags) - Biopsychosocial Model - Communication	patient presentation, prior experience with techniques that have been successful, patient's preferences regarding manual therapy	- Patient Expecations

	expertise and current research, use of evidence based techniques and not things that are 'showy' (i.e. cupping, dry needling, etc.)				similar form of asterisk/test-retest because it doesn't need to be Maitland necessarily) so it is known if their interventions work						
7/26/2022 13:47	Functional joint integration (eg. Hip, TL Junction and ankle dorsiflexion) which easily can be applied to functional gait.	- Functional joint integration	A framework which "blames the joint" without context of the CNS influence.	- Biomechanical effects of OMT	Selecting appropriate patients, effective treatments (functional), safety (avoid large levers and force), follow up with neuro-re-ed and function.	- Appropriate patient selection- Clinical Reasoning- Safety- Follow up post technique	Functionally applied anatomy, clusters of tests for serious pathology and regional diagnosis, safe joint setup, functional integrative biomechanics (focused on gait, sit to stand, lifting and real world use of the body)	- Anatomy- Indications/contraindications - Biomechanics- Link to function	Clinical reasoning which takes into account the best cluster of tests supporting manual intervention, and patients which appear they would respond well and most importantly those who will not.	- Clinical Reasoning- Utilizing test clusers to identify likely responders	I agree that a lot of manual therapy education is bloated, non-functional and lives in a fantasy world of minutia without contextual functional application. My concern with the current application of manual therapy is the loss of reasoning and safety. Palpation (which is a necessary part of clusters for long head of biceps pain, plantar fascial

Appendix VII: Delphi Round I Results with Thematic Coding

											pain, and even the multifidus lift test) is suboptimal. The trend towards general application makes precision emphasized less, which can alter reasoning and decrease safe application of manual therapy. Your manual therapy is only as good as your functional application (neuro re-ed).
7/26/2022 14:27	clinical reasoning behind the choice of technique and how to apply the technique appropriately	- Clinical Reasoning - Psychomotor Skills	just one type of approach.	- Specifics of individual philosophies	FEEL!!!!!! Subtleties of movement / resistance	- ability to assess based on touch/feel	a strong knowledge of anatomy	- Anatomy	patient presentation. You can attain both mechanical and neurophysiological effects with manual therapy.	? Patient presentation?	Education should focus on why and how you use a technique and the purported effects.

Appendix VII: Delphi Round I Results with Thematic Coding

7/26/2022 21:28	clinical reasoning first and foremost vs seeing manual therapy as series of hands applied techniques of ax and rx	- Clinical Reasoning	outdated models that do not have the evidence to support them and tend to catastrophize patients.	- Outdated philosophies - Non-evidence based techniques/fads	the intent of the technique being achineved vs specific hand placements etc - are you achieving what you are doing the technique for, in a way that is safe for you.	- intent? I don't get where this is going?	First and foremost is attempting to get clinicians to think and reflect on how they think - be able to step outside their bubble and have the humility to know we do not everything - this open mindedness and reflective thinking is the cornerstone that overlies everything else - with out it every other piece of knowledge that is gained will be put inot a frame work in a completely different way. Other areas of focus shopuld be - Significant pain science education, significant education on the different effects of movement on tissues, subjective examination and how to do a good one,	- Ability to self reflect on knowledge/skills - Pain Science - Biomechanics - Ability to obtain good history - Motivational Interviewing	a good subjective is the most importantg aspect of the examkination process.	- Thorough subjective exam	you need to get your definitions clear here - i am not quite sure what you mean by manual therapy - i did a manual therapy fellowship 25 years ago in australia - however what it really was , was a clinicial reasoning fellowship with an emphasis on hands on passive type treatment techniques . I am not sure what we are calling manual therapy here - hands on , astm, dry needling, cupping, passive vs activive vs a combination - why are you doing this research

							motivational interviewing should be first thing we learn at school as a health professional. .				for manual therapy training- is it for exclusively hands on type treatment specialization, or are you intersted in how to produce a more complete clinician for musculoskeletal problems of which manual therapy is just one tool?
7/27/2022 4:54	I feel that manual therapy training does and should incorporate many aspects, but I believe in the primacy of patient response in terms of indicators for success. I also believe MT training should focus on its place as a means to get on to something else (often	- Identification of responders and non-responders- Use of OMT as part of care plan (Therex, Education)- Mechanisms- OMT based on staging?	I wouldn't altogether omit much of anything, per se, but I have long felt that the role of arthrokinematics should perhaps be de-emphasized. Based on thousands of n=1 studies with actual patients in the clinic, I do believe there is value in specificity at some times and not others. However, approaching MT based on arthrokinematic rules has long been the hallmark of MT training from entry-level on. And even	- Arthokinematics	The rationale for the technique. The communication with the patient before/during/after. Key "minor" details that may improve comfort and efficiency with performance.	- Clinical Reasoning- Communication- Technique (comfort, effiency)	Anatomy and biomechanics. Foundational MT concepts related to the relationships between pain and resistance and resultant grading/dosage of techniques. Pain neurophysiology, how to form estimations of pain mechanisms at play, and how to target MT	- Anatomy- Biomechanics- Clinical Reasoning- Pain Neurophysiology- Mechanism based OMT- Patient Response Model (test-retest)- Following OMT with self treatment	The current stage of management (stage 1/symptom modulation/intervention/etc; stage 2/movement control/rehabilitation/impairment focus/etc.); stage 3/functional optimization/prophylaxis/etc.), the current estimation of SINSS (including estimates of	- Stage of management- SINSS model- Pain Mechanism	

	exercise) with more lasting treatment effects. I also believe much emphasis should be given on appropriate staging of management (incorporative of pain mechanism considerations), and the selection and dosage of MT should be based on that more so that strict biomechanical principles.		in cases where I do find there's value in specificity, I don't believe arthrokinematics tells the whole story - or even the majority of it. In other words, there is a lot more at play besides the shape of bony surfaces that will dictate my direction of treatment. Even just keeping a mechanical mindset and not getting into neurophysiological aspects, do the soft tissues enveloping a joint not play as much of - if not more of - a role in influencing joint motion than the shape of articular surfaces? If we recognize that, then we must recognize the need to go beyond the convex-concave rules when choosing an MT technique for a specific impairment. And that initial selection may be based on targeting those things that surround the joint - rather than the joint surfaces themselves.				accordingly. How to utilize the patient response model as a barometer of success (or lack thereof) and to inform Rx selection and dosage.		pain mechanisms at play within "nature"), and whether MT has a role to play accordingly - and if so, how.	

7/27/2022 9:23	Teaching how to listen to patients more carefully.	- Communication/Alliance	Focus less on pathoanatomy and biomechanics. Less focus on pain education.	- Anatomy - Biomechanics - PNE	Achieving the desired movement with the minimal amount of effort	- Technqiue (efficiency)	Having a solid understanding of the state of the patient's condition. That is the stage and stability.	- SINSS	The patient's tolerance for movement/exercise	- Patient tolerance	I think fellowship programs need to be more careful in who they choose for education. Some candidates join programs so they can become skilled at joint manipulation (thrust) and don't realize that is a very small part of the process.
7/28/2022 8:19	a biomechanical model as a building block for the basis for the mechanics of movement but expanding into a neurophysiological model	- Biomechanics - Mechanisms (Neruophys)	Biomechanics/Arthrokinematics/osteokinematics. These concepts do not need to be completely omitted but should not be a focus	- Biomechanics - Arthrokinematics/Osteokinematics	An open line of communication between the therapist and patient while using appropriate body mechanics. Know what you want to do, position yourself with appropriate body mechanics, your patient in a position of advantage and do what you intend	- Communication - Technique (therapist positioning, patient positioning)	Communication skills> biomechanical models build into neurophys models allowing one to recognize how to take advantage of gains from manual techniques in order to advance motion/function for optimal retention of gain	- Communication - Biomechanics - Neurophysiology - Link to Function	Their ability to communicate and their interest in learning/seeking information	*Looked at question the wrong way	OMT is a piece of the puzzle along with appropriate patient education/training in optimizing motion and function in order to both remove the negative (that which is contributory to the problem) and take advantage of the

											positive (that which we do to and with the patient). Some may consider these non OMT concepts but if we don't incorporate them then we're taking on the role of "healer" and fostering dependence. We have the opportunity to facilitate creation of an environment whereby the body can improve performance. We don't fix things, we enable the patient.

Appendix VII: Delphi Round I Results with Thematic Coding

7/28/2022 9:04	The evidenced informed mechanism by which it may impact as patient's trajectory, the valued of therapeutic touch and it's impact/influence it may have on therapeutic. Clinical reasoning of when MT should be used and on which patient populations. Anatomy and biomech are still important elements and should also not be lost. MT should be presented within a biological, physcholical and social realm	- Mechanism- Therapeutic touch- Clinical Reasoning- Identifying appropriate patients- Biomechanics - Biological, psychological, and social realm?	Teaching MT needs to be more hollistic. Because the impact and effects are greater than singular system change, it should be presented as a mutil modal intervention. When it is taught using one umbrella/model i.e biomechanics, you lose the ability to present the multifactorial changes that can occur when this intervention is applied	- Biomechanical basis for the application of OMT	general principals of techniques- not the very specific biomechanical cues. Because the impacts and systems that are influenced are broad. MT should be taught using a flexible approach.	- Flexible approach to technique application	Communication Skills and ability to foster strong Therapeutic alliance, Clinical Reasoning of when and when not to incorporate, and knowledge of anatomy to help apply	- Communication- Clinical Reasoing- Anatomy	information gathering (patient's story/ safety to perform), patient expectations/ values, best available evidence, clinician expertise- i.e evidence informed care	- Thorough subjective exam- Patient Expectations- Current best evidence- Provider skill/preference	teaching should not be directive or prescriptive. When students are taught in a manner where they feel they have to perform an MT technique way, it limits their ability to develop confidence in application. The effects of manual therapy are broad and vary across patients and hence the MT techniques and the way they are applied should also reflect this.
7/28/2022 10:47	Frameworks for patient assessment and re-assessment to apply manual therapy	- Clinical Reasoning - Safety - Psychomotor skills - Mechansisms - Specificity	I do not support removing training on items such as those listed in the introduction of the survey. I do however feel that understanding the	? None?	Patient comfort and positioning, Therapist handling and body mechanics, Palpation/Orie	- Technique (patient positioning, therapist handing, therapist positioning, palpation	Differential Diagnosis including red and yellow flags, Indications and Contraindicati	- Differential Diagnosis - Indications/Contraindications (red flags) - Anatomy -	A framework that considers red and yellow flags, contraindications, differential diagnosis,	- Safety - Patient Expectations - Contrai	I do feel that specificity has a time and place. Moving away from understand

	within. Indications and Contraindications/Screening procedures. Handling Technique. Mechanisms of manual therapy. A variety of techniques per body region to be used within the framework. Specificty of application of forces for patient comfort and safety (not necessarily biomechanical based mechanism)	for patient comfort?	mechanisms behind manual therapy and applying them within a framework for patient management that includes assessment/re-assessment is key.		ntation to technique, Amplitude, Force, Direction of Force, Constant Dialogue/Communication	skills, amplitude, force, direction - Communication - Patient comfort	on, Anatomy and Biomechanics, Tissue Healing, Framework for patient assessment/re-assessment	Biomechanics - Principles of tissue healing - Patient Response Model (Test-Retest)	self report and performance based outcome measures, continuous assessment and re-assessment	ndications - Differential diagnosis - Use ofoutcome measures (self reports and performance based) - Patient response model (test-retest)	ing the biomechanical model may lead to patient discomfort or injury. I think it is important to understand the biomechanics, but not teach or intervene expecting a biomechanical mechanism. I feel it is important to be able to incorporate many treatment styles and philosophies into your framework so that you can best work with the individual patient, focusing on assessment/re-assessment to guide your plan of care.

Appendix VII: Delphi Round I Results with Thematic Coding

7/28/2022 11:47	current best available research, development of skilled handling (psychomotor), clinical reasoning	- EBP - Psychomotor skills - Clinical Reasoning	overemphasis on biomechanics, biomechanics education has a place and programs shouldnt remove entirely but selecting the right patient is more important than applying a biomechanical model to treatment selection.	- biomechanical basis for application of OMT	handling skills, develop skilled and therapeutic hands, be able to monitor symptom response and within session outcomes.	- Technique (therapist handing) - Patient Response Model (Test-Retest)	an understanding of research methodology/ critique, screening and evaluation methods to determine appropriatness of techniques, anatomy/biomechanics to a degree.	- Ability to critique research methodology - Indications/Contraindication - Biomechanics - Anatomy	current best evidence, symptom response model.	- Current best evidence - Patient response model (test-retest)	
7/28/2022 13:35	Safety; differential diagnosis; principles of arthrokinematics/osteokinematics	- Safety - Clinical Reasoning - Arthrokinematics/Osteokinematics	1- Overly specific techniques; 2- Clinical prediction rules - even the lumbar manipulation rule. Students need to understand that validation doesn't mean "valid", especially in the face of conflicting evidence. This concept should be specifically discussed rather than omitting discussion of CPRs altogether.	- Specific Techniques (specific as in how it is performed of what it is trying to target?) - CPRs as basis for application of OMT	Safety; differential diagnosis; principles of arthrokinematics/osteokinematics; body mechanics	- Safety - Clinical Reasoning - Arthrokinematics/Osteokinematics - Technique (Therapist positoning)	Safety; differential diagnosis; principles of arthrokinematics/osteokinematics	- Safety - Differential Diagnosis - Arthokinematics/Osteokinematics	Safety; differential diagnosis; absence of hypermobility; treatment response; internal locus of control	- Safety - Differential Diagnosis - Joint Mobility Findings - Patient Response Model (test-retest) - ?? Internal locus of control ??	No one should leave doctoral-level manual therapy training without an understanding that it is inappropriate for PTAs to perform joint mobilization/manipulation since differential diagnosis and joint play assessment are not a mandatory part of PTA educational program curricula; Students

											should recognize that it's inappropriate to show techniques to younger cohort before they have learned the relevant foundational content.
7/29/2022 11:42	If research is telling us that the specific techniques don't matter as much as we think/hope, then focusing on clinical reasoning, critical thinking and problem solving as well as patient safety is critical. In addition, success of outcomes; and modifying interventions if not getting the desired outcome is important.	- Clinical Reasoning- Safety- Assessing outcomes- Modifying techniques?	interventions without a reasoning framework (there must a why, and not only performing a technique because research, or mentor, suggests it)	- Application of techniques without clinical resoning?- Over-emhpasis on research	Quality of technique; are they respecting arthrokinematics, and specificity of techniques- are they targeting the tissue they intend to, and for the purpose they intend to.	- Technique (quality)- Arthrokinematics/Osteokinematics- Specificity of application- Clinical reasoning	foundational anatomy, biomechanics, tissue healing, pain science, patient interview and management skills.	- Anatomy- Biomechanics- Principles of tissue healing- Pain Science- Ability to obtain good history- Patient management skills??	a thorough history and examination to locate tissue specific impairments. In addition, understanding the patient's belief of what will help them, and framing your treatment plan with their interests in mind.	- Thorough subjective exam- Identification of tissue specific impairments- Patient Expectations	I will admit, that despite research, I am biased in my examination and manual therapy interventions choices. In part because of who I was trained by and their philosophy (Stanley and Catherine); but also by the outcomes I see with my patients. I think there is a time and place for more specific, vs more general

Appendix VII: Delphi Round I Results with Thematic Coding

											manual therapy interventions.
8/1/2022 4:30	Neurological effects of touch, localisation training and the language used to explain methods	- Touch - Mechanism (neurophys) - Communication/Alliance	Notions relating to joint lubricaiton, readjusting position of vertebrae, fixing stuck joints, resetting the nervous system with spinal manipulation	- Biomechanical effects of OMT - ? Reseting of nervous system?	The concepts relating to the effects of communication, proprioception and touch, localisation and motor imagery.	- Communication - Ability to assess based on touch/feel - localization and motor imagery?	Pain mechanisms, motor control and proprioception, localisation training, communication skills and understanding of the bio-psycho-social, complex interaction being undertaken	- Pain Mechanisms - Motor Control and proprioception - Localization Training - Communication - Biopsychosocial Model	Candidate expectations, evaluation of psycho-social profile particular emphasis on locus of control and coping styles	- Patient Expectations - Psychosocial factors - ??locus of control ??	Manual therapy is Physical Education and adds a strong component to our role as physical educators
8/4/2022 12:26	The appropriate relationship between manual therapy and other management methods (education, functional training, exercise) and how it best aligns with characteristics of high-performing PT's	- Use of OMT as part of care plan	the obsession with segment, specificity and direction. Stuff we either can't prove or has been rightfully discredited. For example, it's embarrassing to continue talking about 'sacral torsions' WTF is that even?	- Specificity (Assessment and treatment) - Treatment choice based on palpation assessment	Repetition of basic skills, in context, known to effective in the patient management episode	-basic skills	Epidemiology, Diagnostic and Therapeutic Clinical Reasoning, Pattern Recognition, Characteristics of high-performing PT, Patient alliance, episode management, prognosis	- Epidemiology - Clinical Reasoning - Pattern recognition - Characteristics of high performing PT's - Therapeutic Alliance	Epidemiology, Stage ot patient within the episode, risk of harm, patient alliance	- Epidemiology - Stage of management - Safety - Therapeutic Alliance	Yes...need to stop teaching it in isolation, and need to get it off the pedestal. It's a management tool, not a way of life.

Appendix VII: Delphi Round I Results with Thematic Coding

8/8/2022 5:01	When to use MT	- Clinical Reasoning	MT for anything other than pain or motion	- OMT for non pain/motion?	the basics: stabilization, motion, thrust	- Technqiue (stabilization, motion, thrust)	anatomy	- Anatomy	those who demonstrate pain modulation in assessment	- Patient response model (test-retest)	Stop moving away from previous knowledge because research may not show excellent outcomes. Most research is on hetergenous populations with several impairments and its nearly impossible to show ONE treatment to be a silver bullet. Also, short term and immediate positive effects...we have that "proven."
8/8/2022 7:27	The evidence-based, scientific rationale behind the mechanisms of manual therapy and the measured outcomes	- EBP - Mechanism	Such a strict segmental focus on where the techniques are directed. Briefly covering biomechanics, arthrokinematics, etc is fine, but the application of regional approaches should also be a focus.	- Specificity (treatment)	Patient positioning and technique as it applies to safety and comfort. If the sciences supports a pain modulating effect of manual therapy then	- Technique (patient positioning) - Patient comfort - Safety	Courses in pain science, manual therapy skills, evidence-based practice, and exercise sciences so that exercises can be applied in a	- Pain Science - Psychomotor skills - Evidence Based Practice - Exercise Science - Following OMT with Exercise	their evaluation of patient expectations, the persistence of yellow flags that modify or confound the results of the manual therapy, their evaluation of	- Patient Expecations - Pain mechanism	none.

	associated with this.				patient safety and comfort during our handling is likely important.		multimodal approach.		ongoing pain mechanisms (neuropathic pain vs nocicplastic pain vs nociceptive pain).		
8/8/2022 13:56	Pain science (and understanding irritability) and Grades of mobilizations (in order to develop handling)	- Pain Science - Grades of Mobilizations - Psychomotor skills	Osteokinematics	- Arthrokinematics/Osteokinematics	Specific location and direction planes	- Specificity in application	Knowledge of anatomy, kinesiology, and grading scale (Maitland)	- Anatomy - Kinesiology - Grades of mobilizations	Clinical differential diagnosis, pain and stiff dominance	- Differential Diagnosis - Pain vs stiffness dominance	Experience is key and taking continuing education in multiple difference philosophies
8/8/2022 14:07	real life application of CPG, considering multiple patient 'nuances' and that manual therapy applicable to expedite pt case, at various points throughout the overall case management (ie. not just a manual therapy Yes/No, at outset, etc)	- EBP ?	some details of joint mechanics considered minutia, but focusing on the critical pieces and providing resources for more depth if desired	- Arthokinematics/Osteokinematics (excessive?)	how the joint/structures feel in their hands, patient & therapist positioning/comfort, patient complexities	- Ability to assess based on touch/feel - Technique (therapist positioning, patient positioning) - Patient comfort - Patient specific modifications	When not to apply techniques, irritability, how to maximize it's effectiveness, alternative techniques when needed, appropriate locking	- Contraindications - Irritability (SINSS?) - Joint locking techiques - Adapability in technique application	evidence, pt preference and their skill/knowledge level and distinct pt characteristics	- Current best evidence - Patient Expectations - Provider skill/prefeeraance	Manual therapy works and 'doesn't suck'!!! Manual therapy is valuable and I hate it when I see a therapist/student do hands off functional mobility and exercise and education only. We are better clinician's than that

Appendix VII: Delphi Round I Results with Thematic Coding

8/8/2022 15:58	Accurate assessment, correct application and neuroeducation	- Clinical Reasoning-PNE			Efficient and safe delivery of techniques	- Technique (efficency)-Safety	Anatomy and biomechanics as well as correct therapeutic exercise prescription	- Anatomy-Biomechanics-Exercise Prescription	Thorough evaluations and understanding of above	- Examination findings	No
8/8/2022 17:13	Developing at least a basic-intermediate level of tactile skills not only for manual therapy, but to aide in diagnostics and therefore guide a full spectrum of PT treatments including exercise, therapeutic activities as well as to know when to refer a patient out. Focus should be placed on more modern concepts of manual therapy, i.e. its role in pain relief, as a sensory stimulus and as a way of getting change in the nervous system or the local tissue and how to integrate the	- Development of tactile skills - Use of OMT as part of a care plan - Mechanisms (neurophys, biomechanical) - Education on use outside of articular techniques (Fascial)	Developing "body workers" who can "fix" patients.	? Biomechanical effects of OMT?	Developing soft hands that are highly sensory-receptive while still being able to evaluate a tissue at end-range if appropriate.	- Technique (soft hands) - Ability to assess based on touch/feel	all of the listed skills you mentioned in the previous screen. It is also important to have an eclectic base of skills (articular, fascia, neural) to meet the needs of a broad base of patients and scenarios.	- Ecletic skill set (articular, fascial, neural)	Pain mechanism (per IASP guidelines), astute clinical reasoning, patient preferences and goals, and with the clinician's understanding of what the patient should do next, i.e. self-care, exercise, experience of being pain-free, return to a function.	- Pain Mechanism - Clinical Reasoning - Patent Expectations	A skilled PT uses tactile skills as a key role in diagnostics for NMSK dysfunction. Skill should be at the level that the PT should be efficient in these tactile skills so it will enable moving onto movement-based treatments.

	two. Based on newer fascial research indicating a richness of nociceptors and proprioceptors, manual therapy training should not be limited to articular techniques.									
8/9/2022 9:00	Safety screening, appropriate patient selection for OMT, biomechanic principles, technique application and hand placement	- Safety - Identifying appropriate patients - Biomechanics - Psychomotor Skills	Excessive detail on technique specificity.	- Specificity	Patient communication, operator body mechanics as well as patient positioning, hand placement	- Communication - Technique (therapist positioning, patient positioning, hand placement)	Biomechanics and patient selection. Pain science knowledge is important as I believe there is a large overlap with biomechanics, but I feel it needs to be separate education as it is too big to be included in the scope of OMT education.	- Biomechanics - Indications - Pain Science? (says too big to be in OMT education?)	There is solid science on this as far as patient selection criteria and elevated pain response.	

Appendix VIII: Delphi- Round I Demographics

End Date	Q7	Q8	Q9	Q10	Q11	Q12	Q13
End Date	What is your age?	What gender do you identify with?	How many years have you been in Research?	How many years have you been in clinical practice?	What level(s) of post-doctoral manual therapy do you currently educate in?	Check all that apply related to your own education/training	What philosophy(s) of manual therapy are you trained?
7/12/2022 8:40	50-60	Male	20 or more	20 or more	Continuing Education	Post-Doctoral Degree (Dsc, Phd etc)	I am Maitland trained by why of entry-level training in Australia and Canadian OMT via Fowler and Pettman primarily; took a variety of series of courses after moving to USa from the IPA group; eg functional orthopaedics etc.
7/12/2022 11:19	40-50	Male	5-10	20 or more	Residency (OCS, SCS, etc),Fellowship (FAAOMPT),Continuing Education	Post-Doctoral Degree (Dsc, Phd etc),Fellow (FAAOMPT)	Eclectic - various. NOT biomechanistic, more symptom response.
7/12/2022 11:21	40-50	Male	None	10-15	Fellowship (FAAOMPT)	Fellow (FAAOMPT)	Australian, MDT, Kaltenborn
7/12/2022 18:14	30-40	Male	0-5	10-15	Residency (OCS, SCS, etc),Fellowship (FAAOMPT),Continuing Education	Post-Doctoral Degree (Dsc, Phd etc),Fellow (FAAOMPT)	Signs and symptoms approach
7/12/2022 20:25	>60	Female	0-5	20 or more	Fellowship (FAAOMPT),Continuing Education	Post-Doctoral Degree (Dsc, Phd etc),Fellow (FAAOMPT)	NAIOMT, osteopathic, eclectic but with sound clinical reasoning
7/13/2022 6:38	40-50	Male	15-20	20 or more	Continuing Education	Post-Doctoral Degree (Dsc, Phd etc)	neurophysiological

Appendix VIII: Delphi- Round I Demographics

7/13/2022 7:33	40-50	Male	5-10	15-20	Continuing Education	Fellow (FAAOMPT)	Mulligan, AAMT, Myopain, Integrative Dry Needling, Dry Needling Institute, AOPT Seminars
7/14/2022 6:15	40-50	Male	None	15-20	Residency (OCS, SCS, etc),Fellowship (FAAOMPT),Continuing Education	Fellow (FAAOMPT)	Eclectic (Maitland, Osteopathic, McKenzie, Paris - a little bit of all)
7/14/2022 20:48	40-50	Male	5-10	10-15		Post-Doctoral Degree (Dsc, Phd etc)	Rather general - Maitland, McKenzie, Mulligan especially (as a New Zealand therapist). Paris, as well as more traditional Kaltenborn techniques.
7/19/2022 14:03	50-60	Female	20 or more	20 or more	Fellowship (FAAOMPT),Continuing Education	Post-Doctoral Degree (Dsc, Phd etc),Fellow (FAAOMPT)	
7/20/2022 21:18	>60	Male	20 or more	20 or more	Fellowship (FAAOMPT)	Fellow (FAAOMPT)	IPA
7/22/2022 14:08	50-60	Male	None	20 or more	Fellowship (FAAOMPT)	Fellow (FAAOMPT)	Pretty eclectic through the OGI
7/26/2022 6:21	50-60	Male	0-5	20 or more	Fellowship (FAAOMPT)	Fellow (FAAOMPT)	Eclectic. The philosophy of manual therapy is a bit of an outdated concept. I guess that still mattered when I did my fellowship training in 1991, but that is not something that is talked about anymore

							nowadays. Definitely not talked about in my manual therapy program.
7/26/2022 7:17	30-40	Female	5-10	10-15	Residency (OCS, SCS, etc),Fellowship (FAAOMPT),Continuing Education	Post-Doctoral Degree (Dsc, Phd etc),Fellow (FAAOMPT)	at least introduced and familiar with: Maitland, Mulligan, Paris, McKenzie, Butler, Elvey, Shacklock, Stecco
7/26/2022 7:58	40-50	Male	5-10	20 or more	Residency (OCS, SCS, etc),Fellowship (FAAOMPT)	Fellow (FAAOMPT)	Maitland and Norwegian ,
7/26/2022 9:09	30-40	Male	5-10	5-10	Residency (OCS, SCS, etc),Fellowship (FAAOMPT),Continuing Education	Fellow (FAAOMPT)	My mentors were a combination of Mckenzie/pain science and Paris/Dunning based.
7/26/2022 10:08	50-60	Male	5-10	20 or more	Fellowship (FAAOMPT)	Post-Doctoral Degree (Dsc, Phd etc)	EBP no specific approach
7/26/2022 10:14	30-40	Male	0-5	5-10	Fellowship (FAAOMPT),Continuing Education	Post-Doctoral Degree (Dsc, Phd etc),Fellow (FAAOMPT)	Eclectic approach, but primarily rooted in Maitland methods.
7/26/2022 10:35	40-50	Female	10-15	15-20	Fellowship (FAAOMPT)	Post-Doctoral Degree (Dsc, Phd etc),Fellow (FAAOMPT)	Not one specific philosophy but definitely biased towards Maitland
7/26/2022 13:47	40-50	Male	None	20 or more	Residency (OCS, SCS, etc),Fellowship (FAAOMPT),Continuing Education	Fellow (FAAOMPT)	NAIOMT
7/26/2022 14:27	40-50	Male	0-5	20 or more	Fellowship (FAAOMPT),Continuing Education	Fellow (FAAOMPT)	Maitland primarily, but practice using McKenzie, Mulligan and Muscle Energy

Appendix VIII: Delphi- Round I Demographics

7/26/2022 21:28	50-60	Male	0-5	20 or more	Fellowship (FAAOMPT),Continuing Education	Fellow (FAAOMPT)	maitland, mckenzie, sahrmann, mulligan
7/27/2022 4:54	30-40	Male	0-5	10-15	Residency (OCS, SCS, etc),Fellowship (FAAOMPT),Continuing Education	Post-Doctoral Degree (Dsc, Phd etc),Fellow (FAAOMPT)	Eclectic training incorporative of multiple philosophies (everything from MDT to Norwegian approaches to Mulligan's concepts), but grounded within the clinical reasoning framework espoused by Maitland.
7/27/2022 9:23	>60	Male	10-15	20 or more	Residency (OCS, SCS, etc),Fellowship (FAAOMPT)	Fellow (FAAOMPT)	Australian/Maitland
7/28/2022 8:19	50-60	Male	10-15	20 or more	Fellowship (FAAOMPT),Continuing Education	Post-Doctoral Degree (Dsc, Phd etc),Fellow (FAAOMPT)	The Australian Approach (primarily Maitland)
7/28/2022 9:04	40-50	Female	0-5	15-20	Fellowship (FAAOMPT),Continuing Education	Fellow (FAAOMPT)	Not sure of 'philosophy' but initially within a biomedical model and as I progressed with education, within a more holistic model of care that includes consideration of biological, psychological, social and environment and personal factors
7/28/2022 10:47	40-50	Female	None	15-20	Residency (OCS, SCS, etc),Fellowship (FAAOMPT)	Fellow (FAAOMPT)	Ola Grimsby, MDT, Kaltenborn, Maitland

Appendix VIII: Delphi- Round I Demographics

7/28/2022 11:47	40-50	Male	5-10	15-20	Continuing Education	Post-Doctoral Degree (Dsc, Phd etc),Fellow (FAAOMPT)	I was trained in the Stanley Paris program but I for sure do not identify with that model, I would say I have developed an eclectic approach from various sources over the years.
7/28/2022 13:35	50-60	Male	0-5	20 or more	Residency (OCS, SCS, etc),Fellowship (FAAOMPT),Continuing Education	Fellow (FAAOMPT)	Nordic (Kaltenborn/Evjenth) originally, but fairly eclectic over the years
7/29/2022 11:42	40-50	Female	10-15	15-20	Residency (OCS, SCS, etc),Fellowship (FAAOMPT),Continuing Education	Fellow (FAAOMPT)	Paris and Patla, (Kaltenborn, Cyriax)
8/1/2022 4:30	50-60	Male	20 or more	20 or more	Fellowship (FAAOMPT)	Post-Doctoral Degree (Dsc, Phd etc),Fellow (FAAOMPT)	Maitland, Mulligan, Combined Movement Theory, McKenzie,
8/4/2022 12:26	40-50	Male	10-15	20 or more	Residency (OCS, SCS, etc),Fellowship (FAAOMPT),Continuing Education	Post-Doctoral Degree (Dsc, Phd etc),Fellow (FAAOMPT)	NAIOMT-MAITLAND
8/8/2022 5:01	50-60	Male	15-20	20 or more	Fellowship (FAAOMPT),Continuing Education	Post-Doctoral Degree (Dsc, Phd etc)	NAIOMT
8/8/2022 7:27	50-60	Male	15-20	20 or more	Fellowship (FAAOMPT),Continuing Education	Post-Doctoral Degree (Dsc, Phd etc),Fellow (FAAOMPT)	A biomechanical approach. Over time, through continuing education courses and independent reading, I gained a better understanding of pain neuroscience approaches to manual therapy.

Appendix VIII: Delphi- Round I Demographics

8/8/2022 13:56	30-40	Female	5-10	10-15	Residency (OCS, SCS, etc),Fellowship (FAAOMPT),Continuing Education	Fellow (FAAOMPT)	Maitland, McKenzie
8/8/2022 14:07	>60	Female	None	20 or more	Fellowship (FAAOMPT),Continuing Education	Fellow (FAAOMPT)	NAIOMT, Diane Lee, Stanley Paris, etc
8/8/2022 15:58	50-60	Male	None	20 or more	Fellowship (FAAOMPT),Continuing Education	Post-Doctoral Degree (Dsc, Phd etc),Fellow (FAAOMPT)	North American institute of orthopedic manual therapy
8/8/2022 17:13	>60	Female	20 or more	20 or more	Residency (OCS, SCS, etc),Fellowship (FAAOMPT),Continuing Education	Post-Doctoral Degree (Dsc, Phd etc),Fellow (FAAOMPT)	Eclectic: articular - Canadian, Scandinavian, Mackenzie, Maitland, Paris, Osteopathic, fascial techniques, neural techniques, visceral techniques, cranial techniques (not craniosacral).
8/9/2022 9:00	40-50	Male	None	15-20	Fellowship (FAAOMPT)	Fellow (FAAOMPT)	NAIOMT
8/9/2022 19:24	50-60	Male	5-10	20 or more	Residency (OCS, SCS, etc),Fellowship (FAAOMPT),Continuing Education	Fellow (FAAOMPT)	Norwegian (Kaltenborn, Grimsby, Olaf Evjenth), Paris, Mulligan, Maitland (Including other Australian approaches), Osteopathic (British and US)

Question 1- I would recommend that manual therapy training should focus on………

1. Patient self-reported outcomes
    1. Ability to assess outcomes
2. Mechanisms
    1. Neurophysiological
    2. Effect of touch (neurophys)
    3. Psychological
    4. Biomechanical
3. Patient Centered Care
    1. Communication
        1. Pain Neuroscience Education
        2. Therapeutic alliance
    2. Managing patient expectations
    3. Addressing lifestyle behaviors to promote overall wellness
4. Clinical reasoning
    1. Use of OMT as part of multimodal care plan
    2. Use of OMT for non-pain uses (Motor control, tone reduction)
    3. Use of OMT for soft tissue and fascial problems
    4. Application of EBP
        1. Patient preference, therapist preference/skill, research
5. Determining candidates for MT
    1. Localization of tissue dysfunction
    2. Identification of responders and non-responders
6. Operator efficiency
    1. Psychomotor skills
    2. Patient Handling
    3. Patient comfort
    4. Advanced assessment skills
    5. Safety
    6. Ability to modify techniques as needed
    7. Ability to grade mobilizations
7. Foundational Knowledge
    1. Biomechanics
    2. Arthokinematics/osteokinematics
    3. Neuromuscular training
    4. The science of pain (pain science)

Question 2- I would recommend that manual therapy training should omit focus on………

1. Theory
    a. Terminological and philosophical considerations of different OMT philosophies
    b. Biomechanical effects of OMT
    c. Complex reasoning that is not observable/reproduceable
    d. Clinical Prediction Rules
    e. Visceral Manipulation
    f. Pain Neuroscience Education

   g. Application of technique without clinical reasoning
   h. Resetting of nervous system with manipulation techniques
   i. OMT for treatment of non-pain/motion complaints
   j. Terminology attempting to differentiate philosophies (school of thought)
2. Application Specificity
   a. Arthrokinematics/Osteokinematics
   b. Non-reliable assessment techniques
      i. Palpation
      ii. SIJ Assessment Techniques
   c. Segment localization
   d. Treatment based on biomechanical findings
      i. Palpation
   e. Treatment direction based on arthrokinematics
   f. Treatment based on clinical prediction rules
   g. Rigidly defined techniques that are not adaptive to patient needs

3. Applying Research/Evidence in training
   a. Treatment 'fads' without evidence supporting
   b. Treatment based purely off a research driven model

Question 3- When demonstrating techniques, I would recommend that the trainees focus on………

1. Patient response (including follow up and re-assessment)
   1. Test-retest
   2. Identifying patient comparable sign
2. Application specifics
   1. Confidence
   2. Hand placement
   3. Proper setup of technique
   4. Therapist positioning
   5. Patient positioning
   6. Patient comfort
   7. Direction of technique
   8. Speed of technique
   9. Amplitude of technique
   10. Grade of technique
   11. Technique specificity
       1. Localization of tissue dysfunction
       2. Ability to lock out specific segments
   12. Technique proficiency and efficiency
   13. Technique based on arthrokinematic principles
3. Communication
   1. Communication with patient during technique
4. Clinical reasoning
   1. Ability to assess based on touch/feel

2. Modifications to technique based on patient
    1. Flexibility in technique application
3. Safety
4. Following OMT with technique to maintain function

Question 4: The foundational knowledge I feel is necessary to apply manual therapy is………

1. Anatomy and physiology
    a. Anatomy
    c. Neurophysiology
    d. Arthrokinematics/Osteokinematics
    e. Relationship between physiology and neuromuscular system
    f. Histology
    g. Epidemiology
2. OMT history and predominant philosophies
    c. History of OMT
    d. Current state of OMT
    e. Philosophies of OMT
    f. Grading Scales
3. Mechanisms
    c. Mechanisms of OMT response
    d. Manual therapy application based on pain mechanism (mechanism based OMT)
    e. Pain Science (could be lumped in with b. above)
    f. Understanding lack of specificity in OMT
4. Indications and contraindications
    c. Indications/contraindications
    d. Patient Safety
        1. Red flag screening
5. Multi-modal management
    a. Patient education as adjunct to OMT
    b. Following OMT with functional movement/exercise
    c. Understanding exercise science
    d. Eclectic skill set (fascial, soft tissue, neural, articular)
6. Principles of OMT assessment and patient interaction
    a. Ability to identify impairments and functional limitations
    b. Ability to obtain good history
    c. Patient centered care
    d. Patient response model (test-retest)
    e. Strong Assessment/Evaluation skills
        1. SINSS Model
        2.
    f. Strong communication skills
    g. Pattern recognition
7. Outcome moderators and mediators
    a. Understanding Cognitive and Psychological contributors to pain and stiffness
        1. Patient expectations and beliefs

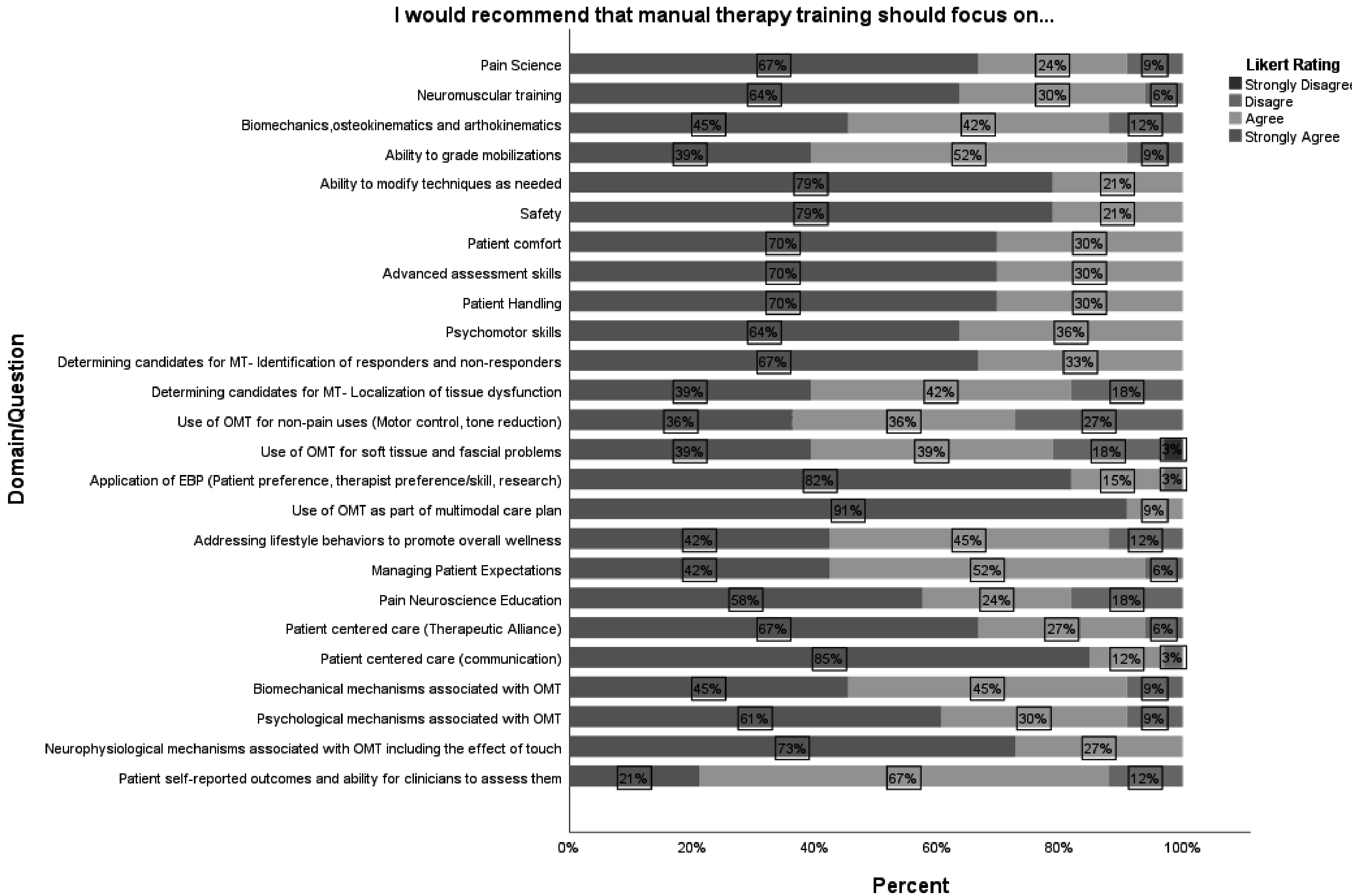
    b. Exercise prescription
    c. Application of the Biopsychosocial Model
8. Principles of EBP
    b. Evidence based practice
    c. Identifying gaps within the literature
    d. Ability to critique research methodology
9. Application Specifics
    b. Technique
    c. Psychomotor skills
    d. Ability to adapt techniques to specific patients
    e. Ability to lock out joints

Q5- I would recommend that trainees attempt to identify candidates for manual therapy based on………

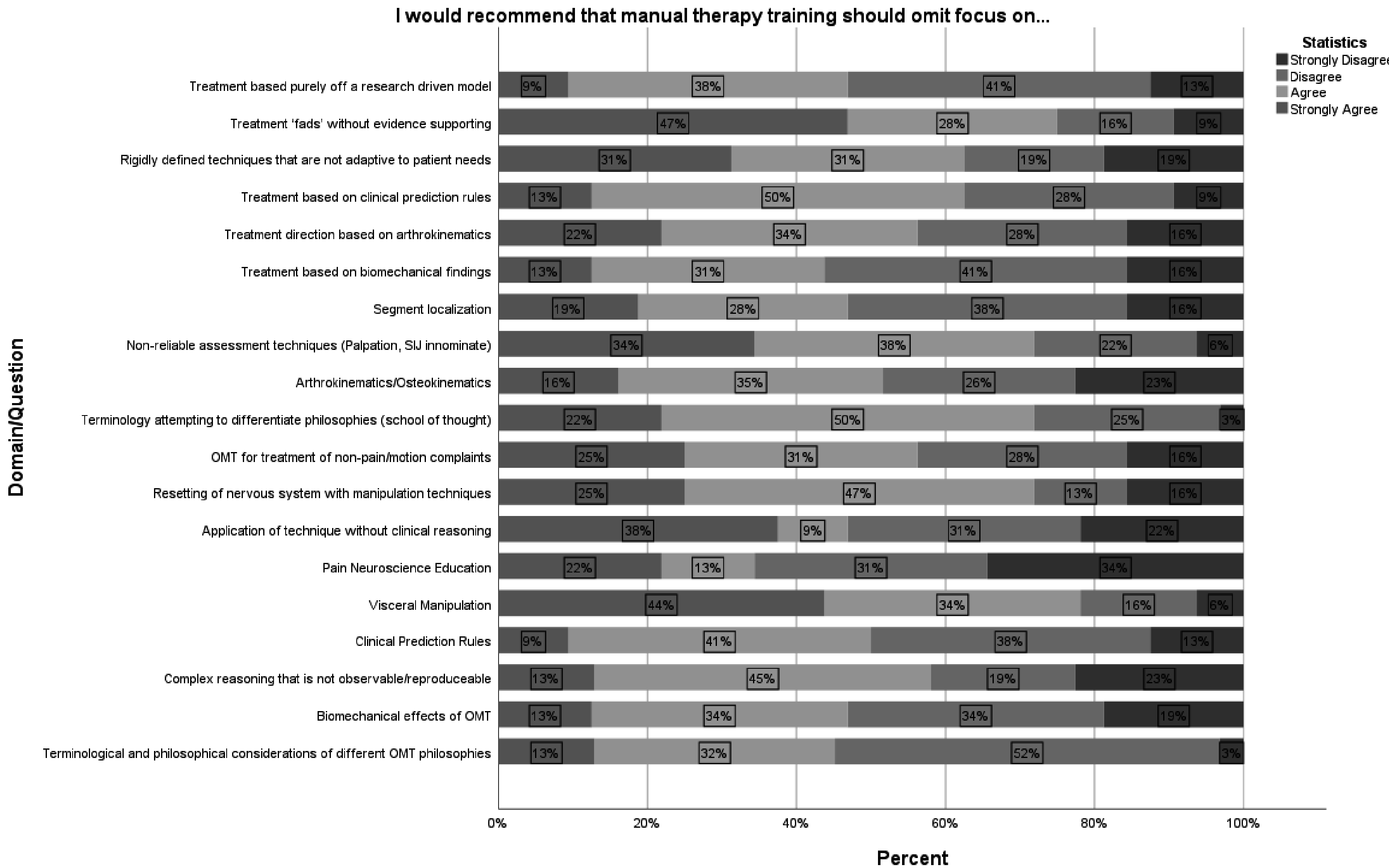
1. Diagnosis
    1. Pain mechanism
    2. Differential Diagnosis
    3. Identification of specific tissue impairment
    4. Pain vs stiffness dominance
2. Clinical examination findings
    1. Lack of contraindications
        1. safety
    2. Patient response model
    3. Stage of management
    4. Biomechanical findings
    5. Joint mobility findings
    6. Utilizing test clusters to identify responders
    7. Identified impairments

    8. SINSS Model
3. Patient preferences and psychological state
    1. Patient expectations
    2. Psychosocial factors
    3. Biopsychosocial assessment
    4. Patient tolerance
4. Treatment objectives
    1. Use of self-reported outcome measures
    2. Use of performance based outcome measures
5. Signs and symptoms
    1. Signs
    2. Symptoms
6. EBP derived categorizations
    1. Current best evidence (patient exp, provider exp, and research)

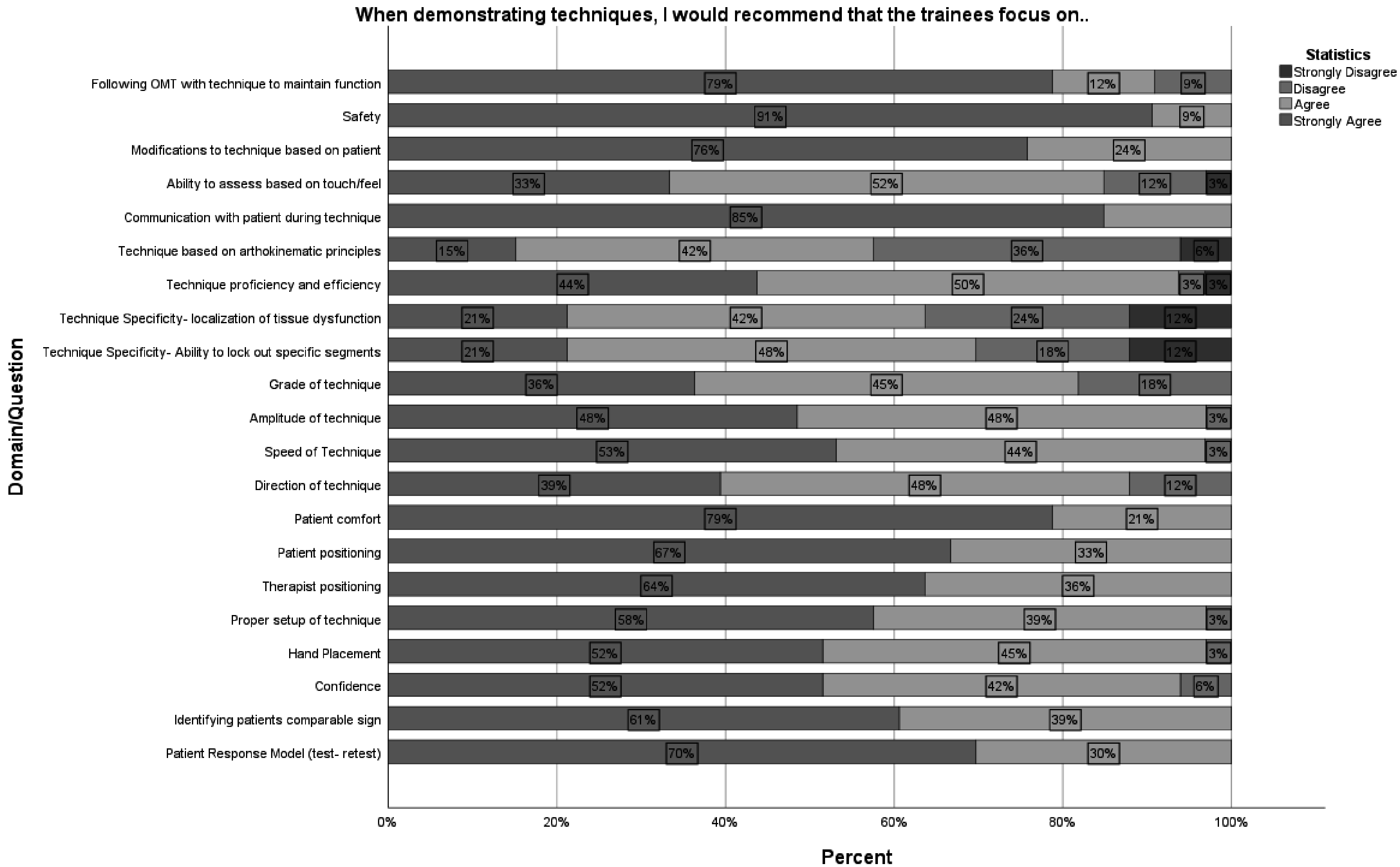
Appendix X: Delphi- Round II Summary of Results



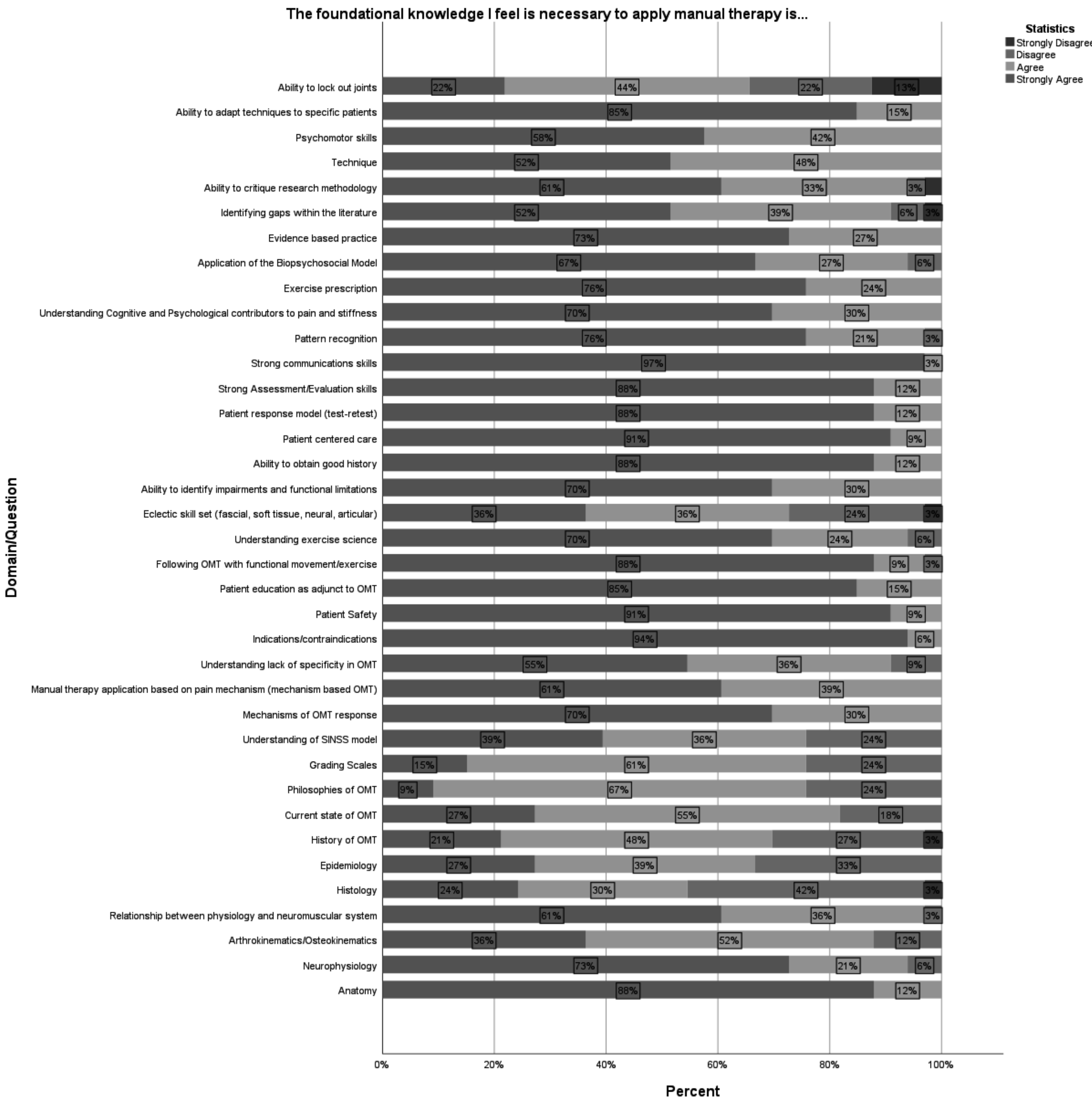
Appendix X: Delphi- Round II Summary of Results



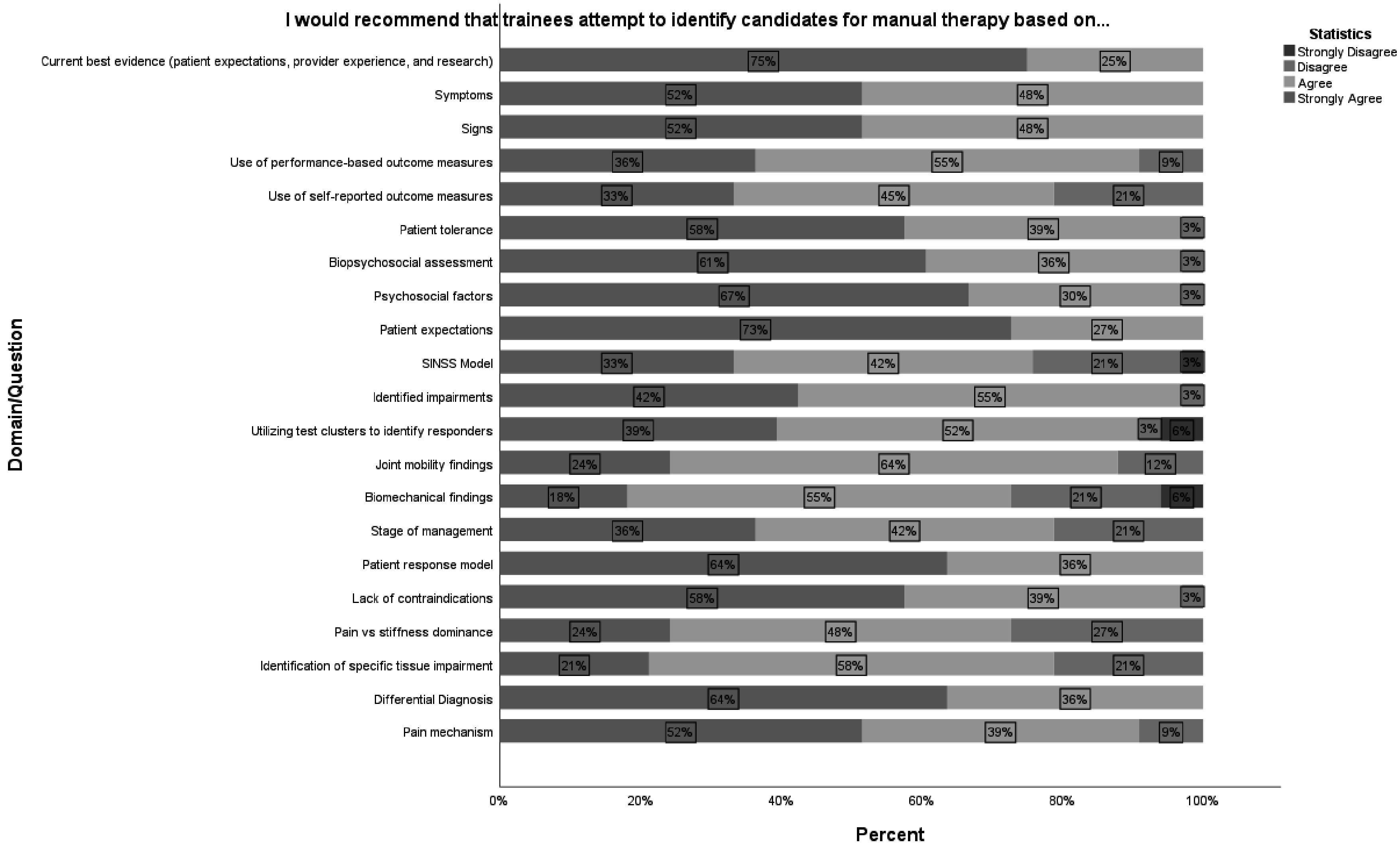
Appendix X: Delphi- Round II Summary of Results



Appendix X: Delphi- Round II Summary of Results



Appendix X: Delphi- Round II Summary of Results



Appendix XI: Delphi Round II Results

	I would recommend that manual therapy training should focus on...																								
End Date	Patient self-reported outcomes and ability for clinicians to assess them.	Neurophysiological mechanisms associated with OMT including the effect of touch.	Psychological mechanisms associated with OMT.	Biomechanical mechanisms associated with OMT.	Patient centered care (communication)	Patient centered care (Therapeutic Alliance)	Pain Neuroscience Education	Managing Patient Expectations	Addressing lifestyle behaviors to promote overall wellness	Use of OMT as part of multimodal care plan	Application of EBP (Patient preference, therapist preference/skill, research)	Use of OMT for soft tissue and fascial problems	Use of OMT for non-pain uses (Motor control, tone reduction)	Determining candidates for MT- Localization of tissue dysfunction	Determining candidates for MT- Identification of responders and non-responders	Psychomotor skills	Patient Handling	Advanced assessment skills	Patient comfort	Safety	Ability to modify techniques as needed	Ability to grade mobilizations	Biomechanics,osteokinematics and arthokinematics	Neuromuscular training	Pain Science
6-Sep-22	3	4	4	4	4	4	4	4	4	4	4	2	3	2	4	4	4	3	4	4	4	3	2	3	4
6-Sep-22	4	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
6-Sep-22	4	4	4	4	3	3	4	3	3	4	4	1	2	3	4	3	3	4	3	4	4	4	4	3	4
6-Sep-22	3	4	4	4	4	4	4	4	3	4	4	4	3	2	3	3	3	3	3	3	3	3	4	4	4
6-Sep-22	3	4	3	3	4	4	2	3	4	4	4	4	4	3	4	3	4	3	4	4	4	3	3	3	4
6-Sep-22	3	4	4	4	4	4	4	3	3	4	4	3	4	4	3	4	4	4	4	4	4	4	4	4	4
6-Sep-22	3	4	4	4	4	4	4	4	4	4	4	2	2	3	4	4	4	4	4	4	4	3	3	4	4
6-Sep-22	3	4	4	4	4	4	4	3	3	4	4	3	2	2	3	4	3	3	3	4	4	2	4	4	4
6-Sep-22	3	4	4	4	4	4	2	4	3	4	4	2	2	2	3	3	4	3	4	4	4	3	2	2	2
6-Sep-22	3	3	3	3	4	3	3	3	4	4	4	4	4	3	3	4	4	4	4	4	4	2	4	4	3
6-Sep-22	3	3	3	3	3	2	2	3	2	4	4	4	2	4	3	4	3	4	4	4	4	3	4	3	2
7-Sep-22	3	4	4	3	4	4	3	3	2	3	4	2	2	4	4	4	4	4	4	4	4	4	3	4	4
8-Sep-22	3	3	3	3	3	3	2	2	2	4	4	3	2	3	4	4	4	4	4	4	4	3	4	4	2
8-Sep-22	3	4	4	3	4	3	3	3	4	3	3	2	2	3	3	3	3	3	3	3	3	3	2	3	3
9-Sep-22	2	4	2	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	3	4	4	4
9-Sep-22	4	4	4	2	4	4	2	4	3	4	4	3	3	2	3	3	3	3	4	4	4	3	3	2	3
12-Sep-22	3	4	4	4	4	4	4	4	3	4	4	3	4	3	4	4	4	4	4	4	4	3	4	4	4
14-Sep-22	2	4	4	4	4	4	4	4	4	4	3	3	3	4	4	4	4	4	4	4	4	4	3	4	4
20-Sep-22	3	4	4	4	4	3	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
20-Sep-22	4	4	4	3	4	4	4	4	4	4	4	3	2	3	4	3	3	3	3	3	3	3	3	4	4
20-Sep-22	3	3	3	3	4	4	3	3	3	4	4	3	3	3	3	4	3	4	3	4	3	3	3	3	4
20-Sep-22	2	3	2	4	2	2	3	2	3	4	2	3	3	4	4	3	4	4	3	4	4	4	4	4	3
20-Sep-22	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	4	4
20-Sep-22	3	3	3	3	4	4	4	3	3	4	4	4	3	3	4	4	4	4	4	4	4	3	4	3	4

Appendix XI: Delphi Round II Results

22-Sep-22	4	4	3	3	4	4	3	3	4	4	4	3	3	3	3	3	3	3	3	3	4	3	3	3	3
26-Sep-22	3	3	3	3	4	3	4	3	4	3	3	3	3	4	4	3	4	4	3	4	3	4	3	4	4
27-Sep-22	2	4	4	3	4	4	4	3	3	4	4	4	4	4	4	4	4	4	4	3	3	4	3	4	4
27-Sep-22	3	4	3	3	4	4	4	4	4	4	4	3	4	3	4	4	4	4	4	4	4	4	3	4	4
28-Sep-22	3	4	4	2	4	4	4	3	3	4	3	3	3	2	3	3	4	4	4	3	4	3	2	3	3
30-Sep-22	3	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
4-Oct-22	4	4	3	2	4	4	3	3	4	4	4	2	3	3	4	4	4	3	4	3	3	2	3	4	3
4-Oct-22	4	3	4	3	4	4	4	4	4	4	4	4	4	3	4	3	3	4	3	4	4	3	3	3	4
6-Oct-22	3	3	2	4	4	3	2	3	2	4	3	4	3	4	4	4	4	4	4	4	4	4	4	4	3

Appendix XI: Delphi Round II Results

	I would recommend that manual therapy training should omit focus on...																		
End Date	Terminological and philosophical considerations of different OMT philosophies	Biomechanical effects of OMT	Complex reasoning that is not observable/reproduceable	Clinical Prediction Rules	Visceral Manipulation	Pain Neuroscience Education	Application of technique without clinical reasoning	Resetting of nervous system with manipulation techniques	OMT for treatment of non-pain/motion complaints	Terminology attempting to differentiate philosophies (school of thought)	Arthrokinematics/Osteokinematics	Non-reliable assessment techniques (Palpation, SIJ innominate)	Segment localization	Treatment based on biomechanical findings	Treatment direction based on arthrokinematics	Treatment based on clinical prediction rules	Rigidly defined techniques that are not adaptive to patient needs	Treatment ‘ fads’ without evidence supporting	Treatment based purely off a research driven model
6-Sep-22	x	2	3	3	4	1	4	3	2	3	3	4	3	2	4	3	4	4	3
6-Sep-22	3	4	3	3	2	4	2	3	4	3	4	3	4	4	4	3	2	2	2
6-Sep-22	4	1	3	4	4	1	4	4	4	4	1	3	2	1	1	4	3	4	1
6-Sep-22	2	2	x	3	3	1	3	3	3	2	x	3	3	2	2	3	3	4	2
6-Sep-22	2	2	1	2	2	2	4	3	2	3	2	4	2	2	2	2	3	3	2
6-Sep-22	2	1	3	1	4	1	4	4	2	2	2	4	1	1	2	2	4	4	3
6-Sep-22	2	3	2	2	1	4	2	3	2	2	3	1	3	3	3	2	2	2	2
6-Sep-22	1	2	1	3	4	1	3	4	3	1	3	2	2	3	3	3	1	2	2
6-Sep-22	3	4	3	3	4	3	4	2	3	3	3	4	4	3	3	3	4	4	2
6-Sep-22	2	1	1	2	3	2	4	1	1	3	1	2	2	3	1	3	4	4	4
6-Sep-22	2	1	3	3	3	3	2	2	3	2	1	2	1	1	1	3	3	3	2
7-Sep-22	2	3	4	3	4	1	4	3	4	4	3	4	2	3	4	3	4	4	4
8-Sep-22	3	1	1	4	4	2	1	2	4	3	1	4	1	1	1	4	3	4	3
8-Sep-22	3	3	3	3	4	2	2	4	2	2	3	3	3	3	3	3	3	4	3
9-Sep-22	3	2	3	4	3	1	4	1	1	3	1	3	1	2	2	4	4	3	3
9-Sep-22	2	3	4	3	4	2	3	3	2	4	3	4	3	3	4	3	4	4	2
12-Sep-22	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
14-Sep-22	2	2	2	2	2	4	2	4	4	4	3	1	2	2	3	2	2	1	1
20-Sep-22	3	4	3	3	1	4	1	3	3	2	4	4	4	4	4	4	1	1	1
20-Sep-22	2	2	3	2	3	2	2	3	3	3	2	3	2	2	2	2	3	3	2
20-Sep-22	2	2	1	3	3	1	1	1	1	4	2	4	4	2	3	3	4	3	2
20-Sep-22	3	3	3	1	2	3	1	3	4	3	4	3	3	3	4	1	1	2	3
20-Sep-22	2	2	3	2	4	1	4	1	1	2	2	3	2	2	2	2	3	3	3
20-Sep-22	2	2	2	3	2	1	4	4	2	3	1	3	2	2	2	3	4	4	1
22-Sep-22	4	2	2	2	4	2	4	3	3	4	2	2	2	2	3	3	3	3	3
26-Sep-22	4	3	4	2	3	4	2	3	3	3	3	3	4	3	3	2	2	2	2
27-Sep-22	2	3	3	2	3	2	4	3	2	3	2	3	2	2	2	3	2	4	3
27-Sep-22	3	3	2	3	3	4	1	4	3	2	3	2	3	3	3	3	1	1	3
28-Sep-22	3	3	3	2	3	2	2	3	3	3	2	3	3	2	4	2	4	3	3
30-Sep-22	4	4	4	2	4	4	2	4	4	4	4	4	4	4	3	2	2	3	2
4-Oct-22	3	3	2	2	4	2	2	2	2	3	4	4	3	4	3	3	3	4	3
4-Oct-22	2	3	1	1	4	1	1	3	4	3	3	2	2	2	2	1	1	4	2
6-Oct-22	2	1	1	1	3	3	1	1	1	3	1	2	1	1	1	1	1	4	4

Appendix XI: Delphi Round II Results

	When demonstrating techniques, I would recommend that the trainees focus on...																				
End Date	Patient Response Model (test- retest)	Identifying patients comparable sign	Confidence	Hand Placement	Proper setup of technique	Therapist positioning	Patient positioning	Patient comfort	Direction of technique	Speed of Technique	Amplitude of technique	Grade of technique	Technique Specificity- Ability to lock out specific segments	Technique Specificity- localization of tissue dysfunction	Technique proficiency and efficiency	Technique based on arthokinematic principles	Communication with patient during technique	Ability to assess based on touch/feel	Modifications to technique based on patient	Safety	Following OMT with technique to maintain function
6-Sep-22	4	4	4	3	4	4	4	4	3	4	4	4	1	1	4	1	4	3	4	4	3
6-Sep-22	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
6-Sep-22	4	4	3	3	4	4	4	3	3	x	3	3	3	3	3	3	4	3	4	4	4
6-Sep-22	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	4	2	3	4	4
6-Sep-22	3	3	3	4	4	4	4	4	2	3	3	3	1	2	3	2	4	2	4	4	2
6-Sep-22	4	4	3	3	4	4	4	4	4	4	4	4	3	3	4	3	4	4	4	4	4
6-Sep-22	4	4	4	3	3	3	3	3	3	3	3	3	3	3	4	3	4	4	4	4	4
6-Sep-22	3	3	4	4	4	4	4	4	3	3	3	2	2	2	3	2	4	2	3	4	2
6-Sep-22	4	4	4	3	3	4	4	4	3	3	3	3	1	1	3	1	4	3	4	4	2
6-Sep-22	3	3	3	4	4	4	4	4	4	4	4	2	3	3	3	3	4	4	4	4	4
6-Sep-22	3	3	2	3	3	3	3	3	3	3	3	2	3	3	3	2	3	3	3	3	3
7-Sep-22	4	4	4	4	4	4	4	4	4	4	4	4	4	3	4	2	4	4	4	4	4
8-Sep-22	4	3	3	4	3	3	3	4	3	4	4	3	3	3	x	3	4	3	4	4	4
8-Sep-22	4	4	4	4	4	4	4	4	3	3	3	3	3	2	3	2	3	3	3	4	3
9-Sep-22	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4
9-Sep-22	4	3	3	2	2	3	3	4	3	3	3	3	2	1	3	2	4	1	4	4	4
12-Sep-22	4	4	4	3	3	3	3	4	2	3	3	3	2	2	4	3	4	4	4		4
14-Sep-22	4	4	4	4	4	4	4	4	3	4	4	3	1	1	1	2	4	3	4	4	4
20-Sep-22	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
20-Sep-22	4	3	3	3	3	4	4	4	3	3	3	3	3	3	3	3	4	3	4	4	4
20-Sep-22	4	4	4	4	4	4	4	4	4	4	4	3	3	3	4	2	4	4	4	4	4
20-Sep-22	3	3	2	3	3	3	3	4	4	3	3	2	3	4	3	4	3	4	4	4	4
20-Sep-22	4	4	4	4	4	4	4	4	4	4	4	4	3	3	4	2	4	3	4	4	4
20-Sep-22	4	3	3	3	4	4	4	4	4	4	4	4	4	3	4	4	4	3	4	4	3
22-Sep-22	3	3	3	3	3	3	3	3	3	3	3	3	2	2	3	3	3	3	4	4	4
26-Sep-22	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4
27-Sep-22	3	3	3	4	3	3	3	4	3	4	4	4	3	3	3	3	4	2	3	4	4
27-Sep-22	4	4	3	4	4	4	4	4	4	4	4	4	3	4	4	3	4	3	4	4	4
28-Sep-22	3	4	4	3	3	3	4	4	3	3	3	3	3	3	3	2	4	3	3	3	4
30-Sep-22	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4
4-Oct-22	3	4	4	3	3	3	3	3	2	4	3	2	2	2	3	2	4	3	3	3	4
4-Oct-22	4	4	4	4	4	4	4	4	3	3	3	3	3	2	3	3	4	3	4	4	4
6-Oct-22	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	4	4	4

Appendix XI: Delphi Round II Results

	The foundational knowledge I feel is necessary to apply manual therapy is...																						
End Date	Anatomy	Neurophysiology	Arthrokinematics/Osteokinematics	Relationship between physiology and neuromuscular system	Histology	Epidemiology	History of OMT	Current state of OMT	Philosophies of OMT	Grading Scales	Understanding of SINSS model	Mechanisms of OMT response	Manual therapy application based on pain mechanism (mechanism based OMT)	Understanding lack of specificity in OMT	Indications/contraindications	Patient Safety	Patient education as adjunct to OMT	Following OMT with functional movement/exercise	Understanding exercise science	Eclectic skill set (fascial, soft tissue, neural, articular)	Ability to identify impairments and functional limitations	Ability to obtain good history	Patient centered care
6-Sep-22	3	3	2	4	2	2	4	4	3	3	4	4	4	4	4	4	4	4	4	2	4	4	4
6-Sep-22	4	4	4	4	4	3	4	3	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4
6-Sep-22	4	3	4	3	3	4	2	2	2	3	2	4	4	4	4	4	4	4	4	2	4	4	4
6-Sep-22	4	4	3	4	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	3	3	3	3
6-Sep-22	4	4	3	3	3	2	4	3	3	3	4	4	3	3	4	4	4	4	4	4	4	4	4
6-Sep-22	4	4	3	4	2	2	4	4	3	4	4	4	4	3	4	4	4	4	4	4	4	4	4
6-Sep-22	4	4	3	4	3	4	3	3	3	3	4	4	4	4	4	4	4	4	4	3	4	4	4
6-Sep-22	4	4	3	4	3	3	3	4	3	2	2	3	3	4	4	4	3	2	4	2	3	4	4
6-Sep-22	4	2	3	3	2	2	2	3	3	3	3	3	3	4	4	4	4	4	3	1	4	4	4
6-Sep-22	4	4	4	4	4	2	2	2	2	2	2	3	3	3	4	4	4	4	4	4	4	4	4
6-Sep-22	4	2	3	2	3	3	4	3	3	3	2	3	3	2	4	3	4	3	2	2	4	4	3
7-Sep-22	4	3	2	3	2	3	3	3	3	3	4	4	3	4	4	4	4	4	3	3	4	4	4
8-Sep-22	4	4	3	3	2	2	2	2	2	2	2	4	3	2	4	4	3	4	3	3	3	4	4
8-Sep-22	3	3	2	3	2	2	2	2	2	3	3	3	3	3	4	4	4	3	3	2	3	4	4
9-Sep-22	4	4	4	4	2	2	2	2	2	2	3	4	4	4	4	4	4	4	2	4	4	4	4
9-Sep-22	4	4	2	3	1	2	2	2	2	3	2	3	4	4	4	4	4	4	4	2	3	3	4
12-Sep-22	4	4	3	4	3	3	1	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4
14-Sep-22	3	3	3	3	2	2	3	3	3	3	4	4	4	4	4	4	4	4	4	2	3	4	4
20-Sep-22	4	4	4	4	4	4	3	3	2	3	3	4	4	4	4	4	4	4	4	4	4	4	4
20-Sep-22	4	4	3	3	3	3	3	4	3	3	3	4	4	3	4	4	4	4	4	3	4	4	4
20-Sep-22	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4
20-Sep-22	4	3	4	3	4	3	3	3	3	3	2	4	3	2	4	4	3	4	4	3	3	3	3
20-Sep-22	4	4	3	3	2	3	3	4	3	3	4	4	4	3	4	4	4	4	4	3	4	4	4
20-Sep-22	4	4	4	4	4	3	3	3	3	3	2	4	4	3	4	4	4	4	4	4	4	4	4
22-Sep-22	3	4	3	4	2	3	3	3	3	2	3	3	3	3	4	4	4	4	4	3	4	4	4
26-Sep-22	4	4	4	4	3	4	3	3	3	4	4	4	4	4	4	4	3	4	3	3	4	4	4
27-Sep-22	4	4	4	4	2	2	3	4	3	3	3	4	4	3	4	4	4	4	4	3	3	4	4
27-Sep-22	4	4	3	4	4	4	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	3	4
28-Sep-22	4	4	4	4	3	4	2	3	3	2	4	3	3	3	3	3	3	3	3	3	3	4	4
30-Sep-22	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
4-Oct-22	4	4	3	4	2	4	3	3	3	2	3	4	3	3	3	3	4	4	3	2	3	4	4
4-Oct-22	4	4	3	4	2	3	3	4	3	3	4	3	4	4	4	4	4	4	4	4	4	4	4
6-Oct-22	4	3	4	3	2	3	2	3	2	2	3	3	3	3	4	4	4	4	3	3	4	4	4

Appendix XI: Delphi Round II Results

	The foundational knowledge I feel is necessary to apply manual therapy is... (continued)													
End Date	Patient response model (test-retest)	Strong Assessment/Evaluation skills	Strong communications skills	Pattern recognition	Understanding Cognitive and Psychological contributors to pain and stiffness	Exercise prescription	Application of the Biopsychosocial Model	Evidence based practice	Identifying gaps within the literature	Ability to critique research methodology	Technique	Psychomotor skills	Ability to adapt techniques to specific patients	Ability to lock out joints
6-Sep-22	4	4	4	4	4	4	4	4	4	4	4	4	4	1
6-Sep-22	4	4	4	4	4	4	4	4	4	4	4	4	4	4
6-Sep-22	4	4	4	4	4	4	4	4	3	4	3	4	4	3
6-Sep-22	3	3	4	4	3	3	3	4	4	4	3	3	3	2
6-Sep-22	4	4	4	4	3	4	3	4	3	3	3	3	4	2
6-Sep-22	4	4	4	4	3	4	4	4	4	4	4	4	4	4
6-Sep-22	4	4	4	4	4	4	4	4	4	4	3	4	4	3
6-Sep-22	3	3	4	3	4	4	4	4	4	4	3	3	4	2
6-Sep-22	4	4	4	3	3	3	3	3	3	3	3	3	4	1
6-Sep-22	4	4	4	4	4	4	4	4	4	4	4	4	4	2
6-Sep-22	3	4	4	3	3	3	3	3	2	2	4	3	4	3
7-Sep-22	4	4	4	4	4	3	3	4	4	4	4	4	4	4
8-Sep-22	4	4	4	3	3	3	2	4	2	3	4	4	4	3
8-Sep-22	4	4	4	3	3	3	3	4	3	3	3	3	3	2
9-Sep-22	4	4	4	4	4	4	4	3	3	3	4	4	4	3
9-Sep-22	4	3	4	2	4	3	3	4	1	1	3	3	4	2
12-Sep-22	4	4	4	4	4	4	4	4	3	4	3	3	4	1
14-Sep-22	4	4	4	4	4	4	4	3	3	4	3	3	3	x
20-Sep-22	4	4	4	4	4	4	4	4	4	4	4	4	4	4
20-Sep-22	4	4	4	4	4	4	4	4	4	4	3	3	4	3
20-Sep-22	4	4	4	4	4	4	4	4	4	4	4	4	4	4
20-Sep-22	3	4	3	4	3	4	2	3	3	3	4	3	4	3
20-Sep-22	4	4	4	3	4	4	4	4	4	4	4	4	4	3
20-Sep-22	4	4	4	4	4	4	4	4	4	4	4	4	4	3
22-Sep-22	4	4	4	4	4	4	4	3	3	3	3	3	4	2
26-Sep-22	4	4	4	4	4	4	4	4	3	3	3	3	3	3
27-Sep-22	4	4	4	4	4	4	4	3	3	3	3	4	3	3
27-Sep-22	4	4	4	4	4	4	4	4	4	4	4	4	4	3
28-Sep-22	4	4	4	3	3	4	4	4	4	4	3	3	4	1
30-Sep-22	4	4	4	4	4	4	4	3	4	4	4	4	4	4
4-Oct-22	4	3	4	4	4	4	3	3	3	3	3	4	4	3
4-Oct-22	4	4	4	4	4	4	4	4	4	4	4	4	4	3
6-Oct-22	4	4	4	4	3	3	3	4	3	3	4	4	4	4

Appendix XI: Delphi Round II Results

	I would recommend that trainees attempt to identify candidates for manual therapy based on...																				
End Date	Pain mechanism	Differential Diagnosis	Identification of specific tissue impairment	Pain vs stiffness dominance	Lack of contraindications	Patient response model	Stage of management	Biomechanical findings	Joint mobility findings	Utilizing test clusters to identify responders	Identified impairments	SINSS Model	Patient expectations	Psychosocial factors	Biopsychosocial assessment	Patient tolerance	Use of self-reported outcome measures	Use of performance-based outcome measures	Signs	Symptoms	Current best evidence (patient expectations, provider experience, and research)
6-Sep-22	4	4	2	3	4	4	4	2	3	3	3	4	4	4	4	4	4	4	4	4	4
6-Sep-22	4	4	4	3	4	4	4	4	4	3	4	3	4	4	4	4	4	4	4	4	4
6-Sep-22	3	4	3	3	4	4	3	3	3	1	3	2	4	4	4	4	2	2	4	4	4
6-Sep-22	3	3	3	2	4	3	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3
6-Sep-22	2	4	3	3	4	4	2	2	2	3	2	4	4	4	3	3	2	3	4	4	4
6-Sep-22	4	4	3	4	4	4	4	3	4	3	4	4	4	3	4	4	3	3	4	4	4
6-Sep-22	3	4	3	3	4	4	4	3	3	4	3	4	4	4	4	4	4	4	4	4	4
6-Sep-22	3	3	2	2	4	4	3	3	3	3	3	2	4	4	4	3	3	3	3	3	4
6-Sep-22	2	3	2	2	3	3	3	1	3	3	3	3	4	4	4	4	3	3	3	3	3
6-Sep-22	3	4	3	3	4	3	2	3	3	3	3	4	4	3	3	3	3	3	3	3	4
6-Sep-22	3	3	3	2	3	3	3	3	3	3	3	2	3	3	3	3	2	2	3	3	3
7-Sep-22	4	3	3	4	3	4	3	2	3	4	4	4	4	4	3	3	3	3	4	4	4
8-Sep-22	3	4	3	2	3	4	3	3	3	4	3	2	3	3	3	3	2	3	3	3	4
8-Sep-22	3	3	3	3	3	4	3	2	2	2	3	3	4	4	4	4	3	3	3	3	3
9-Sep-22	4	4	4	4	4	4	4	3	4	4	4	3	3	2	3	3	2	4	3	3	4
9-Sep-22	4	3	2	2	4	3	2	1	2	3	3	2	4	4	3	3	3	3	3	3	4
12-Sep-22	4	4	2	2	4	4	2	3	3	3	3	3	4	4	4	4	2	3	4	4	4
14-Sep-22	4	4	2	3	3	4	4	2	3	3	4	4	4	4	4	4	3	4	3	3	3
20-Sep-22	4	4	4	2	4	4	4	4	4	4	4	2	4	4	4	4	4	3	4	4	4
20-Sep-22	4	4	3	4	4	4	4	3	3	4	3	3	4	4	4	4	4	4	4	4	4
20-Sep-22	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
20-Sep-22	2	4	4	3	3	3	3	3	4	1	3	1	3	3	2	3	3	4	4	3	3
20-Sep-22	4	3	3	4	2	4	3	3	3	4	4	4	4	4	4	2	2	2	4	4	4
20-Sep-22	4	4	3	2	4	4	2	3	3	3	4	2	4	4	4	4	4	4	3	4	4
22-Sep-22	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	3
26-Sep-22	4	4	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	3	3
27-Sep-22	4	4	3	3	4	3	3	3	3	3	3	3	3	3	4	4	3	3	4	4	4
27-Sep-22	3	3	3	3	4	4	4	3	3	4	4	3	4	4	4	4	3	3	3	3	4
28-Sep-22	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
30-Sep-22	4	4	4	4	3	3	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4
4-Oct-22	4	4	2	3	3	4	3	2	3	3	4	3	4	4	4	4	4	4	3	3	4
4-Oct-22	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
6-Oct-22	3	3	3	3	4	3	3	4	3	4	4	3	4	4	3	4	4	3	4	4	4

Appendix XII: Delphi Round III Results

	I would recommend that manual therapy training should focus on...																								
End Date	Patient self-reported outcomes and ability for clinicians to assess them.	Neurophysiological mechanisms associated with OMT including the effect of touch.	Psychological mechanisms associated with OMT.	Biomechanical mechanisms associated with OMT.	Patient centered care (communication)	Patient centered care (Therapeutic Alliance)	Pain Neuroscience Education	Managing Patient Expectations	Addressing lifestyle behaviors to promote overall wellness	Use of OMT as part of multimodal care plan	Application of EBP (Patient preference, therapist preference/skill, research)	Use of OMT for soft tissue and fascial problems	Use of OMT for non-pain uses (Motor control, tone reduction)	Determining candidates for MT- Localization of tissue dysfunction	Determining candidates for MT- Identification of responders and non-responders	Psychomotor skills	Patient Handling	Advanced assessment skills	Patient comfort	Safety	Ability to modify techniques as needed	Ability to grade mobilizations	Biomechanics,osteokinematics and arthokinematics	Neuromuscular training	Pain Science
20-Oct-22	3	4	4	4	4	4	3	4	3	4	4	3	3	4	3	4	4	4	4	3	4	4	4	3	3
20-Oct-22	4	3	3	4	3	3	3	3	3	4	4	4	3	4	3	4	4	4	4	4	4	3	4	3	3
20-Oct-22	2	4	4	4	4	4	4	4	4	4	3	3	2	2	4	4	4	4	4	4	4	2	4	3	4
20-Oct-22	3	3	3	3	4	4	3	4	4	4	4	3	3	3	3	3	3	3	4	4	4	3	3	3	3
20-Oct-22	3	4	3	3	4	4	2	4	3	4	4	4	3	2	2	3	4	3	3	4	4	2	3	3	3
21-Oct-22	3	4	3	4	4	4	4	4	3	4	4	4	3	4	4	4	4	4	4	4	4	3	4	4	4
21-Oct-22	3	3	3	3	3	3	3	4	4	3	3	3	2	4	4	3	3	3	3	3	4	3	3	3	3
22-Oct-22	4	4	3	2	3	4	3	4	4	4	3	1	3	1	4	3	3	3	3	3	3	2	4	4	3
23-Oct-22	3	4	4	2	4	4	3	4	3	4	3	3	2	3	3	3	4	3	4	4	4	3	3	3	3
23-Oct-22	3	4	4	3	4	4	4	3	4	4	4	2	3	2	4	4	4	3	4	4	4	4	2	3	4
24-Oct-22	3	4	4	4	4	3	3	4	4	4	4	4	4	4	2	4	4	4	4	4	4	2	4	4	4
24-Oct-22	4	4	4	4	4	4	4	3	3	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4
24-Oct-22	2	4	4	2	4	4	2	4	4	4	4	2	1	1	3	4	4	2	4	4	4	2	2	1	3
24-Oct-22	4	3	4	2	4	4	4	4	4	4	4	1	1	3	4	4	4	4	4	4	4	3	3	4	4
27-Oct-22	4	4	4	3	4	4	4	4	4	4	4	4	4	3	3	4	4	4	4	4	4	3	3	4	4
29-Oct-22	4	3	3	3	4	4	4	4	3	4	4	3	2	3	4	3	3	4	3	4	3	3	3	3	4
31-Oct-22	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
1-Nov-22	3	3	3	3	3	2	2	3	2	4	4	4	3	4	3	3	3	4	3	3	4	3	4	3	2
3-Nov-22	4	4	4	4	4	4	4	4	4	4	4	3	3	3	4	4	4	4	4	4	4	4	3	3	4
3-Nov-22	4	4	4	4	4	4	4	4	4	4	4	2	3	4	4	4	4	4	4	4	4	3	4	4	4
3-Nov-22	2	4	4	3	4	4	3	3	3	4	4	3	3	3	4	4	4	4	4	4	4	4	3	3	3
3-Nov-22	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Appendix XII: Delphi Round III Results

3-Nov-22	3	4	4	4	4	3	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4
4-Nov-22	4	3	3	4	4	3	3	4	3	4	4	4	4	4	4	4	4	4	4	4	4	3	4	4	3
9-Nov-22	3	4	4	4	4	4	4	4	4	4	4	3	3	2	4	4	4	4	4	4	4	3	4	4	4
9-Nov-22	4	4	4	4	3	4	4	4	3	4	4	3	4	3	4	4	4	3	4	4	4	3	4	4	4
14-Nov-22	3	3	2	3	2	2	3	3	3	3	2	3	3	4	3	3	4	x	4	4	4	4	4	3	3
16-Nov-22	2	4	4	3	4	4	3	3	3	3	3	3	3	3	4	4	4	3	4	4	3	3	3	3	3

Appendix XII: Delphi Round III Results

	I would recommend that manual therapy training should omit focus on...																		
End Date	Terminological and philosophical considerations of different OMT philosophies	Biomechanical effects of OMT	Complex reasoning that is not observable/reproduceable	Clinical Prediction Rules	Visceral Manipulation	Pain Neuroscience Education	Application of technique without clinical reasoning	Resetting of nervous system with manipulation techniques	OMT for treatment of non-pain/motion complaints	Terminology attempting to differentiate philosophies (school of thought)	Arthrokinematics/Osteokinematics	Non-reliable assessment techniques (Palpation, SIJ innominate)	Segment localization	Treatment based on biomechanical findings	Treatment direction based on arthrokinematics	Treatment based on clinical prediction rules	Rigidly defined techniques that are not adaptive to patient needs	Treatment fads without evidence supporting	Treatment based purely off a research driven model
20-Oct-22	2	1	2	2	4	2	4	3	2	2	2	4	2	1	2	2	4	3	3
20-Oct-22	3	4	4	2	2	3	1	2	1	3	3	1	4	3	3	1	1	1	2
20-Oct-22	4	4	4	2	1	4	2	2	2	3	4	x	2	3	2	2	1	2	2
20-Oct-22	3	2	2	3	4	2	3	2	4	4	2	3	3	2	3	3	3	4	3
20-Oct-22	2	2	2	2	4	2	1	3	1	4	2	2	2	2	2	2	4	2	2
21-Oct-22	2	1	2	2	4	1	4	3	4	4	1	1	1	1	1	1	4	4	3
21-Oct-22	2	2	2	2	4	2	4	2	2	2	2	3	2	2	2	3	3	3	3
22-Oct-22	3	3	2	2	4	2	4	2	3	3	3	4	4	4	4	2	4	4	4
23-Oct-22	2	3	2	3	4	3	4	2	2	2	3	4	3	3	3	3	4	4	3
23-Oct-22	2	2	2	3	4	1	3	2	2	2	3	4	4	4	3	2	4	4	3
24-Oct-22	4	3	3	4	4	2	4	1	1	3	1	3	2	2	2	3	4	4	4
24-Oct-22	3	1	3	3	3	1	1	3	1	3	1	3	1	1	1	3	3	3	3
24-Oct-22	4	4	4	3	4	4	3	3	4	4	3	4	4	2	4	3	4	4	2
24-Oct-22	2	3	4	2	1	3	2	3	3	2	3	1	2	3	2	2	1	1	2
27-Oct-22	3	3	4	4	1	4	2	2	1	2	3	3	3	3	2	4	1	4	4
29-Oct-22	3	2	3	2	3	2	3	3	3	3	2	3	2	2	2	2	2	3	3
31-Oct-22	3	4	4	3	2	4	1	3	4	3	3	2	3	3	2	3	1	2	2
1-Nov-22	2	1	3	3	3	3	2	3	1	2	2	3	2	1	2	3	3	3	3
3-Nov-22	3	3	3	3	2	4	1	3	3	3	3	1	2	3	2	2	2	2	2
3-Nov-22	3	2	3	3	2	1	4	4	2	4	4	2	2	2	3	3	4	2	2
3-Nov-22	1	2	3	3	3	1	4	2	3	2	3	4	2	4	4	3	4	4	3
3-Nov-22	2	2	2	2	3	1	3	2	3	2	2	3	3	2	2	3	3	3	3
3-Nov-22	4	4	4	2	4	4	2	3	4	4	4	4	4	4	3	2	2	3	3

Appendix XII: Delphi Round III Results

4-Nov-22	3	4	4	4	3	3	1	3	4	2	4	3	4	4	4	4	1	1	1
9-Nov-22	2	2	4	2	4	1	4	2	2	2	2	4	2	2	2	2	4	4	4
9-Nov-22	2	1	3	4	4	1	4	4	4	3	1	3	2	1	1	4	4	4	1
14-Nov-22	3	2	2	4	3	2	4	2	2	3	1	2	1	1	1	4	4	3	3
16-Nov-22	3	3	3	3	3	2	4	3	3	3	2	3	2	2	3	3	3	4	3

Appendix XII: Delphi Round III Results

	When demonstrating techniques, I would recommend that the trainees focus on...																				
End Date	Patient Response Model (test- retest)	Identifying patients comparable sign	Confidence	Hand Placement	Proper setup of technique	Therapist positioning	Patient positioning	Patient comfort	Direction of technique	Speed of Technique	Amplitude of technique	Grade of technique	Technique Specificity- Ability to lock out specific segments	Technique Specificity- localization of tissue dysfunction	Technique proficiency and efficiency	Technique based on arthokinematic principles	Communication with patient during technique	Ability to assess based on touch/feel	Modifications to technique based on patient	Safety	Following OMT with technique to maintain function
20-Oct-22	4	4	3	3	4	3	3	3	3	4	4	4	3	3	3	2	4	4	4	3	4
20-Oct-22	4	3	4	4	3	4	4	4	3	4	4	3	3	3	4	3	4	3	3	3	3
20-Oct-22	3	3	4	4	4	4	4	4	3	3	4	2	2	2	4	2	4	3	4	4	3
20-Oct-22	4	4	3	3	3	3	3	3	3	3	3	3	2	2	3	2	4	3	4	4	4
20-Oct-22	4	4	4	3	3	4	4	4	3	3	4	3	2	2	3	2	4	3	4	4	4
21-Oct-22	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4
21-Oct-22	4	4	3	3	3	3	3	4	3	3	3	3	2	2	3	2	4	3	4	4	3
22-Oct-22	4	3	4	3	3	3	3	4	2	3	3	2	2	2	2	2	4	3	4	3	4
23-Oct-22	4	4	4	4	4	4	4	4	4	4	4	4	2	2	4	2	4	3	4	4	4
23-Oct-22	4	4	4	4	4	4	4	4	4	4	4	4	2	1	4	2	4	3	4	4	4
24-Oct-22	4	4	4	4	4	4	4	4	3	4	4	2	3	3	4	4	4	4	4	4	4
24-Oct-22	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
24-Oct-22	4	4	4	3	3	3	3	4	2	4	4	4	1	1	3	2	4	1	4	4	4
24-Oct-22	4	4	4	4	4	4	4	4	4	4	4	3	3	2	4	2	4	3	4	4	4
27-Oct-22	4	4	4	3	4	4	4	4	3	3	3	3	3	2	3	2	4	3	4	4	3
29-Oct-22	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	3	4	3
31-Oct-22	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	4	3	4	4	4
1-Nov-22	4	3	3	4	4	4	4	4	4	3	4	3	3	4	4	3	3	3	3	3	3
3-Nov-22	3	3	4	4	4	4	4	4	4	4	4	3	3	3	4	2	4	3	4	4	4
3-Nov-22	4	4	4	4	4	4	4	4	4	4	4	2	3	4	4	3	4	4	4	4	4
3-Nov-22	4	4	4	4	4	4	4	4	4	4	4	4	3	3	4	2	4	4	4	4	4
3-Nov-22	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3
3-Nov-22	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4
4-Nov-22	4	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4	3	4	4	4
9-Nov-22	4	4	4	3	3	4	4	4	3	3	3	3	2	3	4	3	4	4	4	4	4
9-Nov-22	4	4	3	4	4	4	4	4	3	4	3	3	2	2	4	4	4	3	4	4	4
14-Nov-22	3	3	3	3	3	4	4	3	4	4	4	4	4	4	3	4	3	3	3	4	3
16-Nov-22	3	4	3	3	3	4	4	4	3	4	4	3	3	3	3	3	3	2	3	4	3

Appendix XII: Delphi Round III Results

End Date	The foundational knowledge I feel is necessary to apply manual therapy is...																						
	Anatomy	Neurophysiology	Arthrokinematics/Osteokinematics	Relationship between physiology and neuromuscular system	Histology	Epidemiology	History of OMT	Current state of OMT	Philosophies of OMT	Grading Scales	Understanding of SINSS model	Mechanisms of OMT response	Manual therapy application based on pain mechanism (mechanism based OMT)	Understanding lack of specificity in OMT	Indications/contraindications	Patient Safety	Patient education as adjunct to OMT	Following OMT with functional movement/exercise	Understanding exercise science	Eclectic skill set (fascial, soft tissue, neural, articular)	Ability to identify impairments and functional limitations	Ability to obtain good history	Patient centered care
20-Oct-22	4	4	3	4	2	2	2	2	3	4	4	4	4	3	3	3	3	4	3	4	4	4	4
20-Oct-22	3	3	3	3	3	3	3	3	3	3	2	3	3	3	4	4	4	4	3	3	3	4	4
20-Oct-22	4	4	3	3	3	3	2	4	3	2	2	4	3	4	4	4	4	4	3	2	3	4	4
20-Oct-22	3	3	3	3	2	2	3	3	2	2	3	3	3	3	4	4	4	4	3	3	4	4	4
20-Oct-22	4	3	3	3	3	2	2	2	2	2	2	3	3	3	4	4	4	4	2	4	2	4	4
21-Oct-22	4	4	4	4	4	4	3	3	3	2	2	4	4	3	4	4	4	4	4	4	4	4	4
21-Oct-22	3	3	2	3	2	2	3	3	3	3	3	3	3	3	4	4	4	3	3	3	3	4	4
22-Oct-22	3	4	3	4	2	4	3	4	3	3	3	4	4	4	3	3	4	4	4	3	4	4	4
23-Oct-22	4	4	3	4	1	3	2	3	3	3	4	3	3	4	4	4	4	4	3	2	4	4	4
23-Oct-22	3	3	2	3	2	2	3	3	3	2	3	4	4	4	4	4	4	4	4	3	4	4	4
24-Oct-22	4	4	4	4	4	3	3	3	3	2	3	4	3	4	4	4	4	4	4	4	4	4	4
24-Oct-22	4	4	4	4	4	4	3	3	2	3	2	4	4	4	4	4	4	4	4	4	4	4	4
24-Oct-22	4	4	2	2	1	2	1	3	2	3	3	4	4	4	4	4	3	4	4	2	3	4	4
24-Oct-22	4	4	3	4	4	4	3	3	2	2	4	4	4	3	4	4	4	4	4	1	4	4	4
27-Oct-22	4	3	3	3	3	3	3	3	3	3	4	3	4	4	4	4	4	4	4	4	4	4	4
29-Oct-22	4	4	3	4	3	3	3	3	3	3	3	3	3	3	4	4	4	3	3	3	3	4	4
31-Oct-22	4	4	3	4	2	3	4	4	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4
1-Nov-22	4	3	4	2	3	3	3	3	3	2	2	3	3	2	3	3	3	3	2	3	3	3	3
3-Nov-22	4	4	3	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4
3-Nov-22	4	4	4	4	4	4	3	4	4	3	3	4	4	4	4	4	4	4	4	4	4	4	4
3-Nov-22	4	4	2	4	2	3	3	3	3	3	4	4	4	4	4	4	4	4	4	2	4	4	4
3-Nov-22	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	3	3	3
3-Nov-22	4	4	4	4	3	3	4	4	4	4	3	4	4	3	4	4	4	4	4	4	4	4	4
4-Nov-22	4	4	4	4	3	4	3	4	4	3	4	4	4	4	4	4	4	4	3	4	4	4	4
9-Nov-22	4	4	4	4	3	3	2	2	3	3	3	4	4	4	4	4	4	4	4	3	4	4	4
9-Nov-22	4	4	4	3	2	4	3	4	3	3	1	4	4	4	4	4	4	4	4	4	4	4	4
14-Nov-22	4	3	4	3	4	3	2	2	2	4	1	3	3	2	4	4	2	3	4	4	4	4	3
16-Nov-22	4	4	3	4	2	3	3	3	2	3	3	4	4	3	4	4	4	4	4	3	4	4	4

Appendix XII: Delphi Round III Results

	The foundational knowledge I feel is necessary to apply manual therapy is… (continued)													
End Date	Patient response model (test-retest)	Strong Assessment/Evaluation skills	Strong communications skills	Pattern recognition	Understanding Cognitive and Psychological contributors to pain and stiffness	Exercise prescription	Application of the Biopsychosocial Model	Evidence based practice	Identifying gaps within the literature	Ability to critique research methodology	Technique	Psychomotor skills	Ability to adapt techniques to specific patients	Ability to lock out joints
20-Oct-22	4	4	4	4	3	4	4	4	4	4	4	4	4	3
20-Oct-22	4	4	4	3	3	3	3	3	3	3	3	3	3	3
20-Oct-22	3	4	4	3	4	4	4	4	4	4	3	3	4	2
20-Oct-22	4	4	4	3	4	3	4	4	4	4	3	3	4	2
20-Oct-22	3	3	4	4	3	2	2	3	3	2	4	4	4	2
21-Oct-22	4	4	4	4	3	4	3	4	3	3	4	4	4	4
21-Oct-22	4	4	4	3	3	3	3	3	3	4	3	3	4	2
22-Oct-22	3	3	4	4	4	4	4	3	4	3	3	3	3	2
23-Oct-22	4	4	4	4	4	4	4	4	4	4	4	4	4	2
23-Oct-22	4	4	4	4	4	4	4	4	4	4	4	4	4	2
24-Oct-22	4	4	4	4	4	4	4	4	4	4	4	4	4	3
24-Oct-22	4	4	4	4	4	4	4	3	3	3	4	4	4	4
24-Oct-22	4	4	4	2	4	4	4	4	1	1	3	4	4	1
24-Oct-22	4	4	4	4	4	4	4	4	4	3	4	4	4	2
27-Oct-22	4	4	4	4	4	4	4	4	4	4	4	4	4	3
29-Oct-22	4	4	4	4	4	4	4	4	4	4	4	3	3	3
31-Oct-22	4	4	4	4	4	4	4	4	4	4	4	4	4	4
1-Nov-22	3	3	3	3	3	2	3	3	2	3	4	3	4	3
3-Nov-22	4	4	4	4	4	4	4	4	4	4	4	4	4	4
3-Nov-22	4	4	4	4	4	4	4	4	4	4	4	4	4	3
3-Nov-22	4	4	4	4	4	4	3	4	4	4	3	4	4	3
3-Nov-22	3	3	3	3	3	3	3	3	3	3	3	3	3	2
3-Nov-22	4	4	4	4	4	4	4	3	4	4	4	4	4	4
4-Nov-22	4	4	4	4	4	3	4	4	4	4	4	4	4	4
9-Nov-22	4	4	4	4	4	4	4	4	4	4	4	4	4	2
9-Nov-22	4	4	4	4	4	4	4	4	3	3	4	4	4	2
14-Nov-22	3	4	3	4	2	3	2	3	3	3	4	2	4	3
16-Nov-22	4	4	4	4	4	4	4	3	4	4	3	3	3	3

Appendix XII: Delphi Round III Results

	I would recommend that trainees attempt to identify candidates for manual therapy based on...																				
End Date	Pain mechanism	Differential Diagnosis	Identification of specific tissue impairment	Pain vs stiffness dominance	Lack of contraindications	Patient response model	Stage of management	Biomechanical findings	Joint mobility findings	Utilizing test clusters to identify responders	Identified impairments	SINSS Model	Patient expectations	Psychosocial factors	Biopsychosocial assessment	Patient tolerance	Use of self-reported outcome measures	Use of performance-based outcome measures	Signs	Symptoms	Current best evidence (patient expectations, provider experience, and research)
20-Oct-22	4	4	3	4	3	4	4	3	3	3	4	4	4	3	4	4	3	3	4	4	4
20-Oct-22	3	3	3	3	3	3	3	3	3	3		2	4	3	3	3	3	3	3	3	4
20-Oct-22	4	4	2	3	4	4	3	3	3	3	3	2	4	4	4	4	3	3	3	3	4
20-Oct-22	3	3	2	3	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
20-Oct-22	2	3	2	3	4	3	3	2	2	2	3	3	3	3	2	3	3	3	3	3	3
21-Oct-22	4	4	4	3	4	3	3	4	4	4	4	2	4	4	3	4	3	3	4	4	4
21-Oct-22	3	3	3	4	4	4	4	2	3	3	4	4	4	4	3	4	3	3	3	3	3
22-Oct-22	4	4	3	2	3	4	3	2	2	3	4	3	4	4	3	3	4	4	3	3	3
23-Oct-22	3	4	3	3	4	4	4	2	3	3	4	4	4	4	4	4	3	3	4	4	4
23-Oct-22	4	4	2	3	4	4	3	2	3	3	3	3	4	4	4	4	4	4	4	4	4
24-Oct-22	3	3	3	3	4	3	3	3	3	3	4	3	3	3	4	4	3	3	4	4	4
24-Oct-22	4	4	4	4	4	3	3	4	4	4	4	2	4	4	4	4	3	4	4	4	4
24-Oct-22	4	4	2	3	4	3	2	1	2	1	4	3	4	4	4	4	4	3	4	4	4
24-Oct-22	4	4	4	4	4	4	4	3	3	3	4	4	4	4	4	4	4	4	4	4	4
27-Oct-22	4	4	3	3	3	4	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4
29-Oct-22	4	4	3	3	3	4	3	3	3	4	3	3	4	4	4	3	4	3	3	3	4
31-Oct-22	4	4	3	4	4	4	4	3	3	3	4	4	4	4	4	4	3	4	4	4	4
1-Nov-22	3	4	3	3	3	3	3	3	3	2	3	2	3	3	3	4	3	3	3	3	3
3-Nov-22	4	4	4	4	4	4	4	4	x	4	4	4	4	4	4	4	4	4	4	4	4
3-Nov-22	4	4	4	3	4	4	4	3	3	4	4	2	4	4	4	4	4	4	4	4	4
3-Nov-22	4	3	4	4	4	4	4	2	3	3	4	4	4	4	4	3	3	3	3	4	4
3-Nov-22	4	4	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3-Nov-22	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
4-Nov-22	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
9-Nov-22	4	3	3	2	4	4	1	3	3	4	4	3	4	4	4	4	4	4	4	4	4
9-Nov-22	4	4	4	4	4	4	4	4	4	1	3	1	4	4	4	4	4	3	4	4	4
14-Nov-22	2	4	4	3	4	3	3	3	4	2	4	4	3	3	2	4	2	3	4	4	3
16-Nov-22	3	3	3	3	4	4	3	3	3	2	3	3	3	4	4	4	3	4	3	3	3