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# JCCA

## Journal of the Canadian Chiropractic Association

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## Commentary

# The Good, the Bad and the Ugly: musings, observations and reflections after a half-century in chiropractic education

Michael R. Wiles, DC, EdD, FRCC<sup>1</sup>

*The author reflects on experiences over a half-century of engagement in chiropractic education. Both positive and negative aspects of the profession's evolution are highlighted, including such areas as clinical education, diversity within chiropractic education, the importance of research, and the importance of gaining public trust through evidence-based practices. The paper concludes with a repeated call to action for the profession to be a major player in the solution to the global challenge of low back pain, which can be supported by integration with the healthcare-system-at-large as a trusted and valued team member.*

(JCCA. 2026;70(1):6-13)

**KEY WORDS:** back pain, chiropractic, education, practice, research

Le bon, le mauvais et le terrible: réflexions, observations et remarques après un demi-siècle dans la formation en chiropratique

*L'auteur réfléchit sur ses expériences accumulées après avoir participé pendant plus d'un demi-siècle à la formation en chiropratique. Les aspects positifs et négatifs de l'évolution de la profession sont mis en évidence, incluant des domaines comme l'enseignement clinique, la diversité au sein de la formation en chiropratique, l'importance de la recherche, et l'importance de gagner la confiance du public grâce à des pratiques fondées sur des données probantes. L'article se conclut par un appel répété à l'action pour faire de la profession un acteur majeur dans la solution au défi mondial de la lombalgie, notamment en intégrant la chiropratique au sein du système de soins de santé en général en tant que membre d'équipe fiable et valorisé.*

(JCCA. 2026;70(1):6-13)

**MOTS CLÉS :** mal de dos, chiropratique, formation, pratique, recherche

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Conflicts of Interest:

The author has no disclaimers, competing interests, or sources of support or funding to report in the preparation of this manuscript.

## Background

I had several alternative titles for this paper, including “the observations and musings of an old chiropractic educator”, and perhaps, more constructively, “Some thoughts, concerns and aspirations for my beloved profession”. On May 1, 2026, I will have had the distinct honor of engagement with the chiropractic profession and chiropractic education for fifty years. Counting my education at the Canadian Memorial Chiropractic College, it adds four more years. I have been a faculty member at seven chiropractic programs and a dean at three of them. I’ve seen a lot of history. It has been said that old chiropractors don’t die, they just crack up. Well, before I crack up, I want to record these reflections in the hope that it might just make a bit of a difference in the future. I write this from the vantage point of a practitioner, and educator, a Dean, and a consultant to a profession that has been a large part of the fabric of my life. It is written with the hope that the story may inspire Doctors of Chiropractic to become change agents with individual and collective participation.

## The Good

When I graduated, there were 11 chiropractic colleges in North America, and only one outside of North America, and none of these were associated with a university. Today, there are 54 chiropractic programs in 19 countries around the world, almost all of them associated in some way with a university (that is, affiliated with an existing university, or transformed from a single purpose institution into a multi-program university). These programs meet the high standards that are prescribed by recognized accreditation councils covering world-wide chiropractic education. In my program at CMCC, not unlike the general state of chiropractic education at the time, we had very few faculty members with advanced degrees (in fact, pathology was taught by a medical technician with a bachelor’s degree), and today we see it has generally become *de rigueur* to have not just one, but several advanced degrees to teach at chiropractic educational institutions. A brief look at the faculty complement at almost any DC program will reveal many PhDs, EdDs, and DCs with additional advanced degrees. As the old saying went, “we’ve come a long way, baby”.

Postgraduate education has also seen a very respectable level of growth and evolution, from the first residencies in radiology in the 1960s to the wide array of opportunities

today for graduates in residencies (many sponsored by DC programs, but also a very well-respected and growing number of residencies within the VA healthcare system) and post-doctoral fellowships (such as at Yale University and the Medical College of Wisconsin).

Fifty years ago, a large part of clinical education experience was gained treating fellow students and their family members, with students “checking off” new patients and office visits until they reached the magic numbers (for me it was 25 new patients and 275 visits). Today, we increasingly see early and longitudinal clinical experience in a wide variety of healthcare settings and an emphasis on community-based clinical training.<sup>1</sup> And, while the profession is still divided on its primary purpose or mission (more of that in the “Ugly” section), there appears to be an increasing tendency to emphasize the role of the chiropractor as a spine practitioner, that is, focusing on spine-related conditions and not trying to replace the primary care physician. Schneider *et al.*<sup>2</sup> commented that, “although the chiropractic profession may debate internally about its professional identity, the chiropractic identity seems to have already been established by society, practice, legislation, and education as a profession of healthcare providers whose area of expertise is spine care”.

Early chiropractic curricula seemed to have grown by accretion from the earliest renditions at Palmer College without any major reforms for decades. Today, I see trends towards evidence-based educational principles, with integrated curricula, team-based learning, and recognition of the importance of transformative pedagogy. We can all be very proud of the evolution of chiropractic education over the past 50 years.

## The Bad

My tuition for chiropractic college in 1972 was \$750 per year (and this was considered outrageous because the typical tuition for undergraduate education was \$550 per year). The value of \$1 in 1972 has been estimated to be equivalent to \$7.60 in 2025<sup>3</sup>, which means my tuition would be equivalent to \$5700 per year today. I can hear the gasps when we consider that the typical annual chiropractic tuition in the US is currently around \$40,000 (as a review of this publicly available information on program websites reveals). Something went terribly wrong with the cost of education (not just chiropractic education),

notwithstanding a correction factor for the improvements in facilities and the quality of the education.

Whether these educational costs or other factors are at play, chiropractic education also suffers from a considerable lack of diversity in its students and faculty. For example, in 2018 the US population consisted of 14.6% African Americans<sup>4</sup>, and in 2025, the NBCE reported that an estimated 3.5% of chiropractors were African American<sup>5</sup>. Similar percentage reductions are seen with other population groups such as Hispanic Americans (18.0% of the population and 6.0% of chiropractors).<sup>5</sup> Incidentally a similar lack of diversity is found among medical doctors as well; in 2018 the AMA reported that only 5.0% of physicians were African American.<sup>6</sup> Altruistic views aside, this means that the overall pool of qualified applicants to chiropractic schools appears to be very (and unnecessarily) limited, and we are missing out a large proportion of potential students as we continue to seek the best and brightest for admission.

We also need a quantum leap in the quality and quantity of clinical training and experience for chiropractic students.<sup>7</sup> Some of the challenges in undergraduate chiropractic education were mentioned in the “good” section – and despite the status of clinical education being described as “good”, this is misleading because chiropractic students continue to be exposed to a very limited quality and quantity of clinical experiences<sup>7,8</sup>, and I suspect that few practicing DCs will disagree with this statement. The need for multi-disciplinary clinical training and experience with a much wider variety of clinical problems (than current chiropractic students see) was well described by Bruce Walker in his paper calling for action towards “a new path, a new beginning, and a new direction”<sup>8</sup>.

MDs, DOs, and DPMs all require the completion of residency programs prior to being licensed to practice independently, and medical educators consider the post-graduate training years to be the most important element in medical education (which is why an increasing number of medical schools are able to graduate MDs after only a 3-year degree program). Approximately 35-40% of dentists complete a one-year residency<sup>9</sup>, and there are 280 residency programs for optometrists (including 215 in the Veterans Health Administration)<sup>10,11</sup>. Chiropractors, on the other hand, can graduate Monday and (assuming State licensing requirements are met) begin practicing on Tuesday. Thankfully, we are seeing an increasing number

of one-year residencies for chiropractors in the VHA, but to date, these have only graduated a total of 70 residents over a ten year period. We desperately need to increase the training opportunities in multi-disciplinary healthcare environments, where chiropractic students and chiropractic residents can train alongside other healthcare students and residents as team members.

Another concern is exposure to research and a general philosophy of critical thinking. As chiropractic education and practice become increasingly evidence-based<sup>5</sup>, students need far more exposure to research – its philosophy, methods and relevance to healthcare practice. This situation is improving, to be sure, and chiropractic researchers continue to receive NIH and other foundational funding (although unfortunately, NIH funding is currently under scrutiny), but the population of chiropractic researchers remains very small (compared to other health professions) and a research career is not yet a widely available option for chiropractic graduates.

Finally, another concern in my opinion is the profession’s lack of an evidence-based preventive “chiropractic checkup”. The dental profession changed forever when they moved away from extracting decayed teeth, to a public health endorsed practice of preventive dentistry. In fact, I recently read that dentists are now recommending the first dental checkup by the time a baby is only one year old!<sup>12</sup> Can you imagine how the chiropractic profession would be transformed overnight if public health officials recommended that everyone have a chiropractic checkup every six months? But sadly, there is no consensus on what this might look like and just about every version of a “checkup” exists in the wildly diverse and esoteric world of chiropractors. If musculoskeletal problems are indeed the number one worldwide cause of disability, then we need to place way more emphasis on prevention, and I hope to live long enough to see the value of a chiropractic checkup equal to the value of a dental checkup.

### **The Ugly**

The simplest explanation of systems theory is a closed system with three components: an input, a process, and an output – which leads back to the input. This all happens within a “context”. For chiropractic education, the input is students who apply and are accepted; the process is the factory where DCs are made; and the output is graduates, who by their representation as DCs influence the system

input either directly (referrals) or indirectly (through professional reputation). There are many moderating influences in the context such as state regulations and state regulators, pseudoscience and esoteric practices, the professional civil war, public health practices and DC participation, and public perception of the field. Unfortunately, we seem to be stuck in a self-perpetuating cycle where some noisy and negative aspects of our “output” continually influence our input. During the COVID pandemic there were numerous instances of DCs claiming that chiropractic boosts immunity (including a press release by 21 “straight” organizations) that created embarrassment and prompted several responsive publications by the chiropractic research community as well as students.<sup>13-15</sup> A student authored paper entitled “Chiropractic Students Call for Action Against Unsubstantiated Claims” stated, “It is our hope that all regulatory bodies will protect the public by taking appropriate action against chiropractors making unfounded claims contradicting public health policy. We call on current chiropractors to ensure a viable profession exists moving forward”<sup>15</sup>. This is indeed a ray of hope.

Regulatory bodies and disciplinary processes come under the microscope when chiropractors violate the public trust by advertising and promoting unethical or pseudoscientific practices.<sup>16</sup> The abovementioned issues related to the COVID pandemic are a good example of the public airing of quite different approaches or paradigms of chiropractic practice. Another issue which may play into the challenges of current day regulation of chiropractic practice is the (generally common) obsolescence of practice acts (many of which were first created decades ago, using the esoteric terminology of their day). And we are all well aware of the fear of “opening the act” that paralyzes the profession and results in (sometimes absurdly) outdated regulations and laws. I will use Florida as just one example.

The definition of the practice of medicine in Florida, in 23 words, is as follows: “Practice of Medicine means the diagnosis, treatment, operation, or prescription for any human disease, pain, injury, deformity, or other physical or mental condition”<sup>17</sup>.

The definition of the practice of podiatry in Florida, in 22 words, is as follows: “Practice of Podiatric Medicine” means the diagnosis or medical, surgical, palliative, and mechanical treatment of ailments of the human foot and leg”<sup>18</sup>.

The definition of the practice of dentistry in Florida, in 29 words, is as follows: “Dentistry” means the healing art which is concerned with the examination, diagnosis, treatment planning, and care of conditions within the human oral cavity and its adjacent tissues and structures”<sup>19</sup>.

The definition of the practice of chiropractic in Florida, in a whopping 122 words, is as follows: “Practice of Chiropractic Medicine” means a noncombative principle and practice consisting of the science, philosophy, and art of the adjustment, manipulation, and treatment of the human body in which vertebral subluxations and other malpositioned articulations and structures that are interfering with the normal generation, transmission, and expression of nerve impulse (sic) between the brain, organs, and tissue cells of the body, thereby causing disease, are adjusted, manipulated, or treated, thus restoring the normal flow of nerve impulse which produces normal function and consequent health by chiropractic physicians using specific chiropractic adjustment or manipulation techniques taught in chiropractic colleges accredited by the Council on Chiropractic Education. No person other than a licensed chiropractic physician may render chiropractic services, chiropractic adjustments, or chiropractic manipulations”<sup>20</sup>.

Now there’s an elevator speech (and perhaps one of the longest sentences in the English language). At least it is “noncombative”.

Just for the record, I would like to propose a new definition for consideration in Florida, in only 20 words: “Practice of Chiropractic Medicine” means the diagnosis, conservative treatment and prevention of disorders of the spine and related musculoskeletal structures”.

Of course, all of this “ugliness” results in a loss of the public trust due to irregular practices and lack of consistency among practices. I suspect that if a patient visited a dentist in either Miami, or Duluth, or Dubai, they would likely get the same or similar approach to dental hygiene and the practice of dentistry. That said, (and I have no other reference for this other than my own experience), there’s a reasonable likelihood that any random five chiropractors in any city in the US would offer five different approaches to the same patient and same problem (i.e. manual manipulation, no manual manipulation, or any one of a myriad of esoteric techniques, etc.). When I was in my first year of chiropractic school, my father, a housepainter, suffered from an acute lower back pain at work.

Without asking me for a recommendation, he picked a nearby DC who advertised himself as a self-proclaimed “headache specialist” (which, unfortunately, impressed my father who believed he was going to a specialist). Despite his pain being clearly localized to his right lumbo-sacral region, the DC proceeded to x-ray and manipulate his neck, whereby my father suffered from neck pain for the rest of his life. Later, it took only one visit from my college faculty instructor to relieve his lower back pain (although it took a bit of convincing to get him there).

In 1990 a survey of McLean County Chamber of Commerce members revealed that chiropractors scored 18<sup>th</sup> or 19<sup>th</sup> out of 19 professions in 9 of 12 categories related to public trust and confidence.<sup>21</sup> A Gallup poll in 2003 about the perception of honesty and ethics, rated Nurses (83%), MDs (68%) and DCs (31%) as “high or very high”.<sup>22</sup> More recently, in 2020, the figures were similar, with a slight improvement for the DCs: Nurses 85%, MDs 65% and DCs 41%.<sup>23</sup> Successive Gallup data on public trust and confidence in chiropractors are as follows: 2003 – 31%, 2006 – 36%, 2009 – 34%, 2012 – 38%, 2016 – 38%, 2020 – 41% (an agonizingly slow climb over two decades).

Besides the impact on the trust of potential patients, these findings also impact the attitudes of potentially referring physicians. Busse *et al.*, in 2009,<sup>24</sup> studied the attitudes of orthopedic surgeons towards chiropractic. He noted, “North American orthopedic surgeons’ attitudes toward chiropractic range from very positive to extremely negative”. In a follow up study in 2011,<sup>25</sup> he noted, “Our analysis identified a number of issues that will have to be considered by the chiropractic profession as part of its efforts to further integrate chiropractic into mainstream healthcare”. And finally, Weis *et al.*,<sup>26</sup> in 2016, wrote about the attitudes of obstetricians towards chiropractors and concluded that their major concerns were safety and the variability of practices among chiropractors. One written comment by an obstetrician is characteristic of their concern: “I realize that there may be many chiropractors who provide safe effective treatment for musculoskeletal issues and do not manage things like asthma beyond the bounds of their training. So sadly those that promote unsafe practice end up painting the entire profession in a bad light”.

### More musings and reflections

The chiropractic “civil war” – historically and colloqui-

ally, “straights vs. mixers” – continues to limit or restrict legislative renewal or updates and scope expansion. Optometrists did not resist being able to use mydriatic drops to better visualize the retina, but there seems to be an obsession in chiropractic to limit our scope (and thereby limit our opportunities to help our patients get better). In Florida, where I spent five years, the DCs seem obsessed with “injecting vitamins”. I’m sure there must be a good reason for this, but I wonder if the attraction is “injecting” or “injecting vitamins”.

Years ago, during my residency, I attended a weekend seminar taught by Graham Apley (of “Apley’s test”). We saw over 30 patients at the hospital during the seminar (in one weekend – more than the number of new patients I saw during my chiropractic education). I distinctly remember a patient with what appeared to be a frozen shoulder. “Mr.” Apley (he was from the UK and insisted upon the respectful title for a physician in England) asked the patient to abduct his arm, which of course he couldn’t do. Apley then injected the tendon area with a local anesthetic and reminded us that if there was a tear, the patient still would not be able to lift his arm, but if it was simply inflamed, he would be able to do it painlessly. Within about five-to-ten minutes, he could lift his arm, thereby confirming the diagnosis and referring the patient to physical therapy instead of orthopedic surgery. In chiropractic practice, without this opportunity to use a local anesthetic, we are limited to applying ice packs (which nobody likes, and besides they aren’t that effective). It is this kind of scope expansion that I would like to see, to improve our ability to differentially diagnose musculoskeletal conditions; but the profession remains split over this with one side fearing that we’ll all be prescribing drugs before too long, like the osteopaths.

In fact, Emary *et al.*<sup>27</sup> described a survey of 187 Swiss chiropractors, who have been licensed since 1995 to dispense medications. In 2018 their permitted formulary was expanded, and although 42% of the DCs were interested in continuing to expand their range of medications, the majority of DCs reported using medications with about only 5% of patients. In a 2019 survey of chiropractic students at D’Youville College (now D’Youville University), Emary *et al.*<sup>28</sup> showed that 90% of the students agreed with scope expansion to include some medications.

The relative isolation of the chiropractic profession from mainstream healthcare was no more evident than

during the COVID pandemic. While there were some positive examples of DCs being able to assist the massive public health efforts with vaccinations in the Canadian province of Quebec, and in the UK, the situation varied within the US. In Florida, on April 5, 2021, the Department of Health published a list of professions whose members were authorized to administer vaccines, including COVID-19 vaccines. The list included 20 professions, including dentists, midwives, optometrists, respiratory therapists, and (yes) veterinarians. Conspicuously absent from the list were chiropractors.

Referring back to the cybernetic model of systems theory, applicants for admission to chiropractic schools are sometimes motivated by the wrong reasons, and the chiropractic civil war manifests itself in student bodies who also experience the schism. Nim *et al.*<sup>29</sup> wrote of this situation at the University of Southern Denmark. He reported, “the level of conservatism (i.e. “straight chiropractic orientation”) was moderately associated with inability to recognize non-indications to treatment. Three outliers...revealed a highly inappropriate handling of clinical cases”. More evidence of the schism among chiropractic students was reported by Swain *et al.*<sup>30</sup> in 2021, and this was a large international study of 2396 students from 25 institutions. It was shown that 45% supported traditional theory (“adjusting the spine corrects dis-ease”) and 55% agreed that “evolving scientific evidence is more important than traditional principles”. Further they concluded that, “chiropractic students’ professional association membership status, pre-chiropractic education ...were associated with ideologically conflicting responses”. So the problem appears to be self-perpetuating.

The schism among chiropractors has even resulted in a call for a professional divorce.<sup>3</sup> Writing in “Chiropractic, one big unhappy family: better together or apart?”, LeBoeuf *et al.* suggest, “there is a need to pause and consider if the many reasons for disharmony within the chiropractic profession are, in fact, irreconcilable”, and “it is time to openly debate the issue of a professional split”... “for this to happen, the middle group of chiropractors will have to become engaged and consider the benefits and risks of respectively staying together or breaking up”. This is clearly a very difficult and emotional topic but at least it has been put out there for discussion.

The result of all of this is, of course, that chiropractic is still conspicuously absent from many public health initia-

tives<sup>8</sup>, publicly funded universities (that is, within North America, with the exceptions of the University of Quebec and the new program at the University of Pittsburgh)<sup>32,33</sup> and from military commissions in a Chiropractic Corps. Many in the public remain confused about the field and still raise eyebrows when you mention chiropractic (check out the chiropractic page on Wikipedia, for example).

### Some good news and a plea for action

French, Downie and Walker<sup>34</sup> issued a “call to action” for the profession in 2018. I will repeat this in terms of a plea for action. These authors stated, “our low back pain ‘call to action’ for the chiropractic profession is to get our house in order”, and “the chiropractic profession is perfectly placed to be a major player in providing a part of the solution to the global challenge of LBP. But the profession has been shut out of this role...due to...internal political conflict, lack of political will, and a minority of chiropractors who provide non-evidence-based approaches.” The challenge couldn’t have been better stated.

We have a strong foundation to rally to this challenge. There is a far more sophisticated chiropractic educational community of practice in 2025 than ever before. We have groups such as the Chiropractic Educators Research Forum (CERF) just to cite one example of this community coming together and sharing their ideas and research. And, from experience, I can state with certainty that there is a growing (and exciting) level of collaboration among chiropractic educational institutions (and other healthcare institutions). And we can be very proud of the Council on Chiropractic Education and its continued good work to ensure the high quality of chiropractic education. Finally we have the strong and significant international growth of chiropractic schools.

At the 2021 ACCRAC meeting, Dr. Lou Sportelli identified four key elements in the profession’s growth, as he spoke of our evolution from “Jail to Yale”. First, he mentioned the shift from isolation to integration. We see this in many examples throughout the country, but the increased opportunity for chiropractic services within the Veterans Health Administration has been perhaps the finest example of this shifting position of the chiropractic profession.

Next, Dr. Sportelli mentioned the changing paradigm of chiropractic care, and this is evidenced by the increased emphasis on evidence-based practices, well-

ness and the quality of life, especially among an aging population (and hopefully to be followed by Medicare reform for DCs). Thirdly, he stated that “research is the weapon of tomorrow”. This is very true, and it may be said that the development of a new DC program at the University of Pittsburgh is mostly due to the volume and significance of the research performed there, largely by Dr. Michael Schneider, the chiropractic program Director. In fact, one might say that the focus on research may be seen as a great awakening in the chiropractic profession, with the recent introduction of various national and international academies, forums and collaborations with creative acronyms such as CARL, CERF, ACORN and CIRCuit.<sup>35-38</sup>

And, finally, emphasizing his theme of Jail to Yale, Dr. Sportelli spoke of the profession’s early challenges and imprisonment of chiropractors for “practicing medicine without a license” (many of whom built practices within the jails during their incarceration!). He spoke of chiropractors now being invited and welcomed into large multidisciplinary healthcare centers around the country, such as the Cleveland Clinics and Mayo Clinics, as well as fellowship opportunities for chiropractors at both Yale and Harvard Universities.

I will conclude with a personal story illustrating the shifting times that Dr. Sportelli described so well. Chiropractors may recall the challenges in dealing with the American Medical Association in the early to mid-20<sup>th</sup> century. During these years, the AMA attempted to “contain and eliminate” the chiropractic profession through a policy of isolation and restriction of opportunities for interprofessional practices. To say that the relationship of these professions was vitriolic would be an understatement. Fast forward to 2018, and while I was serving as Dean of the College of Chiropractic Medicine at Keiser University in West Palm Beach, FL, I was invited by the Palm Beach Medical Society to a private dinner in which they were hosting the new AMA president, Dr. David Barbe, who gave the keynote address at the dinner. I was seated among AMA dignitaries at a table at the front of the room, adjacent to Dr. Barbe. Yes, times are indeed a-changin’.

Let us do what we can, while we can. I am reminded of a saying that I once heard from a University Chaplain, and I will paraphrase it for the chiropractic profession. She said, “I am only one; but I am one; and I can’t do

everything; but I can do something; and while I can, I will do what I can to advance the chiropractic profession.”

I hope others will share my dream which is to see the Doctor of Chiropractic as a trusted, valued, and necessary member in all health-related environments.

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## Commentary

# Chiropractic specialties in Canada: realizing the full potential of advanced practice: a commentary

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*Chiropractic specialization in Canada has evolved into a nationally coordinated, competency-based framework guided by the Federation of Canadian Chiropractic (FCC) and regulated through the Competency Profile for Chiropractic Specialists in Canada (2023) and emerging accreditation standards. Although specialists represent only 3% of Canadian chiropractors, they contribute disproportionately to education, research, and professional leadership. A 2025 survey on the value proposition of chiropractic specialty confirmed broad consensus that specialization enhances professional*

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*Spécialités en chiropratique au Canada: réaliser tout le potentiel de la pratique avancée : un commentaire*

*La spécialisation en chiropratique au Canada a évolué vers un cadre national coordonné, fondé sur les compétences, guidé par la Fédération chiropratique canadienne (FCC) et encadré par le Profil de compétences pour les spécialistes en chiropratique au Canada (2023) ainsi que par les normes d'accréditation en développement. Bien que les spécialistes ne représentent que 3 % des chiropraticiens canadiens, leur contribution à la formation, à la recherche et au leadership professionnel est disproportionnée. Une enquête nationale menée en 2025 sur la proposition de valeur des spécialités en chiropratique a confirmé un large consensus selon lequel la spécialisation améliore la qualité professionnelle et la protection du public, mais a également révélé des obstacles persistants, notamment une reconnaissance provinciale inégale, une*

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*quality and public protection, yet revealed persistent barriers including inconsistent provincial recognition, limited visibility, and uneven geographic access. Framed within an advanced-practice paradigm, this commentary proposes three strategic priorities—harmonized recognition across provinces, equitable access through innovation, and enhanced visibility and evidence—to position chiropractic specialists as valued contributors to Canada’s healthcare system. Implementation will strengthen quality assurance, expand interprofessional collaboration, and advance evidence-informed neuromusculoskeletal care.*

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KEY WORDS: chiropractic, education, health policy, interprofessional relations, postgraduate, professional, professional competency, scope of practice

*visibilité limitée et un accès géographique disparate. Inscrit dans un paradigme de pratique avancée, ce commentaire propose trois priorités stratégiques — une reconnaissance harmonisée entre les provinces, un accès équitable par l’innovation, et une visibilité et des données probantes renforcées — afin de positionner les spécialistes en chiropratique comme des contributeurs de valeur au système de santé canadien. La mise en œuvre de ces priorités renforcera l’assurance qualité, élargira la collaboration interprofessionnelle et fera progresser les soins neuromusculosquelettiques éclairés par les données probantes.*

(JCCA. 2026;70(1):14-26)

MOTS CLÉS : chiropratique, formation, politique de santé, relations interprofessionnelles, études supérieures, professionnel, compétence professionnelle, champ d’activité

## Introduction

The development of chiropractic specialties in Canada reflects a sustained effort to strengthen the profession’s academic foundation and clinical expertise. In 1973, the Ontario Council of Health recommended that chiropractic graduates who aspired to academic or leadership positions undertake additional postgraduate study or research training to prepare as future educators and investigators.<sup>1</sup> Under the auspices of the Canadian Chiropractic Association (CCA), this guidance led to the creation of the first specialty colleges and full-time residency programs at the Canadian Memorial Chiropractic College (CMCC).<sup>2</sup> These early initiatives established a tradition of scholarship and interprofessional collaboration that continues to define chiropractic specialization in Canada.<sup>2,3</sup>

By the mid-1990s, administrative responsibility for specialty oversight was transferred from the CCA to the Canadian Federation of Chiropractic Regulatory and Educational Accrediting Boards (CFCREAB), later renamed the Federation of Canadian Chiropractic (FCC). Through its Specialty Colleges Council (SCC), the FCC established a coordinated governance structure that uni-

fied the specialty colleges and linked their activities to national regulatory and educational objectives.

Over the past decade, this model has evolved into a competency-based and quality-assured system. Anchored by the *Competency Profile for Chiropractic Specialists in Canada*,<sup>4</sup> the *SCC Policies for Chiropractic Specialty Colleges*,<sup>5</sup> and the forthcoming *Council on Chiropractic Education Canada (CCEC) Accreditation Standards for Graduate Specialty Programs*, it now provides clear national expectations for specialist education, recognition, and accountability across jurisdictions.<sup>4</sup>

Despite these advances, integration of chiropractic specialization remains limited within the profession and across the wider healthcare system. A 2025 survey on the value proposition of chiropractic specialty confirmed widespread agreement among regulators, specialists, and chiropractors that specialization enhances quality and public protection, yet it also revealed persistent barriers related to recognition, access, and visibility.<sup>6</sup> This commentary interprets these findings within the broader policy and educational landscape, outlining strategic directions to achieve harmonized recognition, equitable

access, and greater visibility—key steps toward realizing the full potential of chiropractic specialization as an advanced-practice model within Canadian healthcare.

### Evolution and framework

Chiropractic specialization in Canada originated in the 1970s with the establishment of the first full-time residency programs at the Canadian Memorial Chiropractic College (CMCC).<sup>1,2</sup> These programs were designed to prepare chiropractors to become educators, researchers and clinicians capable of managing complex neuromusculoskeletal conditions.<sup>1,3</sup> Developed in collaboration with hospital and academic partners, they introduced structured postgraduate education and interdisciplinary rotations – concepts that anticipated today’s evidence-based and collaborative models of advanced practice.<sup>2,4</sup>

The initial specialty colleges—the *College of Chiropractic Sciences (Canada)* and the *College of Chiropractic Roentgenology*—were soon joined by additional colleges in Sports Sciences, Orthopaedics, and Rehabilitation. From the outset, these colleges combined three defining functions: clinical expertise, academic scholarship, and professional leadership. This multidimensional approach established chiropractic specialization as both an educational and professional mechanism for advancing quality of care and knowledge translation within the profession.<sup>4</sup>

Over time, national coordination and regulatory oversight evolved to strengthen accountability and public pro-

tection. The formation of the *Specialty Colleges Council (SCC)* under the *Federation of Canadian Chiropractic (FCC)* unified all recognized specialty colleges within a single governance structure responsible for policy development, collaboration with regulators, and oversight of specialty recognition. This model provided the organizational foundation for linking specialty education to national competency standards.<sup>5</sup>

During the past decade, three interrelated policy instruments have completed the transition from independent postgraduate programs to a coherent national framework that aligns specialist’ competencies, specialty colleges recognition and educational program accreditation.

- the *Competency Profile for Chiropractic Specialists in Canada*,<sup>4</sup> developed by the *Council on Chiropractic Education Canada (CCEC)*, which defines specialist competencies using the CanMEDS model (summarized in Table 1);
- the *SCC Policies for Chiropractic Specialty Colleges*,<sup>5</sup> which articulate transparent criteria for recognition, governance, and accountability (summarized in Table 2); and
- the forthcoming *CCEC Accreditation Standards for Graduate Specialty Educational Programs* (anticipated 2026), which will establish national benchmarks for curriculum design, faculty qualifications, and outcome evaluation.

Table 1.  
*Competency framework for chiropractic specialists in Canada*

Role	Key competencies (summary of role description)
1. Neuromusculoskeletal (NMS) Expert	Advances expertise in clinical assessment, diagnosis, and management in the provision of patient-centred care; develops and evaluates evidence-based specialist strategies; performs and appraises specialty-specific procedures; and provides expert consultation or opinion, including advice to third-party organizations and legal testimony.
2. Communicator	Establishes and maintains effective, respectful, and compassionate communication with patients, families, and other professionals; integrates listening, documentation, and digital communication to facilitate shared decision-making and continuity of care.
3. Collaborator	Works effectively with colleagues and health-care teams to optimize patient outcomes; promotes mutual understanding, resolves conflict, ensures safe transitions of care, and supports interdisciplinary and intraprofessional collaboration.
4. Health Advocate	Recognizes and responds to factors influencing health; supports patients in navigating the health system; advocates for access to high-quality, evidence-based chiropractic and interprofessional services at the individual and system levels.

Role	Key competencies (summary of role description)
5. Scholar	Demonstrates commitment to continuous learning and to the creation, application, and dissemination of new knowledge; teaches and mentors others; and integrates evidence into specialist practice and research.
6. Professional	Upholds ethical standards, accountability, and professional integrity; engages in self-regulation, quality improvement, and reflective practice; demonstrates compassion, respect, and cultural safety in all interactions.
7. Leader	Contributes to the improvement of health-care systems through leadership, quality enhancement, and resource stewardship; manages practice responsibilities, mentors colleagues, and supports effective system function.

Note: The Competency Profile delineates key and enabling competencies under each role. The summary above reproduces the key intent of each domain while maintaining the seven official role headings. For detailed wording and performance indicators, refer to the Competency Profile for Chiropractic Specialists in Canada (FCC/CCEC, 2023), pp. 3–7.<sup>4</sup>

Table 2.  
*Recognition criteria for chiropractic specialty colleges*

Criterion	Overview (condensed summary)
1. Need and Relevance	The proposed specialty must demonstrate a clearly defined need within chiropractic and the broader health system, showing potential to improve public protection, patient outcomes, and access to specialized services [Sec 3.1].
2. Distinct Body of Knowledge and Specialist Practice	The specialty must articulate a distinct, evidence-based domain of expertise—encompassing knowledge, skills, and clinical approaches that extend beyond entry-to-practice chiropractic and complement existing specialties [Sec 3.2].
3. Educational Standards and Clinical Competencies	The sponsoring college must establish postgraduate educational programs aligned with the Competency Profile for Chiropractic Specialists in Canada (2023), integrating evidence-based learning and comprehensive assessment of specialist competencies [Sec 3.3].
4. Examination and Certification	A certifying process must exist, supported by valid, reliable examinations that assess specialty competencies and include mechanisms for maintaining certification through continuing education and currency [Sec 3.4].
5. Research and Evidence	The specialty must contribute to the advancement of scientific knowledge by generating, applying, and disseminating evidence that informs specialty-level practice and improves patient care [Sec 3.5].
6. Public Safety	Policies and practices must uphold regulatory and ethical standards, incorporate quality-assurance measures, and demonstrate explicit mechanisms to protect the public [Sec 3.6].
7. Organizational Stability	The sponsoring body must have transparent governance, financial sustainability, and administrative capacity to deliver its mandate, support Fellows, and ensure ongoing compliance with FCC and SCC oversight [Sec 3.7].

(Adapted from the Federation of Canadian Chiropractic, Policies for Chiropractic Specialty Colleges, approved Nov 2024. For detailed requirements, refer to Sections 3.1–3.7 of the policy document.)<sup>5</sup>

Together, these instruments consolidate chiropractic specialization into a competency-based, quality-assured framework that integrates regulation, education and public accountability. This structure positions chiropractic specialists as practitioners of *advanced practice*; clinicians who combine expert-level knowledge, research literacy,

and interprofessional collaboration to improve access, quality, and safety in neuromusculoskeletal health care.

*The 2025 survey on specialty value propositions*  
To assess current perceptions and identify barriers to specialty integration, a cross-sectional survey was con-

ducted with three groups of interest: provincial regulators (n=12), FCC-recognized chiropractic specialists (n=58), and general practice chiropractors from Ontario and Quebec (n=178).<sup>6</sup>

Survey participants were asked to rate their agreement with twelve distinct value propositions for chiropractic specialization, encompassing clinical practice excellence, educational leadership, research contribution, and professional collaboration.<sup>6</sup>

*Key Findings and Professional Consensus:* The survey demonstrated broad consensus that specialization enhances professional quality, public protection, and evidence-based practice standards. Across all respondent groups, the agreement with the value proposition was consistently high (58.5–91.1%).<sup>6</sup> Educational leadership, qualification for expert opinions, and clinical expertise were consistently identified as among the highest-rated value propositions across all stakeholder groups.<sup>6</sup>

*Persistent Barriers Despite Consensus:* However, despite this endorsement of specialization's value, the survey also revealed significant structural and systemic barriers that currently limit the realization of specialty potential<sup>6</sup>:

- **Regulatory Inconsistency:** Inconsistent provincial recognition and legislative frameworks prevent specialists from functioning to their full potential across jurisdictions
- **Geographic Concentration:** Limited access to specialist care outside Ontario, reducing patient access and interprofessional collaboration opportunities in other regions
- **Visibility and Awareness:** Limited recognition and understanding among interprofessional partners, insurers, healthcare administrators, and the general public regarding specialist competencies and roles

These findings underscore both the current maturity and the significant untapped potential of chiropractic specialization in Canada. They provide the empirical foundation supporting the strategic priorities outlined in this commentary.

#### *Contributions and demonstrated value*

Although chiropractic specialists represent only about 3%

of Canada's 9,000 licensed chiropractors, they make a disproportionate contribution to education, research, and clinical advancement. Their collective influence demonstrates how graduate specialty training strengthens professional standards, enhances scholarly productivity, and promotes evidence-informed care across the profession. Their collective achievements exemplify the goals of the Competency Profile for Chiropractic Specialists in Canada and align closely with the twelve value propositions for chiropractic specialists assessed in the 2025 national survey, which confirmed overwhelming agreement that specialization enhances professional quality, scholarship and public protection.<sup>4,7</sup>

#### *Educational leadership and mentorship*

Chiropractic specialists form the academic backbone of chiropractic education in Canada. This foundational role extends far beyond formal teaching; specialists serve as custodians of academic rigor, quality assurance, and evidence-based practice standards within chiropractic curricula.

*Faculty Leadership and Curriculum Development:* At the Canadian Memorial Chiropractic College (CMCC), specialists represent over 50% of all faculty and approximately 80% of teaching-clinic supervisors.<sup>8</sup> Within the Department of Chiropractic at Université du Québec à Trois-Rivières (UQTR), they comprise 46% of full-time faculty.<sup>9</sup> These proportions illustrate how specialist expertise sustains the intellectual and clinical capacity of chiropractic education nationwide.

Specialists' participation in curriculum design ensures that educational frameworks reflect current evidence and evolving clinical practice. By serving on examination committees and competency assessment boards, they establish and maintain rigorous standards for knowledge validation across cohorts. This ongoing quality assurance strengthens the profession's credibility both internally and with external healthcare partners.

*Mentorship and Scholarly Socialization:* Through classroom teaching, clinical supervision, and research mentorship, specialists embed the values of critical inquiry, scholarship, and interprofessional collaboration within the learning environment.<sup>10</sup> This mentorship function is particularly important: it does not merely transfer know-

ledge but actively shapes the professional identity and values of incoming practitioners.<sup>11</sup>

Survey respondents consistently linked these roles to several key value propositions, emphasizing advanced graduate education, evidence-based practice, and professional leadership.<sup>6</sup> By modeling rigorous critical thinking and collaborative problem-solving, specialists cultivate a culture of accountability and interprofessional competence that resonates throughout each new generation of chiropractors entering the profession.

### *Research leadership and scientific innovation*

The research contributions of chiropractic specialists far exceed their proportional representation within the profession. Analysis of CCRF funding from 2019-2024 reveals that specialists led or co-led approximately 24.5% of funded projects, despite representing only 3% of practicing chiropractors.<sup>12</sup> This remarkable concentration of research leadership demonstrates both the advanced research training specialists receive and their ongoing commitment to evidence-based practice development.

The scope of specialist-led research encompasses diverse areas of neuromusculoskeletal health, from fundamental biomechanical studies to clinical intervention trials. These projects frequently involve collaborations with academic institutions, government agencies, and multidisciplinary research teams, illustrating specialists' capacity to function as bridge-builders between chiropractic and broader healthcare communities.<sup>13-15</sup>

Similarly, their scholarly impact is evident in peer-reviewed publications. From 2019-2024, specialists authored or co-authored 48% of the Journal of the Canadian Chiropractic Association (JCCA) articles, with 30% serving as first authors (see Table 3 for analysis of JCCA publications by chiropractic specialist during that period).<sup>16</sup> These publications span systematic reviews, original research, case series, and clinical guidelines, contributing significantly to the evidence base for neuromusculoskeletal care.<sup>16</sup> The quality and scope of these contributions demonstrate how specialists operationalize the CanMEDS scholar role through rigorous investigation and knowledge dissemination.<sup>4,17</sup>

Table 3.  
*Analysis of JCCA publications by chiropractic specialists (2019-2024).*

Category	Metric	n (%)
Overall Coverage (/140)	Total JCCA articles analyzed	140
	Articles with specialist authors	66 (48%)
	Articles with specialist first authors	42 (30%)
	Unique specialists contributing	32
Publication Types (/66)	Original Research	16 (24%)
	Clinical Guidelines	8 (12%)
	Case Reports/Series	24 (36%)
	Other (commentaries, editorials)	18 (27%)
	Research Methodology	Case reports/series
	Qualitative research	12 (18%)
	Systematic reviews	10 (15%)
	Cross-sectional studies	8 (12%)
	Clinical trials	4 (6%)
	Narrative reviews	8 (12%)
	Specialty Areas	Clinical Sciences
Sports Sciences		18 (27%)

Category	Metric	n (%)
	Orthopaedics	2 (4%)
	Radiology	12 (18%)
	Rehabilitation	6 (9%)
Geographic Distribution	Ontario	38 (58%)
	Quebec	12 (18%)
	Alberta	8 (12%)
	British Columbia	6 (9%)
	Other	2 (3%)
Interprofessional Collaboration	Medical specialists	18 (27%)
	Allied health professionals	14 (21%)
	Academic institutions	22 (33%)
	Chiropractic only	32 (48%)
Trend (2019-2024) ;% of the year	2019	22 (41%)
	2020	25 (52%)
	2021	24 (50%)
	2022	26 (50%)
	2023	23 (48%)
	2024	20 (40%)

Data compiled from Journal of the Canadian Chiropractic Association archives (2019-2024), cross-referenced with Fellowship registries from recognized specialty colleges. Percentages reflect proportion of specialist-authored articles (n=66).

Survey participants reinforced this view, identifying research contribution as among the highest-rated value proposition of specialization.<sup>6</sup> The impact extends beyond quantity to encompass groundbreaking contributions that have shaped clinical practice. Specialists have led development of clinical practice guidelines, established diagnostic protocols for complex conditions, and advanced understanding of conservative management approaches for musculoskeletal disorders. Their work has been recognized not only within chiropractic but also in interdisciplinary journals, establishing credibility for conservative care approaches within broader healthcare contexts.<sup>18,19</sup>

#### *Clinical innovation and interprofessional leadership*

Recent JCCA publications illustrate how specialists advance clinical practice through innovative approaches to complex cases. Examples include multi-modal concus-

sion management protocols that integrate chiropractic, medical, and athletic perspectives,<sup>20,21</sup> advanced imaging applications for musculoskeletal conditions,<sup>22</sup> and interprofessional research collaborations that establish new care pathways.<sup>23-28</sup>

These contributions demonstrate specialists' capacity to function as leaders and collaborators within multidisciplinary healthcare settings.<sup>29</sup> Their advanced communication skills and evidence-based approach facilitate seamless integration with other healthcare providers, positioning chiropractic as a valued contributor to patient-centered care.<sup>14,29</sup> The ability to communicate effectively across professional boundaries and translate research findings into practical clinical applications distinguishes specialists as valuable team members in complex healthcare environments.

Specialists have pioneered innovative care delivery models that optimize patient outcomes. Their leadership

in developing interprofessional protocols, particularly in areas such as sports medicine,<sup>30</sup> and primary care<sup>13,14</sup> has established chiropractic as an essential component of comprehensive care teams.

### Overall contribution

Taken together, these educational, research, and clinical achievements confirm that chiropractic specialists serve as the profession's academic, scientific, and professional nucleus. Their leadership shapes the competencies of future chiropractors, drives the evidence base for musculoskeletal care, and anchors chiropractic's role within interprofessional collaboration. The recent survey on the value proposition of chiropractic specialty provide empirical support for these contributions, affirming that specialization represents not just a higher level of professional training but a system-wide asset for education, research and patient care.<sup>6</sup>

### System barriers and evidence gaps

While chiropractic specialization in Canada has achieved a high level of organizational maturity, several enduring system-level barriers continue to limit its full integration within the healthcare environment. Regulatory inconsistency, geographic concentration, limited visibility and a shortage of comparative clinical studies, restrict the profession's ability to translate advanced competencies into a measurable system impact. Addressing these barriers is essential to realizing the advanced-practice potential.

### Regulatory inconsistency and recognition gaps

Although most provinces now recognize the five FCC-endorsed specialties—Chiropractic Sciences, Radiology,

Sports Sciences, Rehabilitation, and Orthopaedics—formal mechanisms remain incomplete or uneven. British Columbia currently lacks legislative provision for specialist registration or title use, and in Québec, despite support from the Ordre des chiropraticiens du Québec, existing legislation still prevents chiropractors from using the title “specialist.” These inconsistencies create public confusion, limit interprovincial mobility and weaken the visibility of advanced credentials.

The Specialty Colleges Council (SCC) and its Specialty Recognition Committee (SRC) now provide the policy tools required to resolve these gaps. Aligning provincial legislation with the *SCC Policies for Chiropractic Specialty Colleges*<sup>5</sup> and the forthcoming *CCEC Accreditation Standards* would harmonize recognition across jurisdictions, strengthen public protection, and establish a coherent national language for specialty designation.

### Geographic concentration and access inequity

Access to specialist-level chiropractic care in Canada remains uneven, with the majority of Fellows concentrated in Ontario. This distribution reflects both population density and the historical location of the residency programs at the Canadian Memorial Chiropractic College (CMCC) in Toronto, where specialty training originated and continues to be offered.<sup>2</sup> As summarized in Table 4, nearly two-thirds of all recognized Fellows practise in Ontario, while only a small proportion are located in Western provinces, Québec, the Atlantic provinces, or the northern territories. This imbalance limits access to advanced chiropractic expertise and reduces opportunities for collaboration and referral in most jurisdictions.

Table 4.

### *Geographic distribution of chiropractic specialists in Canada (2025).*

(Data compiled from the Federation of Canadian Chiropractic Specialty Colleges registry, March 2025.)

Region of Canada	Total Number of Specialists	% of National Total
Western Canada	51	21.7 %
Ontario	166	70.6 %
Quebec	9	3.8 %
Atlantic Canada	9	3.8 %
Northern Territories	0	0.0 %
Total (Canada)	235	100.0 %

Note: Totals reflect Canadian-resident specialists (n = 235). The higher FCC registry total (n = 263) includes practitioners based outside Canada or without a listed province.

Expanding graduate specialty education, particularly through institutions such as the Université du Québec à Trois-Rivières (UQTR) and developing regional specialty hubs or virtual consultation networks could mitigate these disparities. Such models would extend advanced-practice expertise nationwide and align with Canada's broader health-system goals of accessibility and equity in health-care.<sup>31</sup>

### *Visibility and interprofessional awareness: a critical gap*

Despite their advanced education and research productivity, chiropractic specialists remain largely invisible within interprofessional and insurance frameworks. Many health professionals, insurers, program planners, and even general practice chiropractors are unaware of how specialists can contribute to complex case management, quality improvement initiatives, or health-system planning. In healthcare systems increasingly oriented toward interprofessional collaboration, this invisibility represents a significant barrier to realizing the advanced-practice potential outlined in this commentary.

This gap stems not from lack of competency but from structural and systemic factors: the absence of specialist designation in insurance coding and reimbursement frameworks; the lack of defined referral pathways within integrated care models such as pain clinics and rehabilitation networks; and insufficient communication within healthcare institutions and professional networks. Without these mechanisms, specialist competencies remain systematically undervalued and untapped—a missed opportunity for patients, the profession, and the broader healthcare system.

Addressing this gap requires a coordinated, multi-level approach. National and provincial associations, in partnership with the Specialty Colleges Council and regulators, must develop consistent, evidence-based messaging that presents chiropractic specialists as recognized providers of advanced neuromusculoskeletal care capable of functioning as leaders and collaborators in complex healthcare environments. Concrete mechanisms could include developing formal referral protocols and clinical pathways; engaging healthcare administrators and policymakers to secure recognition of specialty credentials in recruitment, credentialing, and advancement frameworks; and establishing collaborative projects with other health-

care professionals that demonstrate specialty value in specific clinical contexts (e.g., concussion management, chronic pain programs).

### *Evidence gaps and policy translation*

Although specialists are major contributors to chiropractic research, there remains limited comparative evidence demonstrating the clinical and economic impact of specialist care.<sup>5,6</sup> Evidence demonstrating the clinical and economic advantages of specialist-level care is needed to support inclusion in publicly funded programs and guide healthcare planning.

Investing in pragmatic clinical trials, outcomes registries, and health-services research would generate the data required to link educational quality assurance with measurable system impact. Such evidence would strengthen both policy advocacy and interprofessional credibility.

### *The advanced practice paradigm*

Findings from the 2025 survey on the value proposition of chiropractic specialty reveal broad professional consensus that chiropractic specialization enhances quality of care, public protection, and professional credibility.<sup>6</sup> Yet participants also identified persistent structural barriers such as limited recognition, restricted scope, and underutilization, that prevent specialists from functioning to their full potential. These observations mirror developments in other health disciplines that have evolved toward advanced-practice models, such as nursing and physiotherapy where higher levels of education and competency are explicitly linked to expanded clinical responsibility and system integration.<sup>32-38</sup>

### *Defining advanced practice in the chiropractic context*

Across health professions, advanced-practice frameworks share core features: graduate-level education, competency-based assessment, regulated title protection, and integration of leadership, scholarship, and direct patient care.<sup>32,36-38</sup> They emphasize the ability to manage complexity, exercise clinical judgment with greater autonomy, and collaborate effectively within multidisciplinary teams. Within this context, Canadian chiropractic specialization already embodies many of these key markers of advanced professional practice. Specialists complete structured graduate programs, demonstrate advanced diagnostic and

management competencies, and contribute to education, research, and interprofessional collaboration.<sup>4,5,17</sup>

### *Reframing specialization as advanced practice*

Positioning chiropractic specialization within an advanced-practice paradigm reframes it from an internal professional credential to a system-level resource. This conceptual shift provides a language familiar to regulators, policymakers, and payers. It situates chiropractic specialists alongside other advanced practitioners in musculoskeletal health. It also underscores that specialization is not hierarchical but integrative. It strengthens general practice through mentorship, consultation, and evidence translation rather than creating divisions within the profession.

Adopting this paradigm has several strategic implications:

- It clarifies the public-protection rationale for specialization by linking graduate education and competency assurance to defined scopes of advanced practice.
- It facilitates policy alignment with other health professions, enhancing recognition and reimbursement pathways.
- It encourages interprofessional integration, enabling chiropractic specialists to participate formally in chronic-pain programs, rehabilitation networks, and collaborative spine-care models.

### *A bridge between framework and implementation*

Conceptually, the advanced-practice model connects the national competency and accreditation framework to its real-world application. It translates the values embedded in the *Competency Profile for Chiropractic Specialists in Canada*<sup>4</sup> including expertise, collaboration, scholarship, and leadership, into a functional identity recognized by health-system partners. By adopting this paradigm, chiropractic specialists can be positioned as advanced clinicians who contribute not only to musculoskeletal care but also to system improvement through research, quality assurance, and health-policy engagement.

This redefinition also provides the foundation for the strategic priorities including harmonized recognition, equitable access as well as strengthened visibility and evidence. Each of these priorities operationalizes the advanced-practice vision within Canada's evolving health-care landscape.

### *Strategic priorities*

The evolution of chiropractic specialization has produced a coherent, competency-based framework capable of supporting professional excellence and public accountability. What remains is to ensure that this framework functions as a living system. Specialists and the services they provide should be recognized and supported across all jurisdictions, accessible to patients, visible within healthcare, and supported by robust evidence. Translating the advanced-practice vision into tangible outcomes requires coordinated action guided by three interdependent priorities.

#### *1. Harmonize recognition and modernize legislation*

National coherence in specialty recognition remains the cornerstone of progress. The *Specialty Colleges Council (SCC)*, *Council on Chiropractic Education Canada (CCEC)*, and *Federation of Canadian Chiropractic (FCC)* already provide the necessary governance foundation. The next step is to align provincial legislation and regulatory policies with the *SCC Policies for Chiropractic Specialty Colleges*<sup>5</sup> and the forthcoming *CCEC Accreditation Standards* (anticipated 2026).

A harmonized model would ensure that the title related to the chiropractic specialty or advanced practice carries the same meaning and protection across all provinces and territories. Provincial legislation should explicitly recognize FCC-endorsed specialties, define registration and maintenance-of-certification pathways, and embed competency assurance within public-protection mandates. The *Specialty Recognition Committee*, established by the FCC, offers a transparent mechanism for assessing new specialties and ensuring national consistency.

Such harmonization is not merely administrative; it is a tangible expression of public protection and professional maturity. By linking competency standards, recognition and accreditation, chiropractic specialization can emulate best practices in other health professions while maintaining provincial autonomy.

#### *2. Expand access and equity through innovation*

Geographic inequities and limited access to specialist chiropractic care persist, with nearly two-thirds of Canada's 263 Fellows practising in Ontario. (Table 4) This imbalance restricts patient access and limits professional collaboration in smaller jurisdictions.

Addressing these disparities requires both educational diversification and innovative service models:

- Establish new graduate specialty programs in underserved areas where institutional capacity already exists (e.g., UQTR), to expand training opportunities.
- Develop regional specialty hubs and telehealth consultation networks that connect general chiropractors with Fellows for case discussions, mentorship, and referral support.
- Integrate specialty expertise into interprofessional community clinics and academic health centres, positioning chiropractic specialists as key contributors to chronic-pain management, rehabilitation, and occupational-health programs.

These initiatives would operationalize the advanced-practice model by extending access to specialized expertise and aligning chiropractic with national priorities for equitable, community-based care.

### *3. Strengthen visibility, evidence, and system integration*

Even as chiropractic specialization achieves structural maturity, its visibility and integration within the healthcare system remain limited. A coordinated communication and data strategy is essential to demonstrate the value of specialist-level care.

**Public and interprofessional awareness:** National and provincial associations, in partnership with the SCC and regulators, should develop consistent messaging that presents chiropractic specialists as evidence-based providers of advanced neuromusculoskeletal care. A public-facing national directory of Fellows would improve transparency, facilitate referrals, and enhance trust among patients, insurers, and healthcare partners.

**Research and outcomes infrastructure:** Establish a national outcomes registry, jointly maintained by the SCC, FCC, and academic partners, to monitor quality indicators, patient outcomes, and cost-effectiveness. These data will provide empirical support for inclusion of chiropractic specialists in collaborative and publicly funded care models.

**Interprofessional integration:** Collaborative research and demonstration projects should quantify the impact of specialist participation in interdisciplinary programs for

chronic pain, rehabilitation, sports injury and spine care. Such evidence will strengthen policy recognition, inform reimbursement frameworks, and advance chiropractic's contribution to healthcare innovation.

Together, these three priorities—harmonized recognition, equitable access, and enhanced visibility and evidence—translate the advanced-practice framework into actionable policy. Implemented collectively, they will ensure that chiropractic specialists are recognized not only for their academic and clinical expertise but also for their essential role in improving accessibility, quality, and sustainability within Canada's healthcare system.

### **Conclusion**

Despite achieving organizational maturity, chiropractic specialization remains incompletely integrated within Canada's healthcare system. Inconsistent provincial recognition, unequal geographic distribution, limited public visibility, and absent comparative outcome data constrain its impact. We propose that addressing these barriers requires coordinated implementation of three interdependent strategies: harmonizing recognition and legislation across provinces; expanding access through regional training, telehealth consultation, and interdisciplinary hubs; and strengthening visibility and evidence through national communication and outcomes registries.

Advancing these priorities will transform chiropractic specialization from a professional credential into a system-level resource. By fully operationalizing its advanced-practice framework, the profession can ensure that specialist expertise contributes not only to patient care but also to healthcare innovation, education, and interprofessional collaboration nationwide—advancing Canada's objectives for accessibility, quality, and safety in musculoskeletal health.

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# Efficacy of spinal manipulative therapy in older adults with chronic spinal conditions: an updated systematic review

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**Background:** *This systematic review evaluated the efficacy of SMT for chronic spinal conditions in adults aged 55 years and older.*

**Methods:** *We searched multiple databases for randomized controlled trials (RCTs) on SMT for older adults with chronic spinal conditions (≥ 12 weeks) published from February 2016 through October 2024. Additionally, studies from the prior article being updated were included as appropriate. Eligible studies compared SMT to active or inert comparators, measuring pain, function, or quality of life.*

**Efficacité de la thérapie de manipulation vertébrale chez les personnes âgées atteintes de troubles chroniques de la colonne vertébrale: une étude systématique (mise à jour)**

**Contexte:** *Cette étude systématique a évalué l'efficacité de la thérapie de manipulation vertébrale (TMV) pour les troubles chroniques de la colonne vertébrale chez les adultes âgés de 55 ans et plus.*

**Méthodes:** *Nous avons effectué des recherches dans plusieurs bases de données pour des essais contrôlés aléatoires (ECA) sur la TMV visant des personnes âgées souffrant de conditions chroniques de la colonne vertébrale (au moins 12 semaines) publiés de février 2016 à octobre 2024. De plus, les études citées à l'article précédent qui est mis à jour ont été incluses, le cas échéant. Les études admissibles comparaient la TMV à des comparateurs actifs ou inertes, mesurant la douleur, la fonction ou la qualité de vie.*

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## Conflicts of Interest:

The authors wish to disclose that Robert J. Trager, an author on this study, reports earning royalties from authoring texts on the topic of sciatica, and received consulting fees from Merck for participation in an expert input meeting on chronic low back pain (October 2025). The authors have no further disclaimers or competing interest to report in the preparation of this manuscript. Partial funding for this study was received from both Clinical Compass and the NCMIC Foundation.

Results: Nine reports were included, evaluating SMT for chronic low back pain (5 RCTs, n=544), chronic neck pain (2 RCTs, n=241), lumbar spinal stenosis (1 RCT, n=259), and combined neck/back disability (1 RCT, n=182).

Conclusion: SMT may offer comparable or modestly greater benefit than other treatments for chronic spinal conditions in older adults, particularly for neck pain and LSS. Evidence certainty remains very low to moderate.

Registration: PROSPERO (CDR42024615084)

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KEY WORDS: musculoskeletal manipulations; aged; chronic pain; low back pain; neck pain; older adults; spinal manipulation; lumbar spinal stenosis; chiropractic

## Introduction

Low back pain (LBP) is the leading cause of years lived with disability globally, with prevalence and disability increasing with age, peaking from ages 80 to 84 years.<sup>1</sup> Neck pain (NP) is ranked 11<sup>th</sup> in terms of years lived with disability globally, having a peak prevalence between age 50 and 74.<sup>2</sup> Despite these conditions being highly prevalent, there remain limitations in the evidence for efficacious treatments in older adults.<sup>1,2</sup> In general, older adults exhibit a slower recovery from new episodes of back pain, and have a greater tendency to develop chronic symptoms.<sup>3</sup> Compared to younger adults, older adults are more likely to be severely debilitated by LBP, have decreased mobility, reduced independence, and require greater healthcare needs.<sup>4</sup>

Although chiropractic services are used less by older patients ( $\geq 55$  years) compared to the general population,<sup>5</sup> at least 20% of chiropractic patients are older adults.<sup>6</sup> Non-surgical, non-pharmacologic interventions such as spinal manipulative therapy (SMT), massage, and exercise, are recommended as first-line approaches to care for LBP.<sup>7-9</sup> SMT is a treatment offered by chiropractors, physical therapists with advanced training, and some

Résultats: Neuf rapports ont été inclus, lesquels évaluaient la TMV pour traiter la lombalgie chronique (5 ECA, n = 544), la cervicalgie chronique (2 ECA, n = 241), la sténose lombaire (1 ECA, n = 259) et les incapacités dues à une combinaison de cervicalgie et de lombalgie (1 ECA, n = 182).

Conclusion: La TMV peut offrir des avantages comparables ou modestement plus importants que d'autres traitements pour les troubles lombaires chroniques chez les personnes âgées, en particulier pour la cervicalgie et la sténose lombaire. La certitude des données probantes demeure très faible à modérée.

Inscription : PROSPERO (CDR42024615084)

(JCCA. 2026;70(1):27-54)

MOTS CLÉS : manipulations musculosquelettiques; âgé; douleur chronique; lombalgie; cervicalgie; personnes âgées; manipulation vertébrale; sténose lombaire; chiropratique

osteopaths and may be appropriate for older adults with chronic spine pain. Several observational studies have reported that SMT for older adults with spine pain is associated with reductions in cost and escalation of health care service utilization (e.g. imaging, injections, surgeries).<sup>10-12</sup> Best practices guidelines for the chiropractic management of older adults have been available since 2010,<sup>13</sup> with a subsequent update in 2017.<sup>14</sup> However, there are notable gaps in high quality evidence syntheses evaluating the efficacy of SMT derived from randomized controlled trials (RCTs) in older adults.<sup>15</sup>

Over the past decade, two systematic reviews on the topic of SMT for older adults have been conducted. Hawk *et al.* (2017) conducted a systematic review, which was used alongside a Delphi process to create best practices statements for chiropractors caring for older adults.<sup>14</sup> Hawk *et al.* identified six efficacy or effectiveness studies and concluded that there were evidence gaps regarding SMT in older adults, with current best practice recommendations being supported by expert opinion. Jenks *et al.* (2022) conducted an individual participant data meta-analysis including 10 studies with 786 patients total, with a search date ending in 2020.<sup>16</sup> The meta-analysis

found that SMT provided similar outcomes to recommended interventions for pain and functional disability in the older adult with chronic LBP, ultimately supporting SMT as an intervention. Despite these promising findings, evidence synthesis is needed for conditions beyond LBP, including stenosis with claudication, and NP. An updated literature synthesis is also needed to capture potential growth in the scientific literature.

Considering potential growth in available evidence since these previously reported systematic reviews on this topic, there is a need for an updated review on the topic of efficacy of SMT in older adults with chronic spinal conditions. The purpose of this systemic review was to investigate the efficacy of SMT for chronic spinal conditions in older adults. This study is an update of Hawk *et al.*'s 2017 systematic review performed as part of best practice consensus publication.<sup>14</sup> In contrast to the prior update, this review does not include any best practices nor guideline component. However, our results will provide evidence on SMT research to inform a separate clinical practice guideline update for the chiropractic management of older adult patients.

## Methods

### *Registration and protocol*

The study protocol was prospectively registered with the International Prospective Register of Systematic Reviews (PROSPERO) in November 2024 (CDR42024615084). Our reporting adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA-2020).<sup>17</sup>

### *Eligibility criteria*

To evaluate the efficacy of SMT for chronic spinal conditions in older adults, we translated PICOS elements (Population, Intervention, Comparison, Outcome, and Study Type) into eligibility criteria.

### *Population*

We included studies in which the study population had a mean or median age of 65 years or older, or the minimum age for study inclusion was 55 years, to ensure generalizability to an older adult population. Chronic spinal conditions were defined as those persisting for a minimum duration of 12 weeks. We chose an age threshold to ensure generalizability to an older adult population

while allowing inclusion of relevant studies. This decision was made a priori in consultation with the co-author team, considering the variable age definitions of “older adults” used in prior research studies, clinical guidelines, policy documents, and international literature.<sup>18,19</sup> Several factors supported our choice: (1) our review updates a prior systematic review<sup>14</sup> that included an RCT enrolling participants aged  $\geq 55$  years,<sup>20</sup> and we aimed to retain this study for consistency; (2) we aimed to maximize the number of eligible studies; (3) age-related changes to the spine often begin before age 65 and may influence response to SMT;<sup>21</sup> (4) the American Geriatrics Society<sup>22</sup> allows for inclusion of studies with a median age over 65 years, even when some participants are younger; and (5) SMT delivery may be modified for patients in their late 50s or early 60s due to age-related changes, for example reductions in bone density,<sup>23</sup> making this group clinically relevant to our review.

### *Intervention*

The intervention of interest was SMT, defined broadly as manual therapy of the spinal vertebral joints, excluding soft tissue techniques such as massage. More specifically, SMT was defined as both high-velocity low-amplitude (HVLA) techniques and low-velocity low-amplitude techniques applied to the spine. This refers to both manual treatments and mechanically assisted treatment (e.g., instrument techniques, flexion-distraction, drop table). SMT could include any portion of the vertebral column, including the occipital-cervical junction, cervical, thoracic, lumbar, and pelvic regions, including the sacroiliac joints. SMT must have been performed by a licensed health care professional (e.g., chiropractor, physical therapist, osteopath). Other non-pharmacological, non-surgical interventions could be provided in conjunction with SMT. These could include but were not limited to, mind-body interventions, acupuncture, massage therapy, acupressure, electrical modalities, heat or cold, or other manual therapies.

### *Comparators*

Comparison groups could include any active pharmacologic or non-pharmacologic intervention, placebo/sham interventions, waitlist controls, or no treatment. This broad inclusion maximized our ability to draw inferences from the available literature.

### Outcomes

The primary outcomes assessed were pain intensity, physical function, quality of life, and activities of daily living. Secondary outcomes included markers of health service utilization such as surgery, medication, and medical visits when reported among included studies.

### Study type

We considered RCTs published in peer-reviewed journals in English. We excluded commentaries, editorials, letters, reviews, pilot or feasibility studies, non-peer-reviewed publications, surveys, observational studies, conference abstracts, animal studies, study protocols, and studies lacking treatment outcomes. The eligibility criteria are reported in Table 1.

### Information sources

This study included RCTs from Hawk *et al.*'s 2017 systematic review performed on the same topic.<sup>14</sup> Given methodological revisions to expand on the age range of inclusion, restriction to chronic pain conditions, and focus on clinical trials, the three RCTs included in the previous review were all re-screened for eligibility in this update. Our database searches included PubMed, Cochrane Central Register of Controlled Trials, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Allied and Complementary Medicine Database (AMED), Index to Chiropractic Literature, and Physiotherapy Evidence Database (PEDro). The search for Index for Chiropractic Literature was conducted on October 28, 2024, and all other searches were conducted on October 30, 2024. Gray literature searches included citation tracking of included

articles, and consulting topic experts in search of relevant articles, which was performed on December 2, 2024.

### Search strategy

The search strategy was developed in collaboration with a health sciences librarian (SW). A second health sciences librarian evaluated the comprehensiveness of the search strategy using the Peer Review of Electronic Search Strategies (PRESS)<sup>24</sup> checklist. Searches were limited to academic journals and the English language. Search terms were relevant to older adults, chronic musculoskeletal spinal conditions, and manipulation or manual therapy. The search was limited by publication date from February 1, 2016 (following the Hawk *et al.* search end date) through October 2024. As an example, the PubMed search syntaxes can be found in Appendix 1.

### Selection process

Retrieved citations were uploaded to a Zotero<sup>25</sup> library and then the Rayyan<sup>26</sup> online systematic review software. Two reviewers (MP and RW) independently screened titles and abstracts for eligibility and resolved disagreements by discussion. The same two reviewers then performed full-text screening. Disagreements were resolved by discussion between the reviewers, and when needed, a third investigator (AS) assisted until consensus was achieved. In cases where multiple articles were derived from the same RCT, we included secondary reports only when they presented unique outcomes or analyses not available in the primary publication. This included data on responder outcomes, healthcare utilization, or cost-effectiveness. Accordingly, this strategy avoided duplication of primary

Table 1.  
*Eligibility criteria*

Inclusion Criteria	Exclusion Criteria
<ul style="list-style-type: none"> <li>• Study population age <math>\geq</math> 55 years or population mean or median age <math>\geq</math> 65 years</li> <li>• Chronic spinal condition(s)</li> <li>• Treatment included spinal manipulative therapy</li> <li>• Randomized controlled trial</li> <li>• Human subjects</li> <li>• English language</li> <li>• Published in peer-reviewed journal</li> </ul>	<ul style="list-style-type: none"> <li>• Commentaries/editorials/letters/reviews/pilot studies/feasibility studies</li> <li>• Non-peer-reviewed publications</li> <li>• Surveys and other descriptive cross-sectional studies</li> <li>• Conference abstracts</li> <li>• Observational studies</li> <li>• Animal Studies</li> <li>• Study protocols</li> <li>• No treatment outcomes included</li> <li>• Low-quality studies</li> </ul>

outcomes such as pain and physical function and allowed us to capture a broader range of outcomes relevant to our aims. All included reports were linked to their respective primary RCTs and reported transparently in the data extraction tables. Considering our non-meta-analytic, qualitative approach and broad scope, inclusion of these secondary analyses provided additional data to support evidence synthesis.

### *Data collection process*

Data extraction of the included RCTs was completed independently by two investigators (RT and JS). A third investigator (AS) verified the data, with discussion to resolve discrepancies. Extracted data were entered into a pre-designed Microsoft Excel worksheet. Corresponding authors of two of the included RCTs were contacted for additional information and clarifications,<sup>27,28</sup> which were provided by one author.<sup>27</sup>

### *Data items*

Information collected for each study included the first author's surname, year of publication, sample size, patient age, symptom duration, condition(s)/diagnosis, treatment/intervention groups, sample size at allocation, and description of any group(s) with SMT, intervention group(s) dosage, comparison groups, sample size at allocation, and description of any group(s) without SMT, comparison group(s) dosage, follow-up duration for primary outcomes, pain and disability outcome measures, between-group effect estimate(s) for primary outcomes, responder analysis for within-group differences (if reported/calculated), other health service outcomes, between-group effect estimate(s) for other health service outcomes (if reported/calculated), and a summary of the key findings. We avoided specific requirements for follow-up durations among included studies. Instead, our strategy aimed to include all relevant outcomes reported, emphasizing any study-defined primary outcomes in our analysis. This ostensibly allowed us to capture the range of available evidence given the limited expected number of eligible studies.

For each RCT, we extracted means, standard deviations and confidence intervals (CIs) from the tables, text, or figures, as available. For two studies that did not provide between-group mean differences,<sup>27,29</sup> the values were calculated with assistance from a statistician. For one study,

which did not provide standard deviations (SD),<sup>29</sup> differences were imputed using pooled variance for Oswestry Disability Index (ODI), 36-Item Short Form Survey (SF-36), and Visual Analog Scale (VAS), using the Satterthwaite approximation to calculate degrees of freedom for each.<sup>30</sup> For the other study,<sup>27</sup> we calculated the mean difference in post-treatment pain scores and SDs and used the t-statistic to derive the 95% confidence intervals.<sup>31</sup>

### *Study risk of bias assessment*

Included RCTs were evaluated independently by two investigators (RT and JS) using the Scottish Intercollegiate Guideline Network (SIGN) checklist.<sup>32</sup> Several tools are available to assess the quality and risk of bias of RCTs, including the Cochrane Risk of Bias tools (RoB 1 and RoB 2), the SIGN checklist, tools from the Joanna Briggs Institute, and others. We opted to use the SIGN checklist as it is a practical, straightforward, and validated tool.<sup>33</sup> Each SIGN question was assigned a value of "1" for each "yes" response and a value of "0" for "no" or "not applicable." Disagreements were resolved by including additional reviewers (AS and CD) and discussion until a consensus was reached. The SIGN tool also allows raters to enter free-text comments to support their individual scores, which facilitated discussion and resolution of discrepant scores. The SIGN checklists provided each study with a raw score from 0-10, with single-site trials being scored out of a total of nine points, instead of ten, because one question was only relevant to multisite trials.<sup>32,34</sup> These raw scores were then divided by the total sum of scores across the total of applicable domains and multiplied by 100 to make a percentage scoring system. We operationalized scoring thresholds in alignment with risk of bias assessments and corresponding quality, a strategy which has been used previously for risk of bias assessment.<sup>35-38</sup> We interpreted scores of  $\geq 80\%$  as being "high quality, low risk of bias," 50% to 79% as "acceptable quality, moderate risk of bias," and  $< 50\%$  as "low quality, high risk of bias." For reports of secondary analyses, we evaluated the risk of bias based on their primary RCT. For the SIGN checklist we adapted item four regarding blinding to interpret it in respect to blinding of the outcome to the assessors, rather than clinicians delivering SMT or SMT recipients, to provide a more realistic and practical assessment of RCTs focused on SMT.<sup>39</sup>

### Effect measures

We reported mean differences between groups along with confidence intervals and *P*-values for primary outcomes. Secondary outcomes, when present, included odds ratios or proportions of patients reaching improvement thresholds.

### Synthesis methods

We qualitatively synthesized the extracted data from the included studies. We assessed clinical heterogeneity by comparing study characteristics, including patient population characteristics, condition treated, SMT co-interventions, comparator interventions, outcome measures, and duration of follow-up.

After reviewing previous literature reviews on the topic,<sup>14,16</sup> our team decided a priori to avoid meta-analysis. First, we expected only a small number of studies would meet our inclusion criteria, limiting the ability to pool data meaningfully. Second, the total sample size across eligible studies was expected to be low (e.g., <400 participants), increasing the potential for imprecision.<sup>40</sup> Third, we anticipated clinical heterogeneity across studies from variations in patient populations (e.g., age, baseline symptoms), SMT protocols (e.g., technique, frequency), comparators (e.g., exercise, sham), and outcome measures (e.g., pain scales, functional status tools) which would hinder analysis.

### Reporting bias

To assess potential reporting bias, one investigator (CD) extracted funding sources from included articles and searched ClinicalTrials.gov in February 2025.<sup>41</sup> Funding sources were categorized as either industry or non-industry,<sup>42</sup> and the Clinical Trials database was searched to identify whether any potentially eligible clinical studies had not been published.<sup>43</sup>

### Certainty assessment

We utilized the GRADE (Grading of Recommendations Assessment, Development, and Evaluation)<sup>40,44–48</sup> system to assess the overall quality of the evidence. Two investigators (AS and CD) performed GRADE assessments independently. When there were disagreements, additional investigators (RT and JS) were included and discussed the ratings until consensus was achieved. Outcomes were automatically deemed “very low” certainty

if no trials were identified that reported on that given outcome.

## Results

### Study selection

The search yielded 99 unique citations, and after title and abstract screening, 30 studies were potentially relevant, and the full-text reports were retrieved for assessment (Figure 1). Percentage agreement was 73% for title and abstract screening, and 100% for full-text screening. Five full-text records were identified through reference tracking and expert consultation, and an additional six reports (five studies) from the 2017 Hawk *et al.* study brought the total number of full-texts to be screened to 38; of those, 32 were excluded (reasons for exclusion detailed in Appendix 2).<sup>49–80</sup> A total of six new reports (four studies,<sup>28,81–83</sup> and two secondary analyses<sup>84,85</sup>) were included as a result of the updated database search, in combination with three studies<sup>20,27,29</sup> from the prior 2017 Hawk *et al.* systematic review, resulting in a total of nine reports<sup>20,27–29,81–85</sup> of seven RCTs<sup>20,27–29,81–83</sup> included in this systematic review.

### Study characteristics

Five studies reported on LBP,<sup>20,27–29,85</sup> two reported on NP,<sup>81,84</sup> one reported on both NP and LBP,<sup>82</sup> and one reported on LSS.<sup>83</sup> Regarding the studies reporting on chronic LBP intervention and comparison group: Learman *et al.* compared thrust manipulation plus a home exercise program to non-thrust manipulation plus a home exercise program (standing hamstring stretches, cat and camel, quadruped pelvic rocking, prone press-ups, and supine lying piriformis stretches); Dougherty *et al.* compared SMT to sham treatment (detuned ultrasound); Enix *et al.* compared SMT plus soft tissue manipulation (proprioceptive neuromuscular facilitation stretching, post-isometric exercise relaxation techniques, transverse friction massage, and passive stretching) to multimodal physical therapy exercise (neuromuscular re-education, muscle endurance and strength training exercises, flexibility stretches, interferential electrical stimulation, ultrasound, postural education, and home exercise program); and Schulz *et al.* compared three groups, which were SMT (including up to four minutes of adjunct therapies to facilitate SMT) plus home exercise program (self-care for pain, low load exercises with graded progressions, stretching exercises muscle strength and endurance exer-

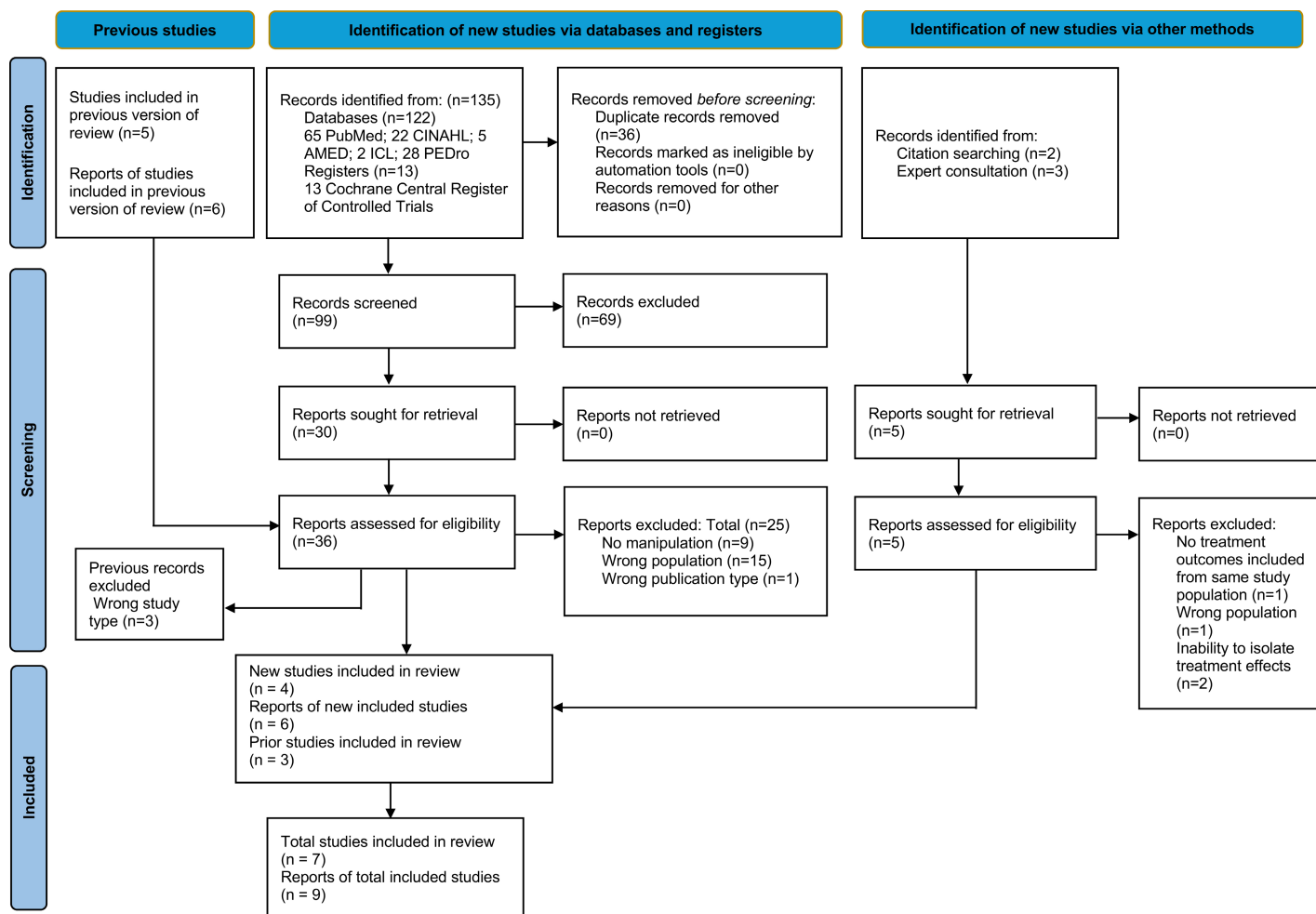


Figure 1.

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram for updated systematic reviews which included searches of databases, registers and other sources. Abbreviations: Cumulative Index to Nursing and Allied Health Literature (CINAHL); Allied and Complementary Medicine Database (AMED), Physiotherapy Evidence Database (PEDro).

cises, and balance exercises), supervised exercise program (self-care for pain, light aerobic warm up on stationary equipment, low load exercise, stretching, strength and balance exercises as described for home exercise program.) plus home exercise program, and home exercise program alone. Maiers *et al.* (2014) reported on chronic NP comparing three groups: SMT plus home exercise and advice (information regarding pain management, consistent messaging to stay active, daily prescribed exercise to improve flexibility, balance, and coordination, as well as enhance trunk strength and endurance); supervised

exercise program plus (one hour session high repetitions of low load exercises with the aim of increasing flexibility, endurance, strength, and balance) home exercise and advice; and home exercise and advice alone. Maiers *et al.* (2019) reported on both chronic NP and chronic LBP and compared treatment duration of SMT plus supervised exercises (aerobic warm up and standardized program of stretching, strengthening, and balance exercises) for 12 weeks versus 36 weeks. Schneider *et al.* reported on LSS and compared three groups which were medical care (oral medication or epidural steroid injections as indicat-

ed), group-based exercise (supervised exercise classes for older adults), as well as manual therapy (including lumbar distraction mobilization, and lumbar/sacroiliac joint mobilization) and individualized exercises. Leininger *et al.* published a secondary analysis of the Maiers *et al.* (2014)

RCT to investigate between group cost-effectiveness, and Maiers *et al.* (2021) published a secondary analysis of Maiers *et al.* (2019) to investigate baseline factors related to response and outcomes for LBP and disability.

Table 2 summarizes study characteristics. In total,

Table 2.  
Study characteristics.

Author and Year	N	Age in years	Symptom duration	Condition	Intervention group(s) with SMT and (N)	Comparison group(s) without SMT and (N)	Outcome measures	Primary follow-up duration(s)
Learman 2013	49	64.5 (SD=8.9); ≥55	22.2 weeks (SD=40.6)	Low back pain	1. TM+HEP (n=19)	2. Non-TM+HEP (n=30)	Primary: NPRS, ODI	Mean 40.0 days (SD=32.9)
Dougherty 2014	136	77; ≥65	≥3 months	Low back pain	1. SMT (n=69)	2. Sham (n=67) “detuned ultrasound” applied over the lumbar spine for 11 minutes	Primary: ODI, SF-36 PFS, VAS Secondary: SF-36 PCS, TUG	5, 12 weeks
Enix 2015	118	72.0 (SD= 6.7); 60-85	>12 weeks	Balance problems and low back pain	1. SMT+soft tissue manipulation (n=61)	2. Multimodal physical therapy exercise, without SMT (n=57)	Primary: 21-point Box Pain Scale	6, 12 weeks
Maiers 2014 Secondary analysis: Leininger 2016	241	1. SMT+HEA 71.7 (SD= 5.2) 2. SRE+HEA 72.6 (SD= 5.6) 3. HEA 72.7 (SD= 5.3)	1. SMT+HEA 6.5 years (IQR= 2.0-19.0) 2. SRE+HEA 7.5 years (IQR= 1.8-20.0) 3. HEA 5.0 years (IQR= 2.0-15.0)	Neck pain	1. SMT+HE (n=80)	2. SRE+HEA (n=82) 3. HEA (n=79)	Primary: 11-Box Pain Scale, NDI, SF-36 PFS Secondary: SF-36 MCS, Improvement, Satisfaction, Cervical spine dynamic motion, Isometric muscle flexion and extension strength, Static muscle endurance, TUG, hand grip strength	12 weeks
Maiers 2019 Secondary analysis: Maiers 2021	182	71.1 (SD= 5.3); 85-87	Neck: 12.7 years (SD=13.1) Back: 17.6 weeks (SD=15.8)	Neck and back disability	1. SMT+ supervised exercise (12 weeks) (n=91)	2. SMT+supervised exercise (36 weeks)	Primary: ODI, NDI, 11-Box Pain Scale, EQ, SPPB Secondary: Improvement, satisfaction, kinesiophobia, self-efficacy, expectations for improvement, hand grip strength	36 weeks
Schneider 2019	259	72.4 (SD=7.8); 60-94	1. MT/IE: 92% >6 months 2. Medical: 92% >6 months 3. Group-based exercise: 86% >6 months	Lumbar spinal stenosis	1. MT/IE (n=87)	2. Medical (n=88) 3. Group-based exercise (n=84)	Primary: SSS, SPWT, daily physical activity	2 months
Schulz 2019	241	1.SMT+HEP 72.5 (SD= 5.6) 2.SEP+HEP 73.6 (SD= 5.3) 3.HEP 74.7 (SD= 5.6)	1. SMT+HEP 13.7 years (SD=15.7) 2. SEP+HEP 12.1 years (SD=15.1) 3. HEP 12.9 years (SD=15.8)	Low back pain	1. SMT+HEP (n=81)	2. SEP+HEP (n=80) 3. HEP (n=80)	Primary: 11-Box Pain Scale, MRS, SF-36 PFS Secondary: SF-36 MCS, Improvement, Satisfaction, Lumbar and spine dynamic motion, Isometric muscle flexion and extension strength, Static muscle endurance, TUG, hand grip strength	12 weeks

Abbreviations: EQ, EuroQol EQ-5D; HEA, Home Exercise and Advice; HEP, Home Exercise Program; IQR, InterQuartile Range; MCS, Mental Component Summary; MRS, Modified Roland Scale; MT/IE, Manual Therapy/Individualized Exercise; NDI, Neck Disability Index; NPRS, Numeric Pain Rating Scale; ODI, Oswestry Disability Index; PCS, Pain Component Summary; PFS, Physical Function Subscale; SD, Standard Deviation; SEP, Supervised Exercise Program; SF-36, 36-Item Short Form Survey; SPPB, Short Physical Performance Battery; SPWT, Self-Paced Walking Test; SRE, Supervised Rehabilitative Exercise; SMT, Spinal Manipulative Therapy; SSS, Swiss Spinal Stenosis Questionnaire; TM, Thrust Manipulation; TUG, Timed Up and Go; VAS, Visual Analog Scale. Listed numbers. (e.g., 1., 2., 3.,) before values correspond to intervention groups, consistent within studies.

1,226 patients were included across all studies, with 579 patients receiving SMT. Mean patient ages varied from 64.5 years to 74.7 years, with the youngest and oldest individual ages reported to be 55 and 94 years, respectively. The number of patients and RCTs per condition were most for LBP with five RCTs including 544 unique patients total, with other conditions only having one RCT and fewer patients (LSS: n=259; NP: n=241; NP and disability and LBP and disability n=182). Symptom duration ranged from >12 weeks to 13.7 years. Follow-up duration for primary outcomes ranged from five weeks to 36 weeks. Accordingly, the maximum durations of follow-up included in the analysis spanned Cochrane-defined windows of short term (closer to four weeks) to intermediate-term (closer to six months) and are reported in Table 2.<sup>86</sup> The most common outcome measures for pain and disability were the ODI (n=3 RCTs), SF-36 (n=3 RCTs), Neck Disability Index (NDI) (n=2 RCTs), and 11-Box Pain Scale (n=3 RCTs). Additional primary

outcome measures, included in only one RCT, were the Numeric Pain Rating Scale (NPRS), VAS, 21-point Box Scale (pain), Modified Roland Scale (MRS), EuroQol EQ-5D (EQ), Short Physical Performance Battery (SPPB), Swiss Spinal Stenosis Questionnaire (SSS), and Self-Paced Walking Test (SPWT).

**Risk of bias in studies**

Table 3 lists the risk of bias of the seven included RCTs. Five studies were assessed as high-quality (low risk of bias),<sup>28,29,81-83</sup> and two were acceptable quality (moderate risk of bias).<sup>20,27</sup> No studies were assessed as low quality (high risk of bias).

**Results of individual studies**

Individual study results are available in Table 4., as well as a responder analysis table and health services outcomes table in the Appendix 3 and Appendix 4, respectively.

*Table 3.*

*Article quality scores. The first column values 1-10 indicate the corresponding response items in the Scottish Intercollegiate Guidelines Network rubric.32 Items: Focused question (1), randomized assignment (2), adequate concealment (3), blinding (4), group baseline similarity (5), treatment is only difference between groups (6), standard, valid, reliable measures of relevant outcomes (7), <20% dropout (8), intention-to-treat (9), multisite comparability – if applicable (10).*

Response item	Learman 2013	Dougherty 2014	Maiers 2014	Enix 2015	Maiers 2019	Schneider 2019	Schulz 2019
1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1
3	0	1	1	0	1	1	1
4	0	1	1	1	1	1	1
5	1	1	1	1	1	1	1
6	1	1	1	0	1	1	1
7	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1
9	0	1	1	1	1	1	1
10	0	1	NA	NA	NA	NA	NA
Overall Quality	Acceptable	High	High	Acceptable	High	High	High

Abbreviations: Not applicable, NA.

Table 4.  
Individual study results.

Author and Year	Condition	Intervention group(s) with SMT	Comparison group(s) without SMT	Between-group effect estimate(s) for spine related pain and physical function, QoL, or ADLs outcomes	Between-group findings and interpretation
Learman 2013	Low back pain	TM+HEP	Non-TM+HEP	Not reported	No significant between-group differences for pain or disability (p=.99)
Dougherty 2014	Low back pain	SMT	Sham (detuned ultrasound)	<p><b>VAS (MD w/ 95% CI)</b></p> <ul style="list-style-type: none"> <li>5 weeks: 5.87 [-2.78, 14.52] (F=1.87, p=0.17)</li> <li>12 weeks: 5.61 [-3.12, 14.34] (F=1.68, p=0.19)</li> </ul> <p><b>ODI (MD w/ 95% CI)</b></p> <ul style="list-style-type: none"> <li>5 weeks: 2.03 [-2.3, 6.3] (F=1.19, p=0.27)</li> <li>12 weeks: 5.25 [1.24, 9.26] (F=6.95, p&lt;0.001)</li> </ul> <p><b>SF-36 PFS (MD w/ 95% CI)</b></p> <ul style="list-style-type: none"> <li>5 weeks: 0.04 [-0.08, 0.16] (F=.42, p=0.52)</li> <li>12 weeks: 0.07 [-0.06, 0.20] (F=1.01, p=0.31)</li> </ul>	No significant between-group differences for VAS and ODI at 5 weeks, or for VAS at 12 weeks. Statistically significant difference at 12 weeks with SMT showing a greater reduction in ODI (p<.001), but not clinically meaningful. Secondary analyses demonstrate a nonspecific therapeutic effect of the intervention.
Enix 2015	Balance problems and low back pain	SMT+soft tissue manipulation	Multimodal physical therapy exercise, without SMT	<p><b>Pain values (all measures)</b></p> <ul style="list-style-type: none"> <li>No significant between-group effects at 6 or 12 weeks for pain (all p-values &gt;0.05)</li> </ul> <p><b>Usual pain (MD w/ 95% CI)</b></p> <ul style="list-style-type: none"> <li>6 weeks: 0.4 [-5.91, 6.71]</li> <li>12 weeks: -1.55 [-8.49, 5.39]</li> </ul>	Statistically and clinically significant improvements in pain outcome measures in both the chiropractic care and physical therapy treatment groups at week 6 and at week 12, however there were no significant between-group effects at 6 or 12 weeks for pain.
Maiers 2014	Neck pain	SMT+HE	SRE+HEA and HEA alone	<p><b>Pain MD at 12 weeks (MD w/ 95% CI)</b></p> <ul style="list-style-type: none"> <li>SMT+HEA vs. SRE+HEA: -0.55 [-1.10, 0.00] (p≤0.05)</li> <li>SMT+HEA vs. HEA: -1.04 [-1.59, -0.49] (p≤0.01)</li> </ul> <p><b>NDI at 12 weeks (MD w/ 95% CI)</b></p> <ul style="list-style-type: none"> <li>SMT+HEA vs. SRE+HEA: -0.27 [-2.55, 2.02] (p&gt;0.05)</li> <li>SMT+HEA vs. HEA: -1.59 [-3.90, 0.73] (p&gt;0.05)</li> </ul> <p><b>SF-36 PFS at 12 weeks (MD w/ 95% CI)</b></p> <ul style="list-style-type: none"> <li>SMT+HEA vs. SRE+HEA: -0.14 [-1.75, 1.46] (p&gt;0.05)</li> <li>SMT+HEA vs. HEA: -0.27 [-1.91, 1.36] (p&gt;0.05)</li> </ul>	SMT+HEA yielded greater pain reduction after 12 weeks of treatment compared to both SRE+HEA and HEA alone. There were no statistically significant between-group differences in disability.
Maiers 2019	Neck and back disability	SMT+ supervised exercise (12 weeks)	SMT+ supervised exercise (36 weeks)	<p><b>NDI at 36 weeks (MD w/ 95% CI)</b></p> <ul style="list-style-type: none"> <li>1.7 [-0.8, 4.2] (p=0.18)</li> </ul> <p><b>ODI at 36 weeks (MD w/ 95% CI)</b></p> <ul style="list-style-type: none"> <li>2.4 [-0.3, 5.1] (p=0.08)</li> </ul> <p><b>Neck pain at 36 weeks (MD w/ 95% CI)</b></p> <ul style="list-style-type: none"> <li>0.7 [0.1, 1.2] (p=0.02)</li> </ul> <p><b>Low back pain at 36 weeks (MD w/ 95% CI)</b></p> <ul style="list-style-type: none"> <li>0.4 [-0.2, 1.0] (p=0.19)</li> </ul> <p><b>EQ at 36 weeks (MD w/ 95% CI)</b></p> <ul style="list-style-type: none"> <li>0.0 [-0.0, 0.0] (p=0.72)</li> </ul> <p><b>SPPB at 37 weeks (MD w/ 95% CI)</b></p> <ul style="list-style-type: none"> <li>-0.5 [-1.0, -0.0] (p=0.04)</li> </ul>	There were no significant between-group differences for ODI, NDI, or medication use at 36 weeks' follow-up. However, there were statistically significant differences in favor of long-term management for self-reported improvement in neck pain, as well as functional measures.
Schneider 2019	Lumbar spinal stenosis	MT/IE	Medical Care alone and Group-based exercise alone	<p><b>SSS at 2 months (MD w/ 95% CI)</b></p> <ul style="list-style-type: none"> <li>MT/IE vs. medical care: -2.0 [-3.6, -0.4] (p&lt;0.05)</li> <li>MT/IE vs. group exercise: -2.4 [-4.1, -0.8] (p&lt;0.05)</li> </ul> <p><b>SPWT at 2 months (MD w/ 95% CI)</b></p> <ul style="list-style-type: none"> <li>MT/IE vs. medical care: 122.9 [-25.7, 271.6]</li> <li>MT/IE vs. group exercise: 43.0 [-111.8, 197.9]</li> </ul>	MT/IE yielded a greater reduction in SSS score compared to medical care, and group exercise, yet did not reach a minimal clinically important difference of 3.02 points. There was no meaningful difference in SPWT, with comparisons of MT/IE vs. medical, and MT/IE vs. general exercise.

Author and Year	Condition	Intervention group(s) with SMT	Comparison group(s) without SMT	Between-group effect estimate(s) for spine related pain and physical function, QoL, or ADLs outcomes	Between-group findings and interpretation
Schulz 2019	Low back pain	SMT+HEP	SEP+HEP and HEP alone	<p><b>Short Term Pain at weeks 4 to 12 (MD w/ 95% CI)</b>                      • SMT+HEP minus HEP: -0.48 [-1.00, 0.03]  <b>Long term pain at weeks 4 to 52 (MD w/ 95% CI)</b>                      • SMT+HEP minus HEP: -0.13 [-0.59, 0.34]</p> <p><b>Short-term MRS at weeks 4 to 12 (MD w/ 95% CI)</b>                      • SMT+HEP minus HEP: 0.78 [-3.99, 5.54]  <b>Long-term MRS at weeks 4 to 52 (MD w/ 95% CI)</b>                      • SMT+HEP minus HEP: -1.42 [-5.88, 3.04]</p> <p><b>Short-term SF-36 PFS at weeks 4 to 12 (MD w/ 95% CI)</b>                      • SMT+HEP minus HEP: 0.56 [-1.09, 2.21]</p> <p><b>Long-term SF-36 PFS at weeks 4 to 52 (MD w/ 95% CI)</b>                      • SMT+HEP minus HEP: -0.34 [-1.87, 1.2]</p>	Adding SMT to HEP alone did not significantly improve pain or disability outcomes in the short- or long-term. There were no significant or meaningful between-group differences with respect to pain, Modified Roland Scale, or SF-36 PFS.

Abbreviations: CI, Confidence Intervals; EQ, EuroQol EQ-5D; HEA, Home Exercise and Advice; HEP, Home Exercise Program; MD, mean difference; MRS, Modified Roland Scale; MT/IE, Manual Therapy/Individualized Exercise; NA, not applicable/present; NDI, Neck Disability Index; NPRS, Numeric Pain Rating Scale; ODI, Oswestry Disability Index; OR, Odds Ratio; PFS, Physical Function Subscale; QALY, Quality-Adjusted Life Year; SF-36, 36-Item Short Form Survey; SPPB, Short Physical Performance Battery; SPWT, Self-Paced Walking Test; SRE, Supervised Rehabilitative Exercise; SMT, Spinal Manipulative Therapy; SSS, Swiss Spinal Stenosis Questionnaire; TM, Thrust Manipulation; VAS, Visual Analog Scale.

**Results of syntheses**

**Low back pain**

Across three RCTs,<sup>27-29</sup> SMT showed no significant between-group difference between active or inert comparators for pain measures for LBP. Regarding low back-specific disability, one RCT found a statistically significant but not clinically meaningful benefit favoring SMT over an inert comparator,<sup>29</sup> while another RCT using an active exercise comparator found results favoring the null.<sup>28</sup> Two RCTs found no significant between-group difference in disability or functional status for LBP.<sup>28,29</sup>

Two RCTs evaluated the comparative efficacy of SMT treatment parameters for LBP and disability.<sup>20,82</sup> Learman *et al.* found no significant difference between thrust and non-thrust SMT, while Maiers *et al.* (2019) reported no significant difference related to SMT treatment duration (i.e., 12 weeks versus 36 weeks).

Schulz *et al.* explored responder analyses, noting modest differences favoring SMT at 12 weeks (16% more participants experienced a 30%-49% pain severity reduction [i.e., moderate], and 18% more participants with a 50% or greater [i.e., substantial] pain reduction),<sup>87</sup> although most responder outcomes were similar between groups. Schulz

*et al.* and Maiers *et al.* (2019) reported no significant between-group differences with respect to medication use. A secondary analysis found that among older adults with back disability, a longer duration of symptoms greater than 14.5 years predicted a poorer response to SMT and exercise.<sup>85</sup>

**Lumbar spinal stenosis**

One RCT evaluated the efficacy of SMT with individualized exercise for LSS.<sup>83</sup> The SMT group yielded greater reductions in SSS scores compared to medical care and group exercise, although these did not meet a minimal clinically important difference of 3.02 points.<sup>88</sup> No significant between-group differences were observed in SPWT. Secondary outcomes showed a higher proportion of responders in symptoms and walking capacity with SMT/exercise at two months compared to medical care or group exercise and with no meaningful differences in falls, medical co-interventions, or spinal surgery rates at 6 months.

**Neck pain**

One RCT studying NP compared the efficacy of three

groups: SMT with home exercise, home exercise alone, and supervised exercises plus home exercise.<sup>81</sup> Results favored the SMT plus home exercise group for pain intensity. However, there was no significant between-group difference for disability nor functional status. A higher proportion of participants receiving SMT achieved  $\geq 50\%$  (i.e., substantial) pain reduction at 12 weeks versus controls, although not at 52 weeks or for other thresholds ( $\geq 30\%$ ,  $\geq 75\%$ ). Medication use showed no significant between-group differences. A secondary analysis found SMT plus home exercise reduced total societal costs and improved pain and disability outcomes over 1 year compared to the control intervention.<sup>84</sup> One RCT evaluated the comparative efficacy of SMT treatment duration parameters for NP and disability and found statistically significant differences in favor of long-term management (36 weeks duration) for NP.<sup>82</sup>

#### *Neck and back-related disability*

For patients with both neck and back-related disability, one RCT did find statistically significant differences in favor of long-term management (36 weeks duration) for functional status, but there were no significant between-group differences for neck or back-related disability, quality of life, or medication use.<sup>82</sup> Additionally, Maiers *et al.* (2019) explored responder analysis but did not find any statistically significant differences between groups receiving 12 or 36 weeks of SMT in the proportions reaching 15%, 30%, or 50% improvement in disability.

#### *Reporting biases*

A search of ClinicalTrials.gov did not identify any RCTs which were completed yet unpublished. Among included studies, one did not receive funding,<sup>20</sup> and six received funding from non-industry sources<sup>27–29,81–83</sup>. The lack of industry funding suggests a low likelihood of publication bias. Specific extracted funding sources from included studies can be found in Appendix 5.

#### *Certainty of evidence*

The certainty of evidence regarding SMT vs. comparator for LBP was low for pain intensity, back-specific disability status, and functional status. The certainty regarding SMT parameters for LBP was very low for pain intensity and back-specific disability status when comparing thrust

vs. non-thrust SMT. The certainty of evidence regarding SMT parameters for LBP was low for pain intensity, back-specific disability status, functional status, and quality of life or activities of daily living (QoL/ADLs) when comparing duration of SMT treatment. The certainty of evidence regarding SMT vs. comparator for LBP was very low for QoL/ADLs. The certainty of evidence regarding SMT for LSS was moderate for back-specific functional status and QoL/ADLs. The certainty of evidence regarding SMT for LSS was very low for pain intensity and was downgraded as no trials were identified that reported this outcome. The certainty of evidence regarding SMT vs. comparator for NP was low for pain intensity, neck-specific disability status, and functional status. The certainty of evidence regarding SMT parameters for NP was low for pain intensity, neck-specific disability status, functional status, and QoL/ADLs when comparing the duration of SMT treatment. The certainty of evidence regarding SMT vs. comparator for NP was very low for QoL/ADLs. All downgrades were due to imprecision, risk of bias, or a lack of identifying studies for the outcome. Appendices 6–10 provide additional detail for graded certainty of evidence for interventions.

#### *Discussion*

This systematic review evaluated the efficacy of SMT for chronic spinal conditions in older adults. All results either favored the null or SMT. Significant between-group differences in outcomes favoring SMT over comparators were NP reduction with low certainty of evidence, and significant but small improvements in back-specific functional status in LSS with moderate certainty of evidence.<sup>88,89</sup> However, there was moderate certainty of evidence favoring the null for QoL in LSS. There was mixed very low and low certainty of evidence for parameters for LBP pain intensity and disability favoring the null. There was very low certainty of evidence for QoL for LBP and NP comparators and LSS pain intensity due to no relevant studies. Several outcomes demonstrated improvement but were not significantly different compared to active comparators, indicating a lack of additive benefit of SMT over other active interventions (e.g., physical therapy-related interventions such as exercise or physiotherapy) and a lack of superiority in head-to-head comparisons. One study found no significant difference versus an inert comparator.<sup>29</sup> Importantly, there were no outcomes where

comparators were superior to SMT. Overall, the certainty of evidence ranged from very low to moderate due to the limited number of trials in this population, imprecision, and risk of bias. A detailed summary of study characteristics can be found in Table 2.

The mixed results identified in the present review may be explained by several factors. First, the focus on chronic condition treatment could lower the likelihood of identifying meaningful changes within and between groups, as the majority of studies were chronic NP and LBP.<sup>90</sup> Second, most RCTs utilized an active treatment as a comparator. Therefore, null outcomes indicate a lack of additional benefit over these comparators rather than a lack of absolute benefit from SMT, and the efficacy of interventions may be better informed by superiority, non-inferiority, and equivalence clinical trial study designs.<sup>91</sup> For example, Enix *et al.* used a head-to-head design demonstrating similar benefits between SMT and physical therapy.<sup>27</sup> Finally, some responder analyses demonstrated favorability towards SMT interventions despite initial null outcomes when looking at within group differences for four<sup>28,81-83</sup> of the included studies as outlined in Appendix 3. This may indicate a trend towards efficacy of SMT or that there are subgroups of patients that respond particularly well to SMT and some that do not. Further research is warranted to clarify these subgroups, as few RCTs of interventions for chronic LBP report responder analyses.<sup>92</sup>

There were limited data across all conditions, with only four RCTs for LBP and one each for LSS, NP, and neck and back disability analyses. Even for LBP, the most studied condition, the available evidence fell short of ideal standards for synthesis, with fewer than 400 patients per comparison and fewer than five studies.<sup>40,93</sup> This small amount of RCTs is not unexpected, considering older adults are often excluded from clinical studies.<sup>94</sup> A recent bibliometric analysis<sup>95</sup> showed that only one in 10 publications on LBP involved older adults. Future research ought to include this population to better understand LBP prevalence and management approaches. The relatively few studies, coupled with clinical heterogeneity, resulted in very low to moderate certainty per GRADE and hindered definitive conclusions despite some positive findings.

Our findings suggest SMT is a viable treatment option for older adults with chronic LBP, LSS, and chronic NP.

While added benefits beyond comparator groups were infrequent in our analyses, there was often a lack of significant differences compared to other standard-of-care comparators like physical therapy or exercise, and there were no unfavorable outcomes for SMT across nine reports of seven RCTs. Non-pharmacological treatments are valued among older adult patients and their clinicians, especially in the context of polypharmacy.<sup>96</sup> Therefore, clinicians should consider SMT as a treatment option when caring for older adults with chronic LBP, chronic NP, or LSS. There are several factors relevant to SMT and older adults that were beyond the scope of this review and which warrant additional study, such as economic considerations, maintenance of function and quality of life, or patient preferences and satisfaction; there is a need for an update of comprehensive guidelines for the use of SMT in managing chronic spinal conditions in older adults.<sup>97</sup>

Limited evidence for SMT in older adults with chronic LBP, LSS, and chronic NP highlights the need for more high-quality large-sample RCTs dedicated to older adult populations to clarify efficacy, enable meta-analysis, and inform clinical practice guidelines. Accordingly, future RCTs should explore areas of research gaps identified herein including pain, disability, identification of SMT responders versus non-responders, cost-effectiveness, and healthcare utilization. Until more robust data become available, clinicians may rely on this review, observational studies (i.e. case series, case-control studies, longitudinal retrospective or prospective cohort studies incorporating medical records or administrative data, or data from clinical registries), and practice guidelines to guide decision-making.

### *Strengths and limitations*

Strengths of this review include protocol registration, adherence to PRISMA 2020 guidelines, a comprehensive search with librarian input and PRESS review, and duplicate independent screening, extraction, and GRADE assessments.

Our findings had several limitations. First, we deviated from the a priori protocol to include a study that defined chronic LBP as greater than 6 weeks, as opposed to the greater than 12 weeks that we had defined. After consideration, we felt it was appropriate to include Schulz *et al.* because, at baseline, 96% of their participants reported that their pain episode duration was 12 weeks or long-

er. Next, we limited our study intervention inclusion to studies that included spinal manipulation as part of the treatment arm. It is unclear if the outcome effects of SMT significantly differ from mobilization, and this limit reduced the number of eligible studies reported. The small number of RCTs and limited sample sizes per comparison, often drawn from single studies per outcome, led to imprecise effect estimates, and as expected, precluded meta-analysis. Focusing on English-language studies may have introduced selection bias. Many extracted outcomes were stand-alone, reported in only one study, limiting robust synthesis. By prioritizing outcomes from RCTs only, the review overlooked broader healthcare utilization and effectiveness measures like cost, surgery likelihood, or medication use in older adults that may be derived from observational studies.<sup>98–101</sup> Inclusion of observational studies may have afforded better real-world generalizability, yet potentially would introduce risk of bias, and was outside the predetermined scope of our review. While we reported individual item responses from the SIGN checklist and discussed them as a team to provide deeper insights into each study's reporting, our evidence certainty assessment primarily relied on overall quality ratings derived from thresholds of total scores. We acknowledge that this approach may oversimplify the risk-of-bias assessment, as certain items may have a disproportionate influence on study outcomes. Future reviews may benefit from using Cochrane tools to assess risk-of-bias at a more granular or domain-based level.

This review did not assess adverse events or safety outcomes, which were beyond the scope of our a priori objectives. Generally, precautions to the use of SMT in older adults include factors that compromise bone density or quality and increase the risk of fracture, such as long-term use of corticosteroids or the presence of osteoporosis.<sup>21,102</sup> An ideal safety evaluation would require a substantially larger sample size than was available in the seven RCTs included herein, which included 1,226 patients. Considering the rarity of serious adverse events (i.e., severe [considerable interference], catastrophic [life-threatening, death]) of 1 per 2 million manipulations to 13 per 10,000 patients receiving SMT,<sup>21,102,103</sup> large observational studies having several thousand patients (e.g., cohort or case-control designs) are better suited to estimate incidence and characterize risk. A separate systematic review focused on the safety of SMT in older adults is currently

in progress, which includes some members of the current author team (PROSPERO CRD42024629286).

## Conclusion

There is very low to moderate certainty that SMT may offer comparable or modestly greater efficacy than other treatments for older adults with chronic LBP, chronic NP, and LSS. NP intensity reduction and LSS functional status favored SMT, but other outcomes demonstrated no additive benefit or superiority over comparators, and no comparators were superior to SMT. These comparators included non-thrust manipulation plus a home exercise program, sham treatment, medical care, multimodal physical therapy exercise, treatment duration as well as different combinations of supervised, home-based, and group-based exercise. Certainty was limited due to relatively few trials, imprecision, and risk of bias. There is need for additional high-quality RCTs to clarify the efficacy of SMT for chronic spinal conditions in the older adult population. Overall, SMT is as efficacious as other conservative treatments and can be considered an option for patients and clinicians, provided there are no contraindications to care.

## Abbreviations

- ADLs – Activities of daily living
- AMED – Allied and Complementary Medicine Database
- CINAHL – Cumulative Index to Nursing and Allied Health Literature
- EQ – EuroQol EQ-5D
- GRADE – Grading of Recommendations Assessment, Development, and Evaluation
- HVLA – High-velocity low-amplitude
- LBP – Low back pain
- LSS – Lumbar spinal stenosis
- MRS – Modified Roland Scale
- NDI – Neck Disability Index
- NP – Neck pain
- NPRS – Numeric pain rating scale
- ODI – Oswestry Disability Index
- PEDro – Physiotherapy Evidence Database
- PICOS – Population, Intervention, Comparison, Outcome, and Study Type
- PRESS – Peer Review of Electronic Search Strategies

- PRISMA – Preferred Reporting Items for Systematic Reviews and Meta-Analyses
- PROSPERO – International Prospective Register of Systematic Reviews
- QoL – Quality of life
- RCT – Randomized controlled trial
- SF-36- 36-Item Short Form Survey
- SIGN – Scottish Intercollegiate Guideline Network
- SMT – Spinal manipulative therapy
- SPPB – Short Physical Performance Battery
- SPWT – Self-Paced Walking Test
- SSS – Swiss Spinal Stenosis Questionnaire
- VAS – Visual analog scale

#### *Availability of data and materials*

All data generated or analyzed for this study are available from the corresponding author upon reasonable request. Available documentation include the complete PRESS checklist, full search strategy and strings, and all extracted data.

#### *Authors' contributions*

AS and CD contributed to the design, implementation and supervision of the study. All authors contributed to the study methodology. SW developed and completed the literature search. MP and RW performed title, abstract and full-text screening. RT and JS extracted and interpreted the data and performed risk of bias assessment, and reporting bias was evaluated by CD. GRADE assessment was performed by AS and CD with assistance from RT and JS. AS, CD, RT, and JS all participated in drafting the manuscript. All authors read and provided critical review of the manuscript.

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### Appendix 1.

#### *PubMed literature search strategy for efficacy of spinal manipulative therapy in older adults with chronic spinal conditions*

PubMed 10.30.24

#1	chronic	1,794,233
#2	pain	1,091,864
#3	musculoskeletal or back or neck or spine or spinal or thoracic or lumbar or cervical or vertebral or pelvic or pelvis or occipital or sacroiliac or sacrum or lumbosacral or coccyx or “SI joint” or intervertebral disc degeneration or intervertebral disc displacement or sciatic* or spondylosis	2,300,335
#4	#1 and #2 and #3	62,844
#5	manual therapy or spinal manipulation or musculoskeletal manipulations or manipulation, osteopathic or manipulation, chiropractic or manipulation, spinal or manipulation, orthopedic or chiropract*	61,947
#6	#4 and #5	2,834
#7	geriatric* or aged[mh] or aged, 80 and over[mh] or older person* or older adult* or older patient*	3,906,896
#8	#6 and #7	495
#9	#8 and 2016/02/01:2024[dp]	227
#10	#9 and English[la]	221
#11	Limit article type: randomized controlled trial	65

PubMed as search string:

(((((chronic) AND (pain)) AND (musculoskeletal or back or neck or spine or spinal or thoracic or lumbar or cervical or vertebral or pelvic or pelvis or occipital or sacroiliac or sacrum or lumbosacral or coccyx or “SI joint” or intervertebral disc degeneration or intervertebral disc displacement or sciatic\* or spondylosis)) AND (manual therapy or spinal manipulation or musculoskeletal manipulations or manipulation, osteopathic or manipulation, chiropractic or manipulation, spinal or manipulation, orthopedic or chiropract\*)) AND (geriatric\* or aged[mh] or aged, 80 and over[mh] or older person\* or older adult\* or older patient\*)) and 2016/02/01:2024[dp]) and English[la] and randomized controlled trial[pt]

## Appendix 2.

### *Reasons for exclusion (32 total)*

#### No applicable treatment outcomes included (1)

- Maiers M, Evans R, Hartvigsen J, Schulz C, Bronfort G. Adverse events among seniors receiving spinal manipulation and exercise in a randomized clinical trial. *Man Ther.* 2015;20(2):335-341. doi:10.1016/j.math.2014.10.003

#### Wrong publication type (4)

- Kendall JC, French SD, Hartvigsen J, Azari MF. Chiropractic treatment including instrument-assisted manipulation for non-specific dizziness and neck pain in community-dwelling older people: a feasibility randomised sham-controlled trial. *Chiropr Man Therap.* 2018;26:14. doi:10.1186/s12998-018-0183-1
- Weigel PA, Hockenberry J, Bentler SE, Wolinsky FD. The Comparative Effect of Episodes of Chiropractic and Medical Treatment on the Health of Older Adults. *J Manipulative Physiol Ther.* 2014;37(3):143-154. doi:10.1016/j.jmpt.2013.12.009
- Holt KR, Haavik H, Elley CR. The effects of manual therapy on balance and falls: a systematic review. *J Manipulative Physiol Ther.* 2012;35(3):227-234. doi:10.1016/j.jmpt.2012.01.007
- Weigel PA, Hockenberry J, Bentler S, Wolinsky FD. Chiropractic Use and Changes in Health among Older Medicare Beneficiaries: A Comparative Effectiveness Observational Study. *J Manipulative Physiol Ther.* 2013;36(9):10.1016/j.jmpt.2013.08.008. doi:10.1016/j.jmpt.2013.08.008

#### No manipulation included (1)

- Buyukturan O; Buyukturan B; Sas S; Kararti C; Ceylan I. The effect of Mulligan mobilization technique in older adults with neck pain: a randomized controlled, double-blind study. *Pain Research & Management* 2018 May 15;(2856375):Epub. Published online 2018.

#### Wrong population (24)

- Rodríguez-Sanz J, Malo-Urriés M, Corral-de-Toro J, et al. Does the Addition of Manual Therapy Approach to a Cervical Exercise Program Improve Clinical Outcomes for Patients with Chronic Neck Pain in Short- and Mid-Term? A Randomized Controlled Trial. *Int J Environ Res Public Health.* 2020;17(18). doi:10.3390/ijer-ph17186601
- Ulger O, Demirel A, Oz M, Tamer S. The effect of manual therapy and exercise in patients with chronic low back pain: Double blind randomized controlled trial. *J Back Musculoskelet Rehabil.* 2017;30(6):1303-1309. doi:10.3233/BMR-169673
- Avila L, da Silva MD, Neves ML, et al. Effectiveness of Cognitive Functional Therapy Versus Core Exercises and Manual Therapy in Patients With Chronic Low Back Pain After Spinal Surgery: Randomized Controlled Trial. *Phys Ther.* 2024;104(1). doi:10.1093/ptj/pzad105
- Garrigós-Pedron M, La Touche R, Navarro-Desentre P, Gracia-Naya M, Segura-Ortí E. Effects of a Physical Therapy Protocol in Patients with Chronic Migraine and Temporomandibular Disorders: A Randomized, Single-Blinded, Clinical Trial. *J Oral Facial Pain Headache.* 2018;32(2):137-150. doi:10.11607/ofph.1912
- Espí-López GV, Rodríguez-Blanco C, Oliva-Pascual-Vaca A, Molina-Martínez F, Falla D. Do manual therapy techniques have a positive effect on quality of life in people with tension-type headache? A randomized controlled trial. *Eur J Phys Rehabil Med.* 2016;52(4):447-456.
- Haller H, Lauche R, Cramer H, et al. Craniosacral Therapy for the Treatment of Chronic Neck Pain: A Randomized Sham-controlled Trial. *Clin J Pain.* 2016;32(5):441-449. doi:10.1097/AJP.0000000000000290

- Licciardone JC, Gatchel RJ, Aryal S. Recovery From Chronic Low Back Pain After Osteopathic Manipulative Treatment: A Randomized Controlled Trial. *J Am Osteopath Assoc.* 2016;116(3):144-155. doi:10.7556/jaoa.2016.031
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Appendix 3.

Study responder analysis results (not applicable for Learman 2013, Dougherty 2014, or Enix 2015)

Author Surname and Year	Condition	Responder Analysis for within group differences	Between-group effect estimate(s) for other health services outcomes
Maiers 2014	Neck pain	The proportion of patients with $\geq 50\%$ pain reduction was meaningfully greater among those receiving SMT+HEA compared to HEA alone at week 12, yet not meaningfully different at week 52, or for either timepoint for $\geq 30\%$ and $\geq 75\%$ pain reduction.	Duration of medication use at 12 weeks (MD w/ 95% CI) <ul style="list-style-type: none"> <li>• SMT+HEA vs. HEA: -0.31 [-0.94, 0.31] (<math>p &gt; .05</math>)</li> <li>• SMT+HEA vs. SRE+HEA: -0.33 [-0.96, 0.30] (<math>p &gt; .05</math>)</li> </ul>
Maiers 2019	Neck and back disability	No statistically significant differences in proportions reaching 15%, 30% or 50% improvement in disability at 12 or 36 weeks. Baseline self-efficacy and improvements in self-efficacy and kinesiophobia were individually associated with clinically important reductions in disability post-intervention, although not in adjusted models when LBP duration was included. There were statistically significant between group differences in the SPPB overall score, and in the SPPB balance test sub-score in favor of the long-term management group.	No significant between-group difference for medication use.  Medication use at 36 weeks (MD w/ 95% CI) <ul style="list-style-type: none"> <li>• 0.5 (95% CI: -0.2, 1.1) <math>p = 0.16</math></li> </ul>
Schneider 2019	Lumbar spinal stenosis	MT/IE had a greater proportion of responders ( $\geq 30\%$ improvement) in symptoms and physical function (20%) and walking capacity (65.3%) at 2 months compared with medical care (7.6% and 48.7%, respectively) or group exercise (3.0% and 46.2%, respectively). No between-group differences in physical activity responder rates were found at 2 months (difference in percentage for MT/IE vs medical care [95% CI], -7% [-21% to 7%]; difference in percentage for MT/IE vs group exercise [95% CI], 1% [-15% to 16%].)	There were no between-group differences in the number of self-reported falls or medical cointerventions between the end of care and 6-month follow-up. At 6 months, only a small minority of participants reported having spinal surgery (medical care: 2 of 79 [3%]; group exercise: 1 of 67 [2%]; manual therapy/individualized exercise: 1 of 80 [2%])
Schulz 2019	Low back pain	Similar between group responder analysis for no pain reduction, or pain reductions of $\geq 30\%$ (meaningful improvement), $\geq 50\%$ (substantial improvement), $\geq 75\%$ , and 100%. Differences in proportions for reduction of LBP severity were mostly below 10%. The largest differences were for SMT+HEP over HEP alone at week 12 where 16 and 18% more participants had pain severity reductions of 30% and 50%, respectively.	Short Term medication use at weeks 4 to 12 (MD w/ 95% CI) <ul style="list-style-type: none"> <li>• SMT+HEP minus HEP: -0.08 [-0.42, 0.27]</li> </ul> Long term medication use at weeks 4 to 52 (MD w/ 95% CI) <ul style="list-style-type: none"> <li>• SMT+HEP minus HEP: 0.09 [-0.22, 0.40]</li> </ul>

Abbreviations: CI, Confidence Intervals; HEA, Home Exercise and Advice; HEP, Home Exercise Program; MD, mean difference; MT/IE, Manual Therapy/Individualized Exercise; SPPB, Short Physical Performance Battery; SRE, Supervised Rehabilitative Exercise; SMT, Spinal Manipulative Therapy.

Appendix 4.

Study health service outcomes for secondary analysis RCT reports only

Author Surname and Year	Condition	Other health service outcomes for secondary analysis	Findings of secondary analysis
Leininger 2016  Secondary Analysis of Maiers 2014	Neck pain	<p>Total costs for SMT+HEA were 5% lower than HEA (mean difference: -\$111; 95%CI -\$1,354 to \$899) and 47% lower than SRE+HEA (mean difference: -\$1,932; 95%CI -\$2,796 to -\$1,097).</p> <p>SMT+HEA also resulted in a greater reduction of neck pain over the year relative to HEA (0.57; 95%CI 0.23 to 0.92) and SRE+HEA (0.41; 95%CI 0.05 to 0.76)</p> <p>SMT+HEA yielded greater reductions of neck disability and QALY gains compared to HEA (disability = 1.67 95%CI: -0.15; 3.41; QALYs = 0.009 95%CI: -0.011; 0.029) and SRE+HEA (disability=1.85; 95%CI: 0.06; 3.57; QALYs=0.009 95%CI: -0.009; 0.027)</p>	<p>On average, SMT+HEA resulted in better clinical outcomes and lower total societal costs relative to SRE+HEA and HEA alone, with a 0.75 to 0.81 probability of cost-effectiveness for willingness to pay thresholds of \$50,000 to \$200,000 per QALY.</p> <p>If adopting a healthcare perspective, costs for SMT+HEA were 66% higher than HEA (mean difference: \$515; 95%CI \$225 to \$1,094), resulting in an ICER of \$55,975 per QALY gained.</p>
Maiers 2021  Secondary Analysis of Maiers 2019	Back pain and disability	<p>Back pain duration was significantly and inversely associated with 12-week back disability recovery in older adults with back pain duration of 14.5 to 30 years OR = 0.321 [95%CI: 0.13, 0.740] (p=0.008), and &gt;30 years OR 0.333 [95%CI: 0.127, 0.874] (p=0.026)</p>	<p>Among older adults with back disability, a longer duration of symptoms greater than 14.5 years predicts a poorer response to SMT and exercise</p>

Abbreviations: CI, Confidence Intervals; HEA, Home Exercise and Advice; OR, Odds Ratio; QALY, Quality-Adjusted Life Year; SRE, Supervised Rehabilitative Exercise; SMT, Spinal Manipulative Therapy.

Appendix 5.  
 Extracted funding sources from included studies

First Author Last Name and Year	Funding Source
Learman 2013	None.
Dougherty 2014	The trial was funded by the U.S. Department of Health and Human Services (HHS), Resources and Services Administration (HRSA), Bureau of Health Professions (BHP), Division of Medicine and Dentistry (DMD), grant number R18HP15127.
Enix 2015	The trial was funded by the U.S. Department of Health and Human Services (HHS), Resources and Services Administration (HRSA), Bureau of Health Professions (BHP), Division of Medicine and Dentistry (DMD), grant number R18HP15127.
Maiers 2014	The trial was funded by the U.S. Department of Health and Human Services (HHS), Resources and Services Administration (HRSA), Bureau of Health Professions (BHP), Division of Medicine and Dentistry (DMD), grant number R18HP15127, Chiropractic and Exercise for Seniors with Neck Pain.
Maiers 2019	The trial was funded by the U.S. Department of Health and Human Services (HHS), Resources and Services Administration (HRSA), Bureau of Health Professions (BHP), Division of Medicine and Dentistry (DMD), grant number R18HP15127.
Schneider 2019	This study was funded through Patient-Centered Outcomes Research Institute award CER-1410-25056.
Schulz 2019	Research reported in this publication was supported by the Department of Health and Human Services (HHS), Health and Human Services Resources and Services Administration (HRSA), Bureau of Health Professions (BHP), Division of Medicine and Dentistry (DMD) under award number R18HP01425 and the National Center For Complementary & Integrative Health of the National Institutes of Health (NIH) under award number K01AT008965.

Appendix 6  
 Certainty of evidence for intervention – Efficacy of SMT vs comparator for Low back pain

Outcomes	No. of participants randomized (Studies)	Results favor (SMT, null, comparator)	Risk of Bias (low, acceptable, high)	Certainty of the evidence	Comments (Reasons for downgrade/ upgrade)
<b>Pain Intensity</b> Scale: VAS, 11-Point Scale, 21-Point box scale	495(3 RCT)	3 favor null	2 low risk, 1 acceptable risk	⊕⊕○○ Low	Imprecision
<b>Back-Specific Disability Status</b> Scale: ODI, MRS	377 (2 RCT)	1 favors SMT 1 favors null	2 low risk	⊕⊕○○ Low	Imprecision
<b>Functional Status</b> Scale: SF-36 physical function subscale	377(2 RCT)	2 favors null	2 low risk	⊕⊕○○ Low	Imprecision
<b>Quality of Life/ Activities of daily living</b>	No trials were identified that reported on this outcome.			⊕○○○ Very Low	No Relevant Studies

Abbreviations: RCT, randomized controlled trial; SF, short form; SMT, spinal manipulative therapy, VAS, verbal/visual pain scale, ODI, Oswestry Disability Index, MRS, Modified Roland Scale

Appendix 7.

*Certainty of evidence for intervention – Efficacy of SMT parameters for Low back pain*

Outcomes	No. of participants randomized (Studies)	Parameter	Results favor (SMT, null, parameter)	Risk of Bias (low, acceptable, high)	Certainty of the evidence	Comments (Reasons for downgrade/ upgrade)
<b>Pain Intensity</b> Scale: NPRS, 11-Point box pain scale	49 (1 RCT)	Thrust SMT vs Non-thrust SMT	1 favors null	1 acceptable risk	⊕○○○ Very Low	Imprecision Risk of bias
	182 (1 RCTs)	12 weeks SMT vs 36 weeks SMT	1 favors null	1 low risk	⊕⊕○○ Low	Imprecision
<b>Back-Specific Disability Status</b> Scale: ODI	49 (1 RCT)	Thrust SMT vs Non-thrust SMT	1 favors null	1 acceptable risk	⊕○○○ Very Low	Imprecision Risk of bias
	182 (1 RCTs)	12 weeks SMT vs 36 weeks SMT	1 favors null	1 low risk	⊕⊕○○ Low	Imprecision
<b>Functional Status</b> Scale: SPPB	182 (1 RCTs)	12 weeks SMT vs 36 weeks SMT	1 favors 36 weeks	1 low risk	⊕⊕○○ Low	Imprecision
<b>Quality of Life/ Activities of daily living</b> Scale: EQ	182 (1 RCTs)	12 weeks SMT vs 36 weeks SMT	1 favors null	1 low risk	⊕⊕○○ Low	Imprecision

Abbreviations: NPRS, numerical pain rating scale; ODI, Oswestry Disability Index; RCT, randomized controlled trial; SMT, spinal manipulative therapy; SPPB, Short Physical Performance Battery; EQ, EuroQol EQ-5D

Appendix 8.

*Certainty of evidence for intervention – Efficacy of SMT vs comparator for Lumbar Spinal Stenosis*

Outcomes	No. of participants randomized (Studies)	Results favor (SMT, null, comparator)	Risk of Bias (low, acceptable, high)	Certainty of the evidence	Comments (Reasons for downgrade/ upgrade)
<b>Pain Intensity</b>	No trials were identified that reported on this outcome.			⊕⊕○○ Very Low	No Relevant Studies
<b>Back-Specific Functional Status</b> Scale: SSS	259 (1 RCT)	1 favors SMT	1 low risk	⊕⊕⊕○ Moderate	Imprecision
<b>Quality of Life/ Activities of daily living</b> Scale: SPWT, daily physical activity	259 (1 RCT)	1 favors null	1 low risk	⊕⊕⊕○ Moderate	Imprecision

Abbreviations: RCT, randomized controlled trial; SMT, spinal manipulative therapy; SSS, Swiss Spinal Stenosis Questionnaire; SPWT, Self-paced walking test

Appendix 9.

*Certainty of evidence for intervention – Efficacy of SMT vs comparator for Neck pain*

Outcomes	No. of participants randomized (Studies)	Results favor (SMT, null, comparator)	Risk of Bias (low, acceptable, high)	Certainty of the evidence	Comments
<b>Pain Intensity</b> Scale: 11- Point box scale	241(1 RCT)	1 favors SMT	1 low risk	⊕⊕○○ Low	Imprecision
<b>Neck-Specific Disability Status</b> Scale: NDI	241 (1 RCTs)	1 favors null	1 low risk	⊕⊕○○ Low	Imprecision
<b>Functional Status</b> Scale: SF-36 physical function subscale	241 (1 RCTs)	1 favors null	1 low risk	⊕⊕○○ Low	Imprecision
<b>Quality of Life/ Activities of daily living</b>	No trials were identified that reported on this outcome.			⊕○○○ Very Low	No Relevant Studies

Abbreviations: NDI, Neck Disability Index; RCT, randomized controlled trial; SF, short form, SMT, spinal manipulative therapy

Appendix 10.

*Certainty of evidence for intervention – Efficacy of SMT parameters for Neck pain*

Outcomes	No. of participants randomized (Studies)	Parameter	Results favor (SMT, null, parameter)	Risk of Bias (low, acceptable, high)	Certainty of the evidence	Comments (Reasons for downgrade/ upgrade)
<b>Pain Intensity</b> Scale: 11-Point box pain scale	182 (1 RCTs)	12 weeks SMT vs 36 weeks SMT	1 favors 36 weeks	1 low risk	⊕⊕○○ Low	Imprecision
<b>Neck-Specific Disability Status</b> Scale: NDI	182 (1 RCTs)	12 weeks SMT vs 36 weeks SMT	1 favors null	1 low risk	⊕⊕○○ Low	Imprecision
<b>Functional Status</b> Scale: SPPB	182 (1 RCTs)	12 weeks SMT vs 36 weeks SMT	1 favors 36 weeks	1 low risk	⊕⊕○○ Low	Imprecision
<b>Quality of Life/ Activities of daily living</b> Scale: EQ	182 (1 RCTs)	12 weeks SMT vs 36 weeks SMT	1 favors null	1 low risk	⊕⊕○○ Low	Imprecision

Abbreviations: NDI, Neck Disability Index; RCT, randomized controlled trial; SMT, spinal manipulative therapy; SPPB, short physical performance battery; EQ, EuroQol EQ-5D

# Force–time characteristics of hip high velocity, low amplitude manipulation in asymptomatic adults: with and without a drop piece.

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**Objectives:** *To describe the force-time characteristics of HVLA hip manipulation (HVLA-HM) with (DP) and without (NDP) a drop-piece.*

**Methods:** *Twenty asymptomatic participants (22-28 years; 60% female) received 3 whip HVLA-HM (DP) on one hip and 3 whip HVLA-HM (NDP) on the other. Force-time characteristics were collected using Force-Sensing Table Technology (FSTT®) and analyzed descriptively.*

**Results:** *On average, HVLA-HM (DP) had a 1st peak force initiation of 40N ( $\pm 19$ ), peak force of 637N ( $\pm 218$ ), time to 1st peak of 62ms ( $\pm 26$ ), loading rate of 10763N/s ( $\pm 5042$ ) and 2nd peak force of 197N ( $\pm 85$ ). HVLA-HM*

**Caractéristiques de la force et du temps de la manipulation de la hanche à haute vitesse et à faible amplitude chez des adultes asymptomatiques: avec et sans planche de vitesse.**

**Objectifs:** *Décrire les caractéristiques de la force et du temps de la manipulation de la hanche à haute vitesse et à faible amplitude (MH-HVLA) avec (PV) et sans (SPV) planche de vitesse.*

**Méthodes:** *Vingt participants asymptomatiques (22 à 28 ans; 60 % de femmes) ont reçu trois HVLA-MH en coup de fouet (PV) sur une hanche et trois HVLA-MH en coup de fouet (SPV) sur l'autre. Les caractéristiques de la force et du temps ont été recueillies à l'aide de la technologie des tables détectant la force (FSTT®) et analysées de manière descriptive.*

**Résultats:** *En moyenne, la HVLA-MH (PV) avait une première force maximale au départ de 40 N (environ 19), une force maximale de 637 N (environ 218), un temps de première force maximale de 62 ms (environ 26), un taux de charge de 10 763 N/s (environ 5042) et une deuxième force maximale de 197 N (environ 85). La HVLA-MH (SPV) avait une première force maximale au départ de 36 N (environ 23), une force maximale de 567 N (environ*

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## Conflicts of Interest:

The authors have no disclaimers, competing interests, or sources of support or funding to report in the preparation of this manuscript. The equipment was provided by Canadian Memorial Chiropractic College. Ethical approval was obtained from the Research Ethics Board (REB) at CMCC (approval #2404B01), and all participants provided informed consent before their involvement.

(NDP) had a 1st peak force initiation of 36N ( $\pm 23$ ), peak force of 567N ( $\pm 290$ ), time to 1st peak of 63ms ( $\pm 22$ ), loading rate of 9465N/s ( $\pm 5966$ ) and 2nd peak force of 197N ( $\pm 82$ ).

Conclusion: Forces during these techniques present with slightly higher peak forces and loading rates during HVLA-HM (DP) at the patient-table interface.

(JCCA. 2026;70(1):55-67)

KEY WORDS: drop-piece, extremity, forces, high velocity low amplitude, hip, manipulation, chiropractic

## Introduction

Chiropractic manipulative therapy (MT) is widely utilized in the management of lower extremity conditions, particularly those involving the hip joint. According to Beliveau *et al.* (2017), 7% of patients seeking chiropractic care had a chief complaint of hip pain.<sup>1</sup> For individuals with hip osteoarthritis, a systematic review found a fair level of limited evidence supporting MT as a short-term intervention when combined with multimodal approaches and exercise therapy.<sup>2</sup> Abbott *et al.* further suggested that manual therapy could lead to significant improvements in patients with hip arthritis,<sup>3</sup> while Hoeksma *et al.* reported that manual therapy was even superior to exercise alone in this population.<sup>4</sup> The benefits of MT are not limited to arthritic conditions, as a recent physiotherapy Clinical Practice Guideline suggests that manual techniques can be considered for pain and joint restriction in the non-arthritic hip as well.<sup>5</sup>

Beyond symptom relief, MT appears to have specific physiological benefits for hip function. Research has shown that drop-piece manipulation can significantly improve pain levels and passive hip abduction, offering a way to improve mobility.<sup>6</sup> High-velocity low-amplitude distraction maneuvers have also been shown to increase the strength of the gluteus maximus, particularly in individuals with knee disorders and hip weakness.<sup>7</sup> In terms of safety, a recent scoping review analyzing adverse events of manual therapy and hip osteoarthritis reported only four cases, all determined to be mild in nature and

290), un temps de première force maximale de 63 ms (environ 22), un taux de charge de 9465 N/s (environ 5966) et une deuxième force maximale de 197 N (environ 82).

Conclusion: Les forces lors de ces techniques présentent des forces maximales et des taux de charge légèrement plus élevés pendant la HVLA-MH (DP) dans le contexte d'un patient sur une planche.

(JCCA. 2026;70(1):55-67)

MOTS CLÉS : planche de vitesse, extrémité, forces, haute vitesse faible amplitude, hanche, manipulation, chiropratique

resolving without treatment,<sup>8</sup> however this area remains under-investigated. Additionally, emerging evidence suggests that manual therapy, such as hip mobilization and movement techniques, may improve balance and muscle activation in patients recovering from stroke.<sup>9</sup> These suggest that MT of the hip may potentially be a beneficial technique for chiropractors to use in their treatments; however, practitioners should consider adverse events and inform patients of such.

Drop tables, boards, or pieces allow specific sections of the table to elevate and release into free fall during a MT and is believed to increase its efficiency (Figure 1).<sup>10</sup> Hence, the drop piece MT could be divided into two phases, phase one the force application and free fall, and phase two the counter-reaction when the free fall ends. One theory for the increased efficiency is that the manipulation force and effort by the provider may be reduced.<sup>10</sup> This is due to the drop-piece decreasing the resistance of both the table and the patient in phase one.<sup>10</sup> Another potential explanation is that the force of the manipulation is enhanced by the counter-reactive force generated across the joint when manipulation thrusts are maintained through the impact of the drop-piece in phase two.<sup>10,12</sup> Both proposed explanations are based on Newton's first law, which states that a body is in equilibrium if no force is acting upon it. If at rest, it remains so; if in motion, it persists in motion unless acted upon by a force. When drop pieces are used, it is believed that the thrust executed by the practitioner imparts motion to the targeted joint

which was at rest, the fall of the drop piece may reduce the table resistance resulting in larger motion of the body part. This joint remains in motion based on Newton's first law until the end of the drop which stops the motion.<sup>13</sup>

Bergmann and Davis<sup>13</sup> outline the basic procedure for using a drop-piece as follows: First, the targeted joint is positioned over the drop section. Then, the drop-piece is set, and its "tension" (in this context, referring to the amount of force required to drop the drop-piece) is checked. The tension should be enough to support the patient's weight without dropping, but light enough so that only minimal force is needed to overcome the resistance (Figure 1).<sup>14</sup> Finally, contacts are established over the structure to receive the thrust, and a thrust is generated to make the section drop. This procedure is repeated for a total of three times.<sup>13</sup>

Drop-piece manipulation is a common chiropractic technique, accounting for approximately 6.3% of total chiropractic interventions in Ontario.<sup>15</sup> Clijsters *et al.* found 10% of chiropractors used drop technique as the first choice to treat lumbar facet syndrome, while 18% used drop technique as the first choice for sacroiliac dysfunction treatment.<sup>16</sup> While the technique is widely used, there is a lack of research investigating its force-time characteristics during high-velocity, low-amplitude (HVLA) manipulations.<sup>17</sup> Previous studies have explored force characteristics during spinal manipulations<sup>18-20</sup> and hip mobilizations,<sup>21</sup> but no study has quantified these characteristics for HVLA hip manipulations (HVLA-HM) performed with and without a drop-piece.

As such, our study seeks to shed some light on this unexplored and yet important area. The study addresses the needs expressed in the literature to improve our understanding of HVLA-HM in managing lower extremity conditions.<sup>2</sup> By describing the force-time characteristics of HVLA-HM with and without drop-pieces, this study aims to provide an initial understanding of the forces during this intervention.

## Methods

### Study design

This descriptive observational cross-sectional study quantified the force-time characteristics at the participant-table interface during HVLA-HM with and without the use of a drop-piece. The study was conducted in July 2024 at the Force-Sensing Table Technology (FSTT®)

lab at Canadian Memorial Chiropractic College (CMCC) in Toronto, Canada. Ethical approval was obtained from the Research Ethics Board (REB) at CMCC (approval #2404B01), and all participants provided informed consent before their involvement.

### Participants

This was the first study investigating the force-time characteristics of HVLA manipulations of the hip with and without drop-pieces. Given that this was a descriptive observational study, no inferential statistics were conducted. The study recruited 20 participants through email notifications, community social media pages, and campus posters. Participation was voluntary and could be withdrawn at any time without penalty or academic consequences. Recruitment and informed consent were conducted by non-instructor staff. Participants received a \$10 gift card for their participation. Participants were asymptomatic adult chiropractic students at CMCC. Inclusion criteria required participants to be 18 years or older with no history of hip symptoms or injuries, including pain in the groin, lateral hip, gluteal region, or knee. Exclusion criteria included ongoing or recent low back or hip pain, prior hip, knee, ankle, or back surgery, hip adjustments within the previous week, or ongoing knee or ankle injuries.

### Intervention

#### High-velocity, low-amplitude hip manipulation

HVLA-HM with drop-piece: participant was supine on the FSTT® table with the drop-piece (Figures 1-2) tension set by determining the amount necessary for the drop-piece to collapse under the participant's body weight and then increased by a ½ rotation of tension knob clockwise (Figure 1). The chiropractor took the participant's targeted leg with one hand, contacting the posterior knee, while the other hand contacted the ankle with approximately 90 degrees of hip flexion, 20-30 degrees of hip abduction and 15-20 degrees of external rotation. The chiropractor initiated a posterior-caudal thrust ending in approximately 15-20 degrees of hip extension, 20-30 degrees of hip abduction and 15-20 degrees of hip external rotation similar to a whip motion, which at the end point transferred the force into the table and released the drop-piece (Figures 3-4). The chiropractor repeated the procedure 3 times. HVLA-HM without drop-piece: Similar to the previous technique, however without the drop-piece. Specific-

ally, the participant was supine on the FSTT® table, the chiropractor took the participant’s targeted leg with one hand, contacting the posterior knee, while the other hand contacted the ankle with approximately 90 degrees of hip flexion, 20-30 degrees of hip abduction and 15-20 degrees of external rotation. The doctor initiated a posterior-cau-

dal long-axis thrust ending in approximately 15-20 degrees of hip extension, 20-30 degrees of hip abduction and 15-20 degrees of hip external rotation similar to a whip motion, which at the end point transferred the force into the table (Figures 3-4). The chiropractor repeated the procedure 3 times.

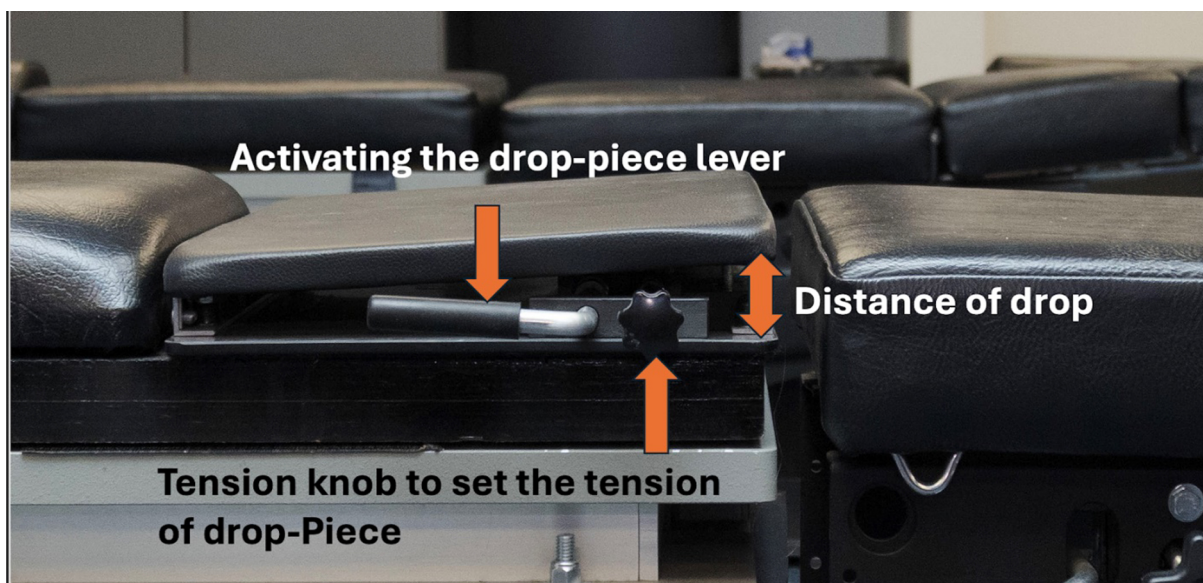


Figure 1.  
*Drop-piece components*



Figure 2.  
*The FSTT® system, equipped with a modified Elite Stationary treatment table with drop-pieces and an embedded AMTI force plate.*



Figure 3.  
*High-velocity, low-amplitude hip manipulation (HVLA-HM) starting point.*

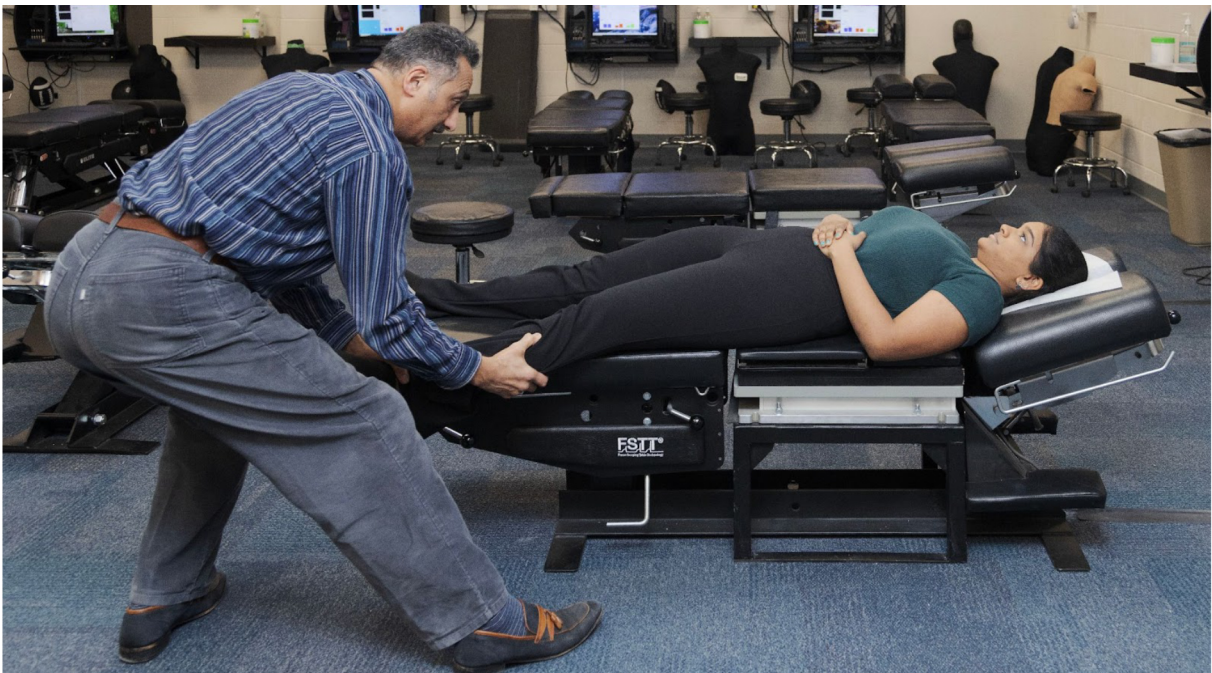


Figure 4.  
*High-velocity, low-amplitude hip manipulation (HVLA-HM) endpoint.*

### *Instrumentation*

Force-time data were collected for each HVLA-HM trial using the Force Sensing Table Technology (FSTT<sup>®</sup>, Canadian Memorial Chiropractic College, Toronto, ON, Canada). The FSTT<sup>®</sup> consisted of a modified Elite Stationary treatment table (Elite Chiropractic Tables, Jarvis, Ontario, Canada) with an embedded 6-degree-of-freedom force plate (AMTI Inc., Watertown, MA) with a 2KHz sampling rate. This device measured the three-dimensional reaction forces and moments at the interface between the table and the participant during the HVLA-HM. The FSTT<sup>®</sup> table was custom outfitted with a ChiroLux AirDrop drop-piece (Spokane, WA), which replaced the standard thoracic cushion. The raw input was analyzed automatically using FSTT<sup>®</sup> software. The raw force–time data was processed using a 20 Hz low-pass, 2<sup>nd</sup> order Butterworth filter to remove noise artifacts. The mean value from a one-second recording, prior to each trial recording, was designated as the zero and subtracted from the subsequent trial recording. This zero-trial adjustment accounted for each subject’s body weight, ensuring that only the net forces resulting from the adjustment were analyzed. The drop-piece tension was checked before every subject and before each trial. The FSTT<sup>®</sup> has been demonstrated to be a valid tool for measuring force-time parameters of manual therapies.<sup>22, 23</sup> The following force-time characteristics were recorded: force initiation, first and second impulse peak force, time to first peak force, and loading rate of first peak force. Force initiation was the force at the moment where a measurable increase in force begins to occur, indicating the start of the thrust. First impulse peak force was the maximum force reached during the thrust. Secondary impulse peak force was a secondary peak in the force-time curve observed after the initial thrust. Time to first peak was measured as the time interval between force initiation and first impulse peak force. Loading rate of first peak force was calculated as the rate of force increase from force initiation to first peak force.

### *Study protocol*

Each participant attended a single 30-minute session. During the session, participants completed a short survey regarding their demographic characteristics and received three HVLA-HM with a drop-piece on one leg and three without a drop-piece on the opposite leg. The sequence

of manipulations (with and without drop-piece) and the hip to be manipulated were randomized to minimize order effects and potential biases related to leg dominance. The randomization and envelope preparation were completed by an investigator (SM) using the online tool “Research Randomizer”. Participants selected an opaque envelope containing this information, and one investigator (SM/HF/AY) recorded the participant’s assigned number on the envelope. All HVLA-HM were performed by experienced chiropractors (MK/GC) using the FSTT<sup>®</sup> to measure and record force-time characteristics. No practice thrusts were performed before data collection began. There were no rests between thrusts.

### *Data processing*

Force-time data were exported from the FSTT<sup>®</sup> system with custom-made software using the Matlab platform (Mathworks, Natick, MA, USA). For each trial, the software automatically identified force initiation and peak points, which were then verified manually by the investigators (SM/HF/AY). Key thrust landmarks were identified using the custom-built FSTT<sup>®</sup> software. The software determines force initiation when the loading rate surpasses a defined threshold value. This threshold was established following an analysis of a diverse range of thrust examples and was found to most accurately represent force initiation in the majority of trials. In instances where the software misidentified landmarks or secondary peaks were present, the correct landmarks were easily verified through visual inspection of the filtered data. Raw force-time data were processed using a 20 Hz low-pass, second-order Butterworth filter. The loading rate was calculated as the average slope from the point of force initiation to the peak force value in the force-time plotting of the data.

### *Data analysis*

Descriptive statistics were calculated for each outcome variable, including mean/median, standard deviation, and 95% confidence intervals (95% CI = Mean  $\pm$  (T.INV.2T(0.05, n-1) / 2) \* (Standard\_Deviation / SQRT(n))) using the Microsoft Excel program version 2509. Outcome variables were calculated per thrust (n = 60 for DP and n = 57 for NDP). Trials with instrumentation or software errors were excluded from analysis.

HVLA-HM does not follow the typical force-time pat-

terms of posterior-to-anterior spinal manipulation.<sup>20,23,24</sup> Therefore, slow-motion videography (Fastec TS5, Fastec Imaging Corp. USA) was used to match force-time graphs with the corresponding phases of the manipulation with a custom-made software written in Matlab. The camera captured images at 500 FPS (frames per second). Slow-motion images were synchronized with FSTT<sup>®</sup> data by using a custom-made software written in Matlab. A custom synchronization device was developed to align the high-speed camera with the FSTT<sup>®</sup> force data. When activated by a trigger switch, an LED illuminated within the camera's view while a simultaneous TTL pulse was sent to the data acquisition unit recording the force data. The LED flash and TTL pulse served as a common event for synchronization between the force and video data. The FSTT<sup>®</sup> force data (2000 Hz) were subsequently downsampled to match the high-speed camera's frame rate (500 Hz). This allowed precise identification of force initiation, first and second peak force, time to first peak force, and loading rate.

The force components F<sub>x</sub>, F<sub>y</sub>, and F<sub>z</sub> represent the forces in the medial-lateral (x-axis), caudad-cephalad (y-axis), and anterior-posterior (z-axis) axes relative to participants. F<sub>res</sub>, the magnitude of the resultant force,

was calculated (Equation 1) and chosen as the primary variable for analysis, since it provides a comprehensive measure of the overall force applied. Primary outcome = F<sub>res</sub>; component forces are secondary descriptors provided in Tables 3–6.

Equation 1.

$$F_{res} = \sqrt{(F_x^2 + F_y^2 + F_z^2)}$$

## Results

### Participants

The study recruited 20 participants, and no participants were excluded. However, one trial (3 HVLA-HM (NDP) thrusts of the left leg, from one participant) was removed from analysis due to an instrument error in recording the force-time profile. Final analyzable thrusts include 60 DP and 57 NDP. No other exclusions were necessary. Participant demographic data are summarized in Table 1.

### Overview of findings

Two peak forces were observed during HVLA-HM with and without a drop-piece. The average findings are shown in Table 2, for drop-piece and no drop-piece HVLA-HM.

Table 1.  
Participant demographics

Total Participants	Female: Male Ratio	Mean Age (years) (±SD)	Mean Height (cm) (±SD)	Mean Weight (kg) (±SD)	Average BMI (kg/m <sup>2</sup> ) (±SD)
20	3:2	25 (±1.65)	171.35 (±8.93)	75.85 (±16.58)	25.66 (±4.55)

Table 2.  
Average parameters for drop-piece and no drop-piece HVLA-HM.

Parameter	HVLA-HM with Drop-Piece Mean (±SD) (95% CI)	HVLA-HM without Drop-Piece Mean (±SD) (95% CI)
First Peak Force Initiation (N)	39.55 (±19.40) (29.54, 48.67)	35.96 (±22.58) (30.25, 41.68)
First Peak Force (N)	637.06 (±218.47) (542.98, 798.25)	567.16 (±290.69) (493.61, 640.70)
Second Peak Force (N)	197.08 (±85.47) (173.75, 220.41)	197.37 (±81.74) (176.51, 218.22)
Time to First Peak Force (ms)	62.34 (±25.55) (55.74, 68.94)	62.82 (±21.88) (57.29, 68.36)
Loading Rate (N/s)	10,763.38 (±5,042.31) (9,498.18, 12,028.58)	9,464.72 (±5,965.50) (7,955.45, 10,973.98)

The force-time graphs displayed in figure 5 provide a visualization of the forces measured at the participant-table interface during HVLA-HM with (A) and without (B) a drop-piece. The peak force and the onset of force application were identified from the resultant force-time curve, and their corresponding locations were superimposed onto the respective Fx, Fy, and Fz component plots.

Fres consistently showed two peaks in both conditions (Fig. 5). Interpretation of these peaks appears in the Discussion. Side specific details (left/right) appear in Tables 3–6; pooled results are presented as primary. Given mild skew, both mean±SD and median (IQR) are reported; mean±SD are primary.

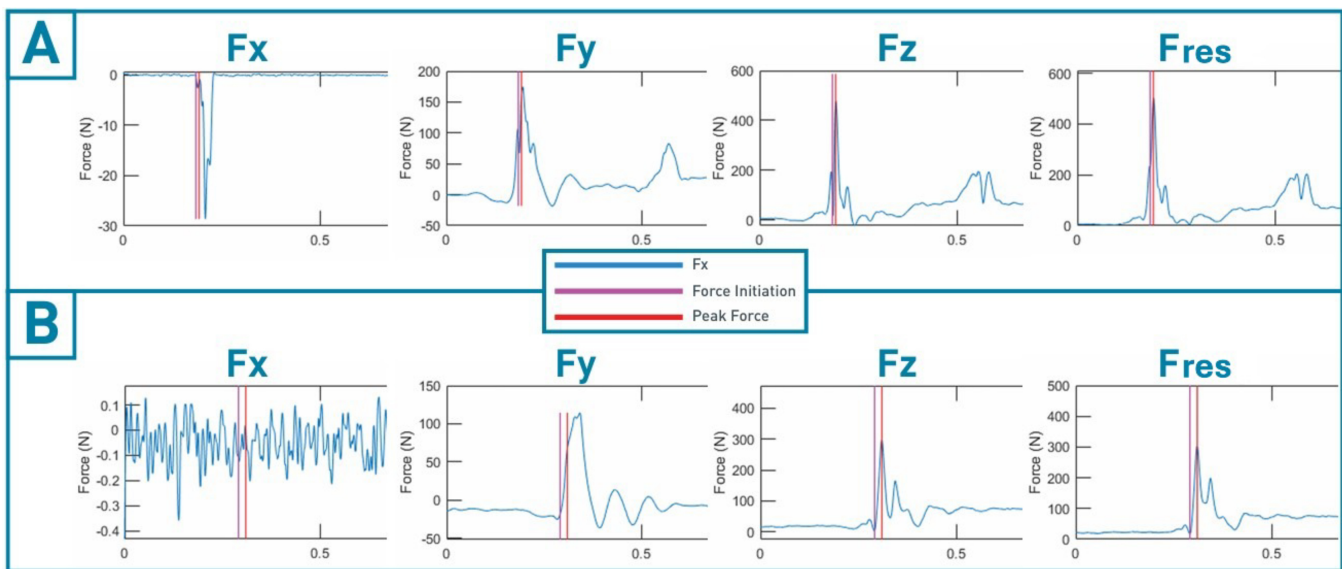


Figure 5.

Force-time graph for HVLA-HM with drop-piece(a) and without drop-piece (b) Fx: forces in the medial-lateral (x-axis), Fy: caudad-cephalad (y-axis), Fz: anterior-posterior (z-axis) axes relative to participants. Fres: the magnitude of the resultant force. Please note the force scales are different for Fx and Fy from the scale for Fz and Fres.

Table 3.  
Forces during 1st peak for HVLA-HM with and without drop-piece

Drop & Leg	Mean Fx (N) (SD) (95% CI)	Median Fx (N)	Mean Fy (N) (SD) (95% CI)	Median Fy (N)	Mean Fz (N) (SD) (95% CI)	Median Fz (N)	Mean Fres (N) (SD) (95% CI)	Median Fres (N)
Drop Left	-1.77 (±3.19) (-2.77, -0.78)	-0.42	49.43 (±76.84) (25.48, 73.37)	61.81	624.85 (±306.57) (529.31, 720.38)	645.01	680.74 (±232.01) (608.44, 753.04)	673.67
Drop Right	-12.20 (±21.12) (-22.71, -1.70)	-3.72	95.44 (±80.31) (55.50, 135.37)	122.57	444.77 (±264.04) (313.46, 576.08)	546.03	535.16 (±141.81) (464.64, 605.68)	566.24
Drop Left & Right	-4.90 (±12.60) (-5.15, -0.83)	-0.80	63.23 (±80.08) (-20.98, 123.56)	65.68	570.83 (±303.85) (471.63, 737.48)	594.85	637.06 (±218.47) (542.98, 798.25)	619.72
No Drop Left	0.01 (±0.07) (-0.03, 0.04)	0.02	113.32 (±46.56) (89.38, 137.26)	100.46	417.09 (±151.20) (339.35, 494.83)	399.93	436.58 (±140.36) (364.41, 508.74)	429.63
No Drop Right	-40.03 (±52.69) (-56.45, -23.61)	-14.81	84.88 (±72.57) (62.26, 107.49)	85.27	605.99 (±323.38) (505.22, 706.77)	557.72	620.02 (±319.25) (520.53, 719.50)	570.13

Drop & Leg	Mean Fx (N) (SD) (95% CI)	Median Fx (N)	Mean Fy (N) (SD) (95% CI)	Median Fy (N)	Mean Fz (N) (SD) (95% CI)	Median Fz (N)	Mean Fres (N) (SD) (95% CI)	Median Fres (N)
No Drop Left & Right	-28.49 (±47.92) (-40.62, -16.37)	-0.18	93.07 (±67.00) (76.12, 110.02)	90.16	551.56 (±296.10) (476.65, 626.48)	460.75	567.16 (±290.69) (493.61, 640.70)	479.48

Fx = Forces in the medial-lateral direction. In the context of a subject positioned supine on the table, a positive force value denotes a vector directed toward the subject's right side, whereas a negative value indicates a vector directed toward the left side.

Fy = Forces in the caudad-cephalad direction. A positive force value corresponds to a vector directed in the caudal direction, whereas a negative value denotes a force oriented cephalad.

Fz = Forces in the anterior-posterior direction. A positive force value denotes a vector going into the table.

Fres = Resultant force

Drop = With drop-piece

No Drop = Without drop-piece

SD = Standard Deviation

95% CI = 95% Confidence Interval

Table 4.  
Forces during 2nd peak for HVLA-HM with and without drop-piece

Drop & Leg	Mean Fx (N) (SD) (95% CI)	Median Fx (N)	Mean Fy (N) (SD) (95% CI)	Median Fy (N)	Mean Fz (N) (SD) (95% CI)	Median Fz (N)	Mean Fres (N) (SD) (95% CI)	Median Fres (N)
Drop Left	0.05 (±0.09) (0.02, 0.07)	0.05	123.10 (±57.35) (104.50, 141.69)	117.84	135.39 (±135.54) (91.46, 179.33)	116.12	211.44 (±95.77) (180.40, 242.49)	193.49
Drop Right	-18.14 (±19.33) (-28.85, -7.44)	-10.24	76.47 (±53.65) (46.75, 106.18)	91.10	51.26 (±124.38) (-17.62, 120.15)	110.08	159.75 (±26.24) (145.22, 174.28)	157.93
Drop Left & Right	-5.01 (±12.90) (-9.28, 9.49)	0.00	110.14 (±59.69) (94.37, 125.92)	103.90	112.03 (±303.85) (75.89, 148.17)	112.67	197.08 (±85.47) (173.75, 220.41)	163.53
No Drop Left	0.02 (±0.08) (-0.02, 0.06)	0.00	109.72 (±63.86) (76.89, 142.56)	101.35	39.60 (±118.68) (-21.42, 100.62)	77.79	165.52 (±57.56) (135.93, 195.11)	165.57
No Drop Right	-37.19 (±32.05) (-47.31, -27.08)	-31.00	143.00 (±47.43) (128.03, 157.97)	141.56	125.03 (±107.52) (91.09, 158.96)	107.45	210.57 (±87.09) (183.91, 237.23)	188.19
No Drop Left & Right	-26.29 (±31.82) (-34.40, -18.17)	-12.23	133.24 (±54.37) (119.37, 147.12)	129.22	99.99 (±116.64) (70.23, 129.75)	106.44	197.37 (±81.74) (176.51, 218.22)	178.13

Fx = Forces in the medial-lateral direction. In the context of a subject positioned supine on the table, a positive force value denotes a vector directed toward the subject's right side, whereas a negative value indicates a vector directed toward the left side.

Fy = Forces in the caudad-cephalad direction. A positive force value corresponds to a vector directed in the caudal direction, whereas a negative value denotes a force oriented cephalad.

Fz = Forces in the anterior-posterior direction. A positive force value denotes a vector going into the table.

Fres = Resultant force

Drop = With drop-piece

No Drop = Without drop-piece

SD = Standard Deviation

95% CI = 95% Confidence Interval

Forces during force initiation, time to first peak, and load rate for HVLA-HM with and without drop-piece are recorded in Table 5 and 6 respectively.

Table 5.  
Forces during force initiation for HVLA-HM with and without drop-piece

Drop & Leg	Mean Fx (N) (SD) (95% CI)	Median Fx (N)	Mean Fy (N) (SD) (95% CI)	Median Fy (N)	Mean Fz (N) (SD) (95% CI)	Median Fz (N)	Mean Fres (N) (SD) (95% CI)	Median Fres (N)
Drop Left	-0.28 (±2.10) (-0.93, 0.38)	0.06	-8.45 (±34.01) (-19.05, 2.15)	-1.52	-11.26 (±26.11) (-19.39, -3.12)	-10.36	40.90 (±20.47) (34.52, 47.28)	41.87
Drop Right	0.07 (±0.55) (-0.20, 0.34)	0.05	11.02 (±17.80) (2.17, 19.87)	15.17	-9.09 (±30.01) (-24.02, 5.84)	-9.13	36.42 (±16.74) (28.100, 44.75)	35.42
Drop Left & Right	-0.17 (±1.78) (-0.59, -0.00)	0.06	-2.61 (±31.24) (-10.68, 5.46)	3.76	-10.61 (±27.10) (-18.56, -6.43)	-9.66	39.55 (±19.40) (29.54, 48.67)	38.54
No Drop Left	0.00 (±0.08) (-0.04, 0.04)	0.03	3.05 (±26.85) (-10.75, 16.86)	1.71	-13.19 (±25.81) (-26.47, 0.08)	-14.21	34.97 (±19.20) (25.10, 44.84)	33.39
No Drop Right	0.74 (±1.22) (0.36, 1.12)	0.17	-9.24 (±27.66) (-17.86, -0.62)	-2.12	-24.36 (±27.69) (-32.98, -15.73)	-20.46	36.36 (±24.02) (28.88, 43.85)	32.71
No Drop Left & Right	0.53 (±1.08) (0.26, 0.80)	0.08	-5.70 (±27.77) (-12.72, 1.33)	-1.56	-21.14 (±27.42) (-28.08, -14.20)	-19.91	35.96 (±22.58) (30.25, 41.68)	32.95

Fx = Forces in the medial-lateral direction. In the context of a subject positioned supine on the table, a positive force value denotes a vector directed toward the subject’s right side, whereas a negative value indicates a vector directed toward the left side.

Fy = Forces in the caudad-cephalad direction. A positive force value corresponds to a vector directed in the caudal direction, whereas a negative value denotes a force oriented cephalad.

Fz = Forces in the anterior-posterior direction. A positive force value denotes a vector going into the table.

Fres = Resultant force

Drop = With drop-piece

No Drop = Without drop-piece

SD = Standard Deviation

95% CI = 95% Confidence Interval

A paired plot of per participant first peak Fres (DP vs NDP) is provided in Figure 6.

## Discussion

This study is the first to investigate the force-time characteristics of HVLA-HM with and without a drop-piece. The findings of this study build upon previous research on hip mobilization techniques and spinal manipulation force-time characteristics.

Prior research on hip mobilizations found that forces averaging 68.6N (±2.9) were effective in improving range of motion in hip osteoarthritis patients.<sup>21</sup> In contrast, our study examined force characteristics of HVLA-HM in asymptomatic participants and identified the mean first peak force at 637N (±218) with the drop-piece and 567N (±290) without the drop-piece. This is possibly a result of

using HVLA instead of mobilization and the method of measurement they used which only recorded perpendicular forces. Because measurements were taken at the table–patient interface, inferences are limited to that interface and do not quantify joint or tissue forces.

Previous studies investigating spinal manipulation (cervical, thoracic and lumbosacral regions) force-time characteristics without drop-piece reported peak forces ranging from 17N to 1,213N and time-to-peak thrust force ranging from 12ms to 938ms.<sup>18</sup> Our results align within this range but highlight the distinct force dynamics of hip manipulations compared to spinal manipulations.

A unique finding of this study was the identification of two peak forces during HVLA-HM, a characteristic not reported in previous spinal manipulation studies without drop-piece tables. See Fig. 5A (DP) and Fig. 5B (NDP)

Table 6.  
Time to first peak and load rate for HVLA-HM with and without drop-piece

Drop & Leg	Mean Time to First Peak (ms) (SD) (95% CI)	Median Time to First Peak (ms)	Mean Load Rate (N/s) (SD) (95% CI)	Median Load Rate (N/s)
Drop Left	56.12 (±16.44) (51.00, 61.24)	50.75	11,969.85 (±4,804.20) (10,472.76, 13,466.95)	10,304.17
Drop Right	76.86 (±35.98) (58.97, 94.76)	61.5	7,948.27 (±4,537.38) (5,691.88, 10,204.65)	6,218.98
Drop Left & Right	62.34 (±25.55) (55.74, 68.94)	52.5	10,763.38 (±5,042.31) (9,498.18, 12,028.58)	9,647.84
No Drop Left	61.5 (±12.81) (54.91, 68.09)	58.00	6,866.05 (±3,051.36) (5,297.18, 8,434.91)	6,761.01
No Drop Right	63.36 (±24.74) (55.65, 71.07)	56.75	10,516.56 (±6,540.33) (8,478.45, 12,554.67)	9,690.12
No Drop Left & Right	62.82 (±21.88) (57.29, 68.36)	57.00	9,464.72 (±5,965.50) (7,955.45, 10,973.98)	7,640.63

Fx = Forces in the medial-lateral direction. In the context of a subject positioned supine on the table, a positive force value denotes a vector directed toward the subject’s right side, whereas a negative value indicates a vector directed toward the left side.

Fy = Forces in the caudad-cephalad direction. A positive force value corresponds to a vector directed in the caudal direction, whereas a negative value denotes a force oriented cephalad.

Fz = Forces in the anterior-posterior direction. A positive force value denotes a vector going into the table.

Fres = Resultant force

Drop = With drop-piece

No Drop = Without drop-piece

SD = Standard Deviation

95% CI = 95% Confidence Interval

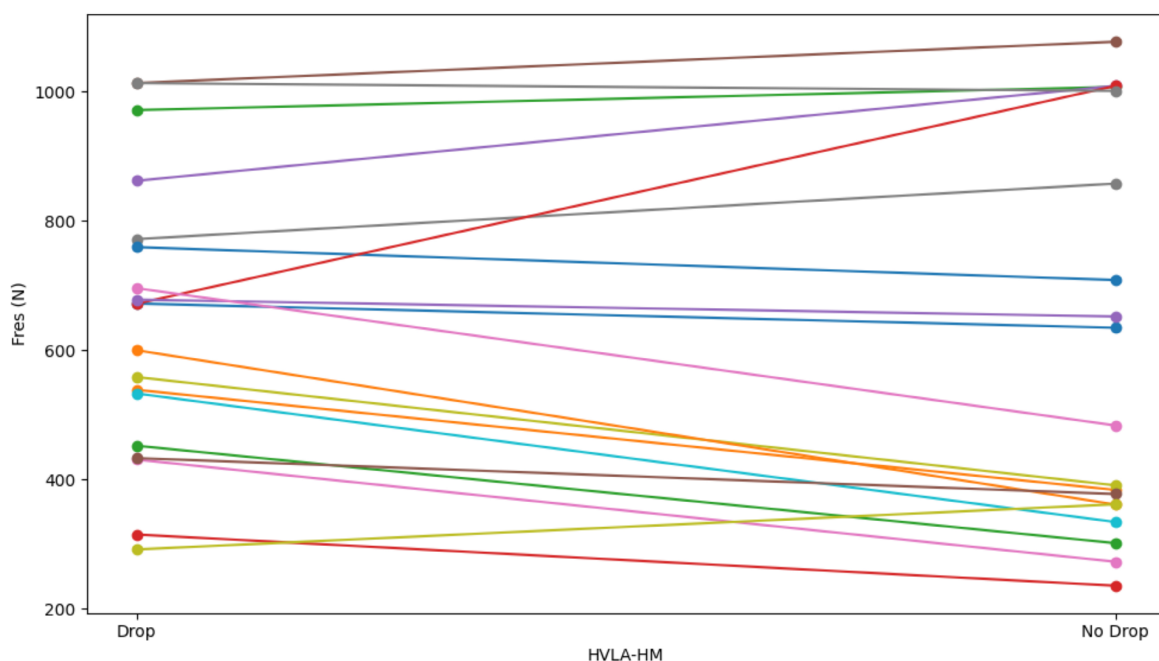


Figure 6.  
Paired plot of per participant first peak Fres (DP vs NDP). One participant excluded from plot due to instrument error of NDP trial.

Fres panels for first and second peak landmarks. DeVocht *et al.*<sup>17</sup> identified a similar dual-peak force-time profile in toggle-recoil cervical spine manipulation which utilizes drop-piece similar to the drop-piece used in our study. They proposed that the first peak represents the force required to release the drop mechanism, while the second peak is due to continued practitioner force application after the table has completed its drop. The presence of a dual-peak in our study may differ from what was observed and suggested by DeVocht *et al.*<sup>17</sup> since they were observed in both drop-piece and non-drop-piece manipulations at very similar force (197N). This is most likely related to the whip action manipulation used in our study inducing body bouncing causing the similar second peak in both drop-piece and non-drop-piece manipulations. In contrast, the forces in toggle recoil manipulation of cervical spine were in sagittal superior to inferior directions. The drop-piece technique resulted in a higher first peak force and a more rapid time-to-peak force compared to the non-drop technique, likely due to the mechanical advantage of using the participant's mass provided by the drop mechanism. The second peak force was similar in both drop-piece and non-drop-piece techniques. While slow motion video suggests Peak 1 demonstrating the thrust of manipulation and Peak 2, post thrust body motion, this interpretation is tentative given the measurement location. Differences in force-time characteristics have been described for different spinal manipulation techniques.<sup>20,23,24</sup> Therefore, given that the HVLA-HM used in our study differs from the cervical manipulation used in DeVocht *et al.*<sup>17</sup> it was expected that forces measured in our study would also differ from previous studies using drop-piece with different techniques.

Similar to our study that did not identify a preload phase during the HVLA-HM, a study on cervical manipulation methods also found that the toggle board technique did not have a detectable preload phase.<sup>25</sup> This is in contrast to manipulations applied to the spine, where preload is usually applied to remove the skin slack before the thrust application, whereas the toggle board adjustments allowed the thrust application without a preload phase. This feature may enable a rapid force delivery and a shorter thrust duration.

Some authors theorized that the higher loading rates achieved with the drop-piece technique could potentially enhance therapeutic outcomes by delivering a more ef-

ficient force transmission to the targeted joint.<sup>26,27</sup> However, the clinical significance of the observed higher mean first peak forces and loading rates with the drop piece at the table–patient interface is unknown and requires further investigation.

Further research is needed to investigate the clinical outcomes associated with these force-time differences and to explore whether these mechanical advantages translate to improved patient outcomes.

This study has several limitations that should be considered when interpreting the findings. The force data was collected at the patient-table interface, which does not capture forces within the hip joint or surrounding soft tissue or the forces directly applied by the chiropractors. The nature of the intervention prevented blinding of both the participants and practitioners, which may introduce performance bias. Manipulations were performed by two experienced chiropractors, which does not account for the variation in technique seen across clinicians. Variability of tables constructs, drop piece settings and operations were not accounted for in our study. Adverse effects of the manipulations were not investigated. Due to the observational design of the study, no statistical significance or causation conclusions can be drawn. The use of asymptomatic participants limits the generalizability to clinical populations, as people with hip pain may demonstrate altered force responses due to muscle guarding or joint pathology. Given the asymptomatic sample, two operators, potential table variability, and the descriptive design, conclusions are intentionally non inferential.

## Conclusion

This study provides novel insights into the force-time characteristics of HVLA-HM with and without a drop-piece. The use of a drop-piece resulted in higher peak forces, and increased loading rates. These findings may inform the training of chiropractic techniques. Future studies should pair force–time metrics with patient reported outcomes and safety monitoring and examine operator technique and drop piece tension as experimental factors.

## Acknowledgements

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# Distribution of prognostic subgroups, assessed by STarT Back Screening Tool, in Veterans with low back pain receiving on-site chiropractic care: a cross-sectional chart review

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*Objective: The primary aim of this study was to report the distribution of prognostic subgroups, as determined by The Keele (STarT) Back Screening Tool (SBT) in Veterans with low back pain presenting for consultation at a chiropractic clinic within the Veterans Health Administration (VHA).*

*Methods: A chart review was conducted on all Veterans completing an initial consultation at a single VHA chiropractic clinic between April 15th, 2021 and January 31st, 2023. STarT Back Screening Tool scores and PROs were collected from the medical record corresponding to the date of consultation available in the VHA's electronic healthcare record (EHR) system. The proportion of each SBT subgroup (i.e., "low-risk", "medium-risk", and "high-risk") was calculated and subgroup differences across patient reported outcomes (PROs) were assessed.*

*Répartition des sous-groupes de pronostic, évaluée par l'outil de dépistage de lombalgie STarT, chez les anciens combattants souffrant de lombalgie et recevant des soins chiropratiques sur place: une étude transversale*

*Objectif: Le principal objectif de cette étude était de déclarer la répartition des sous-groupes de pronostic, tels que déterminés par l'outil de dépistage de lombalgie (STarT) de Keele (SBT) chez les anciens combattants souffrant de lombalgie qui se présentent pour une consultation dans une clinique de chiropratique au sein de la Veterans Health Administration (VHA) des États-Unis.*

*Méthodes: Une étude a été réalisée sur tous les anciens combattants ayant assisté à une première consultation dans une seule clinique de chiropratique de la VHA entre le 15 avril 2021 et le 31 janvier 2023. Les notes et les sous-groupes de pronostic du SBT ont été recueillis à partir du dossier médical correspondant*

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**Results:** *Of 458 completed consultations, 386 (84.3%) sought care for low back pain and 251 (54.8%) had SBT data collected; 51 (20.3%) scored low-risk, 107 (42.6%) medium-risk, and 93 (37.1%) high-risk for persistent disability. As expected, the subgroups differed across baseline PRO.*

**Conclusions:** *In this chiropractic clinic, the percentage of Veterans with a favorable prognosis suggested by SBT was low.*

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**KEY WORDS:** veterans, veterans health, low back pain, prognosis, chiropractic, patient reported outcome measures

## Introduction

Low back pain (LBP) is highly prevalent among United States (US) military Veterans<sup>1</sup> and prompts them to seek medical care.<sup>2</sup> Germane to treatment of Veterans with LBP is the recently updated Veterans Administration and Department of Defense (VA/DoD) clinical practice guideline (CPG) for the diagnosis and treatment of low back pain.<sup>3,4</sup> The VA/DOD CPG suggests there is sufficient evidence to support the use of predictive screening instruments in the evaluation of LBP to inform prognosis and treatment planning, although the optimal method is not defined. The Keele Subgroups for Targeted Treatment (STarT) Back Screening Tool (SBT), as discussed in the VA/DoD CPG, offers one possible method. The SBT is a screening instrument designed to stratify patients with non-specific LBP into low, medium, and high risk of future persistent disabling LBP (see Table 1).<sup>5</sup> Although initially designed to screen patients with acute LBP presenting to primary care, SBT has been implemented and validated in various clinical settings and mixed-duration LBP populations.

*à la date de la consultation disponible dans le système de dossiers de santé électroniques (DSE) de la VHA. La proportion de chaque sous-groupe du SBT (c.-à-d. « risque faible », « risque moyen » et « risque élevé ») a été calculée et les différences entre les sous-groupes de pronostic ont été évaluées.*

**Résultats:** *Des 458 consultations terminées, 386 (84,3 %) concernaient une lombalgie et 251 (54,8 %) ont vu leurs données recueillies par le SBT; 51 (20,3 %) ont obtenu la note « faible risque », 107 (42,6 %) ont obtenu « risque moyen » et 93 (37,1 %) ont obtenu « haut risque d'invalidité persistante ». Comme prévu, les sous-groupes différaient selon le niveau de référence des sous-groupes de pronostic.*

**Conclusions:** *Dans cette clinique chiropratique, le pourcentage d'anciens combattants ayant un pronostic favorable suggéré par le SBT était faible.*

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**MOTS CLÉS :** anciens combattants, santé des anciens combattants, lombalgie, pronostic, chiropratique, mesures des résultats déclarés par les patients

The predictive and discriminative ability of the SBT in LBP populations is supported in the literature among primary care populations in the US<sup>6</sup> broadly and Veterans Health Administration (VHA) specifically<sup>7</sup>. Interestingly, the distribution of prognostic subgroups in the VHA primary care setting differed from the original validation study completed in the United Kingdom primary care setting<sup>5</sup> and published US primary care setting.<sup>6</sup> The distribution of SBT subgroups across different chiropractic settings has also been reported,<sup>8,9</sup> however the distribution has not been reported in a VHA chiropractic clinical setting. Therefore, our objective was to report the frequency of SBT prognostic subgroups in VHA chiropractic clinical settings and compare each subgroup across baseline patient-reported outcomes (PROs).

## Methods

### *Study design*

A cross-sectional chart review was conducted of Veterans who presented for an initial visit to a VHA chiropractic

Table 1.  
*Keele STarT Back Scoring and Prognosis*

Risk Category	Prognosis Description
Low Risk (Total Score 3 or less)	Good prognosis, improvement expected, minimal treatment with reassurance to remain active and continue to home care strategies
Medium Risk (Total Score 4 or more and Sub score 3 or less)	Good prognosis, improvement expected but residual pain likely
High Risk (Total score 4 or more and Sub score 4 or more)	Guarded prognosis, improvement likely, but residual pain expected.

tor over a 22-month period. The chiropractic service is administratively aligned under the Integrated Wellness Center (IWC), which includes clinical services under the Whole Health Program. The IWC falls under Anesthesia & Physical Medicine and Rehabilitation Service line. Chiropractic is a specialty service in this particular VHA medical center, meaning a licensed healthcare provider must place a request for services (consultation) after which an appointment is scheduled. During the 22-month period, there was a total of 4 full-time chiropractors, however only the medical records of one (CWP) of those providers reviewed had SBT scores available. The facility also had an established chiropractic clerkship program. During the 22-month period, three chiropractic clerks spent some of their time being supervised by this provider and engaged in the initial evaluation of Veterans, including the administration (via pen and paper), collection, and documentation of baseline prognostic and PRO information. The VHA electronic health record (EHR) system was used to generate a list of all Veterans and the date an initial encounter occurred with this single provider between April 15<sup>th</sup>, 2021 and January 31<sup>st</sup>, 2023. Each medical record was reviewed to identify Veterans with LBP (either as the primary concern or in combination with other concerns). Initial visits were completed in-person or virtually. For in-person visits, the medical record corresponding to the initial visit was used to extract data. When the visit occurred virtually, the medical record corresponding to the dates of the virtual and first in-person visits were used to extract data. The study was approved by the Institutional Review Boards of the VA Orlando Healthcare System.

We used the Strengthening the Reporting of Observational Studies in Epidemiology guidelines to report this cross-sectional study.<sup>10</sup>

### *Setting*

The chiropractic service is situated within an urban, 1a-High Complexity facility in the Integrated Wellness department, serving Veterans in the South Eastern United States. Level 1a-High Complexity is a descriptive term used by the VHA to identify facilities that possess the highest patient volume and medical risk, as well as the most research activities and clinical training programs compared to other facilities.

### *Participants*

Veterans who presented to a VHA chiropractic clinic with low back pain and underwent SBT screening. Individuals without low back pain or who did not have SBT measures collected at baseline were excluded.

### *Variables*

#### *Primary outcome*

The distribution of SBT subgroups: The original 9-item version of the SBT was administered via paper at initial visit and the STarT Back “total score” and “psychological sub-score” were recorded in the Veteran’s EHR. These SBT scores were extracted and used to stratify participants according to their STarT Back risk group. The STarT Back scoring system converts the 0-9 total score and the 0-5 psychological sub-score into three categories: (1) low risk (a total score of  $\leq 3$ ), (2) medium-risk (a total score of

$\geq 4$  and a sub-score of  $\leq 3$ ), and (3) high risk (a total score of  $\geq 4$  and a sub-score of  $\geq 4$ ). SBT scores have previously shown excellent internal consistency (Cronbach's alpha = 0.79) and test-retest reliability (Cohen's kappa = 0.73).<sup>5</sup>

**Patient Reported Variables of Interest:** The VA/DoD CPG recommends routine collection and use of PROs. In this clinic, all PROs were administered to Veterans via pen and paper, collected, scored, and recorded into the medical record corresponding to the initial in-person visit. During the review of medical records, only PROs recorded in the medical records corresponding the initial visit were collected. Several different PRO measures were encountered during chart reviews. Here, we provide a brief synopsis of each measure.

“Pain average,” “interference with Enjoyment of life,” and “interference with General activity” (PEG) questionnaire: The ultra-brief three-item PEG questionnaire was validated in ambulatory care settings.<sup>11</sup> The PEG includes one severity item (average pain) and three interference items (enjoyment of life and general activity.) Both the average pain and interference items are scaled from 0-10, with response options at scale point 0 and 10, respectively, of “No pain” and “Pain as bad as you can imagine” for the severity items and “Does not interfere” and “Interferes completely” for the interference items.

**Modified Oswestry Disability Index (ODI):** The modified version of ODI described by Fairbank *et al.* (1980).<sup>12-14</sup> The ODI has 10 items that assess how LBP affects common daily activities (e.g., sitting, standing, and lifting). The ODI has a range of percentages from 0% (“no disability due to back pain”) to 100% (“completely disabled due to back pain”), where higher scores indicate higher interference from LBP. The ODI has been found to have high levels of test-retest reliability [intraclass correlation ICC=0.90], convergent validity with the Roland Morris disability questionnaire ( $r > 0.80$ ) and responsiveness (effect size = 1.8) in patients receiving therapy for LBP<sup>12,14</sup> and is recommended as an appropriate measure of self-report of disability for patients with LBP.<sup>15,16</sup>

**Quadruple Numeric Rating Scale (NRS):** NRS Now, NRS Average, NRS Worst, NRS Least: The NRS is a segmented numeric version of the visual analog scale, where patients select a whole number (0-10 integers), that best reflects the intensity of their pain at a specific period. The anchors are 0 equals “no pain” and 10 equals “worst pain imaginable”. The quadruple NRS obtains the intensity of

pain across four time periods (current, and average, worst, and least over the prior seven-day period).<sup>17</sup>

**PROMIS Short Form v1.0 – Pain Interference 6b and v1.2 – Physical Function 6b:** These stand-alone six-item PROMIS Short Forms were administered individually<sup>18,19</sup> and not derived from a PROMIS Profile (for example PROMIS-29). The PROMIS Pain Interference 6b measures self-reported consequences of pain on relevant aspects of a person's life and includes the extent to which pain hinders engagement with social, cognitive, emotional, physical, and recreational activities. The PROMIS Physical Function 6b measures the self-reported capabilities of physical activities, including mobility and instrumental activities of daily living.<sup>20</sup>

Raw scores of PROMIS measures are converted to an interval-standardized T-score, using the scoring manuals available at <http://assessmentcenter.net>, which is calibrated on large samples of the general population to facilitate normative comparisons. T-scores are centered on a mean of 50 and standard deviation of 10. For PROMIS Physical Function 6b higher scores indicate a greater amount of the physical function. For PROMIS Pain Interference 6b higher scores indicate a greater amount of pain interference.

Additional information was collected from the EHR at the time of data extraction, including demographic characteristics, such as age on the initial visit, sex (male or female), and clinical characteristics, such as body mass index (BMI),<sup>21</sup> and non-age adjusted Charlson Comorbidity Index (CCI).<sup>22,23</sup> BMI was calculated based on height and weight values recorded in the EHR and categorized into (<18.5 kg/m<sup>2</sup>), (18.5 -<25 kg/m<sup>2</sup>), (25-<30 kg/m<sup>2</sup>), (>30.0+ kg/m<sup>2</sup>), or missing.<sup>21</sup> The CCI was calculated based on the presence of International Classification of Diseases-10 (ICD-10) codes appearing in their medical records and categorized into four groups (CCI = 0, CCI = 1, CCI = 2, CCI = 3 or greater).

### Analysis

Descriptive statistics were calculated for demographic variables, clinical variables, and patient reported variables of interest. Frequencies and proportions were used to calculate the distribution of SBT subgroups within Veterans receiving on-site chiropractic care. When applicable, comparisons were made between the Veterans with lower back complaint who had SBT results in their EHR (in-

cluded sample) and those that did not (excluded sample). Analysis of variance was used to compare baseline patient reported variables of interest across the SBT subgroups, with an alpha level 0.05 considered significant. When groups' means were found to differ, post hoc group-wise comparisons were conducted using Tukey Honestly Significant Difference with a family-wise error at 0.05.<sup>24</sup> All analyses were performed using Microsoft Excel (2016),<sup>25</sup> R Statistical Software version 4.3.2<sup>26</sup> and RStudio version 2023.12.1<sup>27</sup> and included the R package tidyverse v3.0.<sup>28</sup>

### Results

A total of 251 Veterans were identified during the study timeframe that completed an initial visit with LBP and had SBT data available, see Figure 1 for derivation of the sample. Of the 251 Veterans included, 51 (20.3%) scored low-risk, 107 (42.6%) medium-risk, and 93 (37.1%) high-risk. Baseline demographic and clinical characteristics are displayed in Table 2 of the entire sample and stratified by SBT subgroup. Mean age (SD) of the included sample was slightly lower than the excluded sample, 51.3 years

(14.2) and 54.5 years (14.5), respectively. A greater proportion of males were represented in the included sample, 86.9%, compared with the excluded sample (72.5%). Mean BMI was nearly identical in both sample groups while the included sample had twice the number of prior lumbar surgeries. Regarding visit type, the excluded sample was more balanced between virtual and in-person visits while a minority of patients (12.4%) in the included sample were virtual visits. Mean (SD) CCI was higher in the included sample, 1.96 (2.06), compared to the excluded, 1.43 (1.92). Mean age, CCI, and BMI did not differ across SBT subgroups.

Mean patient reported variables of interest differed across SBT subgroups which are displayed in Table 3. Veterans in the high-risk SBT subgroup consistently reported worse scores across multiple PROs compared to those in the low- and medium-risk groups. For example, the PEG total score was highest in the high-risk group (mean = 21.5, SD = 4.1), followed by medium-risk (mean = 18.1, SD = 4.9), and lowest in the low-risk group (mean = 9.8, SD = 4.4). The mean difference between low- and

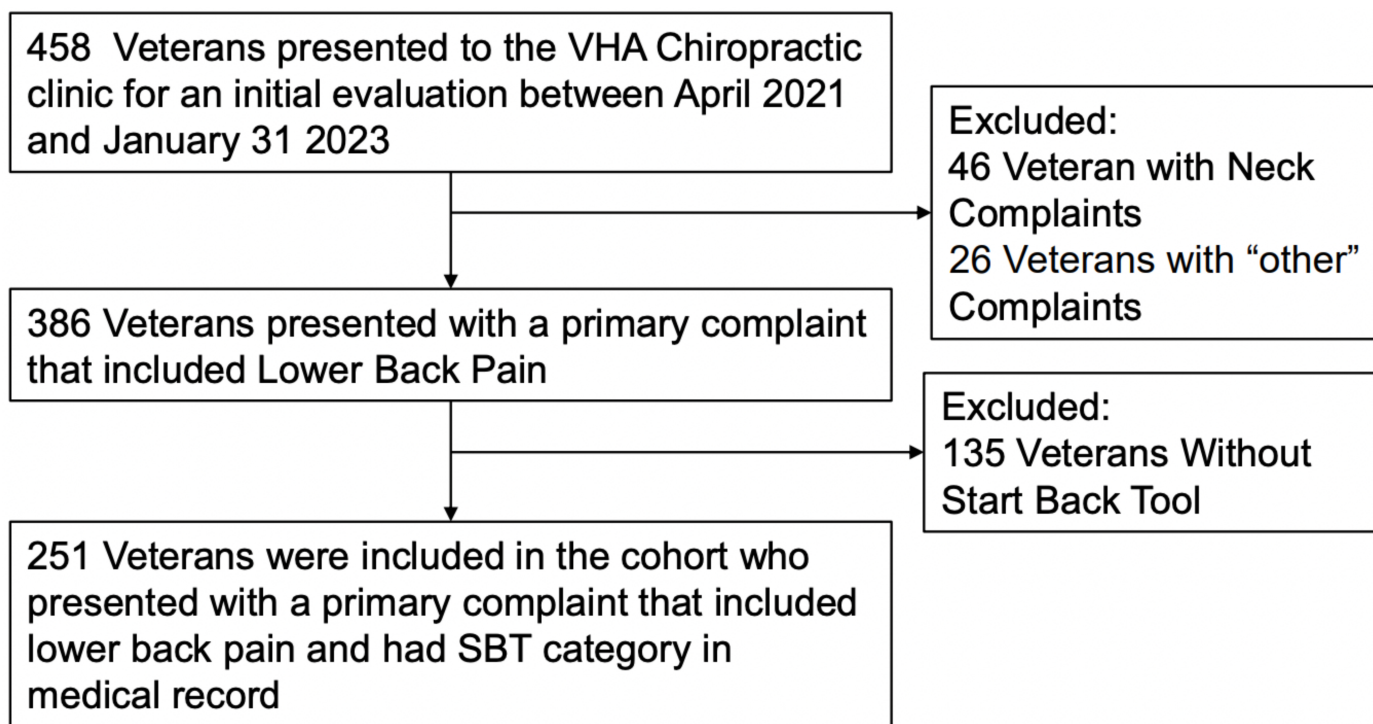


Figure 1.  
Flowchart of the study sample

high-risk groups was 11.7 points (95% CI: 7.6–15.9), which was statistically significant.

Similar trends were observed across the PEG subscales. For average pain, the high-risk group reported a mean of 6.9 (SD = 1.6), compared to 5.9 (SD = 1.5) in

the medium-risk and 3.8 (SD = 1.8) in the low-risk group. Interference with enjoyment of life and general activity followed the same pattern, with the high-risk group reporting the greatest interference (means = 7.2 and 7.4, respectively).

Table 2.  
Sample Characteristics Sample characteristics (Overall and across SBT Subgroups)

Characteristic	Excluded Sample N = 207	Included Sample N = 251	Low Risk N = 51 (20.3%)	Medium Risk N = 107 (42.6%)	High Risk N = 93 (37.1%)
Age Mean (SD)	54.5 (14.5) N = 207	51.3 (14.2) <sup>a</sup> N = 251	52.2 (17.6) N = 51	50.8 (14.2) N=107	51.4 (12.1) N=93
Sex <sup>z</sup>					
Male	150 (72.5%)	218 (86.9%)	47 (21.6%)	93 (42.7%)	78 (35.7%)
Female	57 (27.5%)	33 (13.1%)	4 (12.1%)	14 (42.4%)	15 (45.5%)
Charlson Comorbidity Index Mean(SD)	1.43 (1.92) N = 206	1.96 (2.06) <sup>a</sup> N=246	1.82 (1.61) N=50	1.94 (1.84) N=105	2.05 (2.48) N=91
0	N = 79	N=56	N = 12	N = 22	N = 22
1	N = 65	N=77	N = 14	N = 34	N = 29
2	N = 21	N=36	N = 7	N = 17	N = 12
3+	N = 41	N=77	N = 17	N = 32	N = 28
BMI	31.3 (6.24) N = 206	31.3 (5.62) N = 250	30.5 (5.61) N=50	31.7 (5.74) N=107	31.2 (5.48) N=93
<18.5	N = 2	N = 0	N = 0	N = 0	N = 0
18.5 – < 25	N = 34	N = 26	N = 8	N = 7	N = 11
25 – < 30	N = 58	N = 92	N = 18	N = 41	N = 33
30+	N = 112	N = 132	N = 24	N = 59	N = 49
Missing	N = 1	N = 1	N = 1	N = 0	N = 0
Prior Lumbar Surgery <sup>z</sup>	N = 10	N= 20	N = 4	N = 10	N = 6
Type of Visit <sup>z</sup>					
In-person	N = 122	N = 220	N = 41	N = 95	N = 84
Virtual	N = 84	N = 31	N = 10	N = 12	N = 9

N = sample size

SD = standard deviation

<sup>a</sup> = included sample statistically different from excluded sample

<sup>b</sup> = statistically different from low risk

<sup>c</sup> = statistically different from medium risk

<sup>z</sup> = statistical comparisons across groups were not computed

BMI – Body Mass Index

Table 3.  
Sample Patient Reported Outcomes

Patient Reported Outcome Measure	Excluded Sample N = 207	Included Sample N = 251	Low Risk	Medium Risk	High Risk
PEG Total	19.9 (6.0) N = 97	17.9 (6.2) N = 50	9.8 (4.4) N=10	18.1 (4.9) <sup>b</sup> N=19	21.5 (4.1) <sup>b,c</sup> N=21
PEG Sub Score Pain average	6.6 (1.6) N = 97	5.9 (1.9) <sup>a</sup> N = 50	3.8 (1.8) N = 10	5.9 (1.5) <sup>b</sup> N = 19	6.9 (1.6) <sup>b</sup> N = 21
PEG Sub Score interference with Enjoyment of life	6.6 (2.4) N=97	5.9 (2.3) N = 50	3.1 (1.5) N = 10	6.0 (2.0) <sup>b</sup> N = 19	7.2 (1.7) <sup>b</sup> N = 21
PEG Sub Score interference with General activity	6.7 (2.3) N = 97	6.0 (2.4) N = 50	2.9 (1.6) N=10	6.1 (1.9) <sup>b</sup> N=19	7.4 (1.6) <sup>b,c</sup> N=21
ODI (%)	41.6 (16.9) N = 10	37.4 (16.3) N = 149	21.1 (9.7) N=25	34.4 (13.6) <sup>b</sup> N=66	47.8 (14.4) <sup>b,c</sup> N=58
NRS Now	5.4 (2.3) N = 53	4.7 (2.0) <sup>a</sup> N = 205	3.1 (1.7) N = 42	4.6 (1.7) <sup>b</sup> N = 85	5.7 (1.9) <sup>b,c</sup> N = 78
NRS Average	6.1 (1.9) N = 51	5.3 (1.6) <sup>a</sup> N = 204	4.2 (1.3) N = 42	5.1 (1.4) <sup>b</sup> N = 84	6.2 (1.5) <sup>b,c</sup> N = 78
NRS Worst	8.7 (1.6) N = 51	8.1 (1.6) <sup>a</sup> N = 204	6.9 (1.9) N = 42	7.9 (1.4) <sup>b</sup> N = 84	9.0 (1.2) <sup>b,c</sup> N = 78
NRS Least	4.1 (2.2) N = 51	2.9 (1.7) <sup>a</sup> N=204	1.6 (1.1) N = 42	2.9 (1.3) <sup>b</sup> N = 84	3.7 (1.8) <sup>b,c</sup> N = 78
PROMIS Physical Function	40.5 (4.0) N = 6	37.9 (5.5) N = 81	42.8 (4.8) N = 20	38.3 (3.6) <sup>b</sup> N = 33	34.0 (4.8) <sup>b,c</sup> N = 28
PROMIS Pain Interference	61.6 (5.6) N = 5	63.9 (5.7) N=81	59.6 (4.3) N=20	62.6 (4.3) N=33	68.4 (5.0) <sup>b,c</sup> N=28

N = sample size

SD = standard deviation

<sup>a</sup> = included sample statistically different from excluded sample

<sup>b</sup> = statistically different from low risk

<sup>c</sup> = statistically different from medium risk

PEG = “Pain average,” “interference with Enjoyment of life,” and “interference with General activity” questionnaire; ODI = Modified Oswestry Disability Index; NRS = Numeric Rating Scale

Disability, as measured by the ODI, was also significantly higher in the high-risk group (mean = 47.8%, SD = 14.4%) compared to medium-risk (mean = 34.4%, SD = 13.6%) and low-risk (mean = 21.1%, SD = 9.7%). The mean difference between high- and low-risk groups was 26.6 percentage points (95% CI: 19.1–34.2).

Across the NRS domains, the high-risk group reported the highest pain intensity at all time points. For example, NRS “now” scores were 5.7 (SD = 1.9) in the high-risk group, compared to 4.6 (SD = 1.7) in medium-risk and 3.1 (SD = 1.7) in low-risk. Similar gradients were observed for NRS average, worst, and least pain.

On the PROMIS measures, the high-risk group had the lowest physical function (mean T-score = 34.0, SD = 4.8) and highest pain interference (mean T-score = 68.4, SD = 5.0). These scores were significantly different from both the low- and medium-risk groups. For example, the mean difference in PROMIS Pain Interference between high- and low-risk groups was 8.8 points (95% CI: 5.5–12.0), and for Physical Function, the difference was also 8.8 points (95% CI: 5.7–11.8). Mean group differences in PROs and 95% confidence intervals (CI) are displayed in Table 4.

### Discussion

We conducted a retrospective chart review of consecutive Veterans with low back pain who completed an initial assessment with a chiropractor and report on the relative distribution of SBT subgroups. Our findings suggest chiropractors in the VHA may encounter a distribution

of SBT subgroups that includes a greater proportion of medium and high-risk subgroups compared to the low-risk subgroup. Further, we found that Veterans in the high-risk subgroup reported significantly greater pain intensity, interference with daily life, and disability compared to those in the medium- and low-risk subgroups. These differences were consistent across multiple validated PROs, including the PEG, ODI, NRS, and PROMIS measures. For example, PROMIS Pain Interference scores were nearly 9 points higher in the high-risk group compared to the low-risk group, while PROMIS Physical Function scores were nearly 9 points lower, indicating substantial differences in perceived function and pain burden. These findings support the discriminative validity of the SBT in this VHA chiropractic setting. The distribution of SBT subgroups we identified is similar with the distribution of subgroups in the VHA primary care setting<sup>7</sup>; where in a sample of 576 Veterans, 17.0% were classified as low

Table 4.  
*SBT Subgroup differences in Patient Reported Outcomes*

Patient Reported Outcome Measure	Low – Medium Risk Mean Difference [95% CI]	Low – High Risk Mean Difference [95% CI]	Medium – High Risk Mean Difference [95% CI]
PEG Total	8.3 [4.0-12.5]	11.7 [7.6 – 15.9]	3.5 [0.04 – 6.9]
PEG Sub Score Pain average	2.1 [0.6 – 3.7]	3.1 [1.6 – 4.5]	0.9 [-0.3 – 2.1]
PEG Sub Score interference with Enjoyment of life	2.9 [1.2 – 4.6]	4.1 [2.4 – 5.8]	1.2 [-0.2 – 2.6]
PEG Sub Score interference with General activity	3.2 [1.6 – 4.8]	4.5 [2.9 – 6.1]	1.3 [0.02 – 2.6]
ODI (%)	13.3 [5.9 – 20.7]	26.6 [19.1 -3 4.2]	13.3 [7.7 – 19.0]
NRS Now	1.6 [0.8 – 2.3]	2.6 [1.9 – 3.4]	1.1 [.4 – 1.7]
NRS Average	0.9 [0.3 – 1.6]	2.0 [1.4 – 2.6]	1.1 [0.5 -- 1.6]
NRS Worst	1.0 [0.3 – 1.6]	2.1 [1.5 – 2.7]	1.1 [0.6 – 1.6]
NRS Least	1.3 [0.6 – 1.9]	2.1 [1.3 – 2.7]	0.8 [0.3 – 1.4]
PROMIS Physical Function	4.5 [1.6 – 7.5]	8.8 [5.7 – 11.8]	4.3 [1.6 – 6.9]
PROMIS Pain Interference	2.9 [-0.2 – 6.1]	8.8 [5.5 – 12.0]	5.8 [3.0 – 8.6]

PEG = “Pain average,” “interference with Enjoyment of life,” and “interference with General activity” questionnaire; ODI = Modified Oswestry Disability Index; NRS = Numeric Rating Scale

risk, 35.5% as medium-risk, and 47.6% as high risk. In the primary care sample, the observed risk of persistent disabling LBP at 6-months substantially increased when comparing medium and high-risk subgroups to the low-risk subgroup and a modest but significant increase in risk when comparing the high-risk subgroup to medium-risk subgroup. Hill *et al.* developed a practical way to utilize the SBT indicators to identify appropriate care pathways based on prognostic indicators in the primary care setting that informed appropriate interventions. The proposed interventions included analgesia, advice and education for the low-risk subgroup, physiotherapy for the medium-risk subgroup, and a combination of physical and cognitive behavioral approaches for the high-risk subgroup.<sup>5</sup> While our study provides the relative frequencies of the SBT subgroups, the ability to predict future improvements in

pain or disability was not addressed and requires further investigation.

The frequency of SBT subgroups in published cohorts of lower back pain is not uniform. Figure 2 depicts the relative frequency of SBT subgroups from 14 published samples of individuals with low back pain,<sup>6,7,9,23,29–38</sup> of which includes samples from US populations. One sample of patients presenting to chiropractors,<sup>9</sup> 2 samples presenting to physical therapy clinics,<sup>37,38</sup> one sample of Veterans presenting to primary care in the VHA<sup>7</sup> and 1 sample of patients presenting to primary care in the US.<sup>6</sup> Our results suggest that the prognosis of improvement from treatment may differ across clinical populations, as reflected by the distribution of SBT subgroups. Compared to published cohorts in non-VHA settings—including primary care and physical therapy clinics—the Veterans

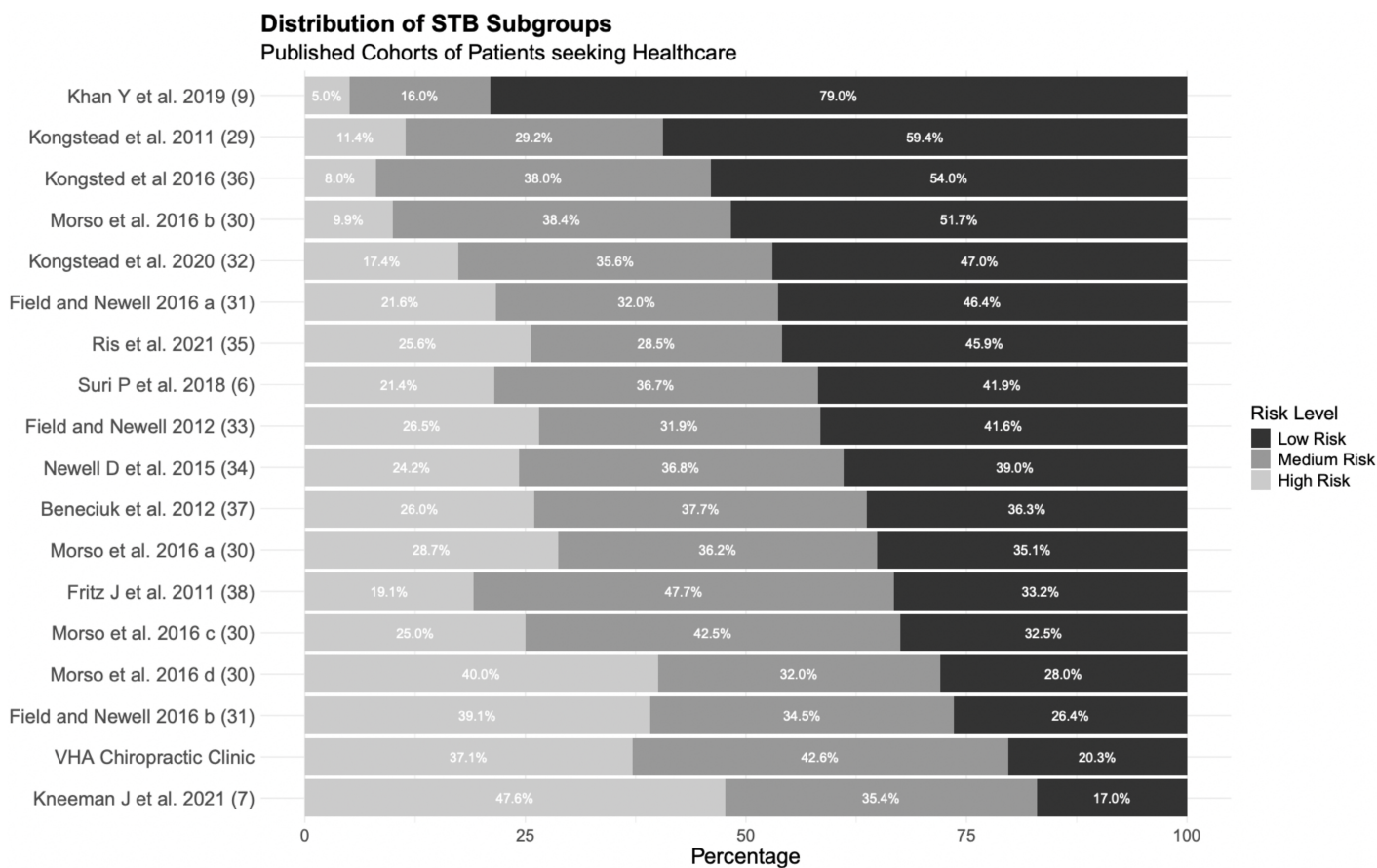


Figure 2.

Distribution of STB Subgroups. Includes current study population and published patient populations seeking healthcare

in our sample had a higher proportion of medium- and high-risk classifications (See Table 5 for further descriptions of the included samples, including general clinical setting, size, and location.). This may reflect the complex biopsychosocial profiles of Veterans seeking care in the

VHA system. While the SBT has demonstrated predictive validity in some U.S. primary care populations<sup>6</sup> and within the VHA<sup>7</sup> its prognostic utility has been more limited in other settings, particularly when used outside of its original context or without accompanying stratified

Table 5.

The Distribution of *STaRT Back Prognostic Subgroups* across published samples of individuals with low back pain.

Referenced Published Sample	Sample Size	Description of Clinic Location	Country	Low Risk N (% , [95% CI])	Medium Risk N (% , [95% CI])	High risk N (% , [95% CI])
Khan Y et al. 2019 <sup>8</sup>	496	3 Chiropractic College outpatient teaching clinics	United States	392 (79%, [75.2 – 82.5])	81 (16% [13.2 – 19.9])	23 (5% [3.0 – 6.9])
Kongstead et al. 2011 <sup>29</sup>	475	19 Private Sector Danish Chiropractic Clinics organized under the Nordic Institute of Chiropractic and Clinical Biomechanics	Denmark	282 (59.4% [54.8 – 63.8])	139 (29.2% [25.2 – 33.6])	54 (11.4% [8.7 – 14.6])
Morso et al. 2016 <sup>30</sup>	265	General Primary Care	Denmark	93 (35.1% [29.4 – 41.2])	96 (36.2% [30.4 – 42.3])	76 (28.7% [23.3 – 34.5])
Morso et al. 2016 <sup>30</sup>	416	Chiropractic Practice	Denmark	215 (51.7% [46.8 – 56.6])	160 (38.4% [33.8 – 43.3])	41 (9.9% [7.2 – 13.1])
Morso et al. 2016 <sup>30</sup>	200	Physiotherapy Clinics	Denmark	65 (32.5% [26.1 – 39.5])	85 (42.5% [35.6 – 49.7])	50 (25.0% [19.2 – 31.6])
Morso et al. 2016 <sup>30</sup>	974	Spine Care Center	Denmark	273 (28.0% [25.2 – 31.0])	312 (32.0% [29.1 – 35.1])	389 (40.0% [36.9 – 43.1])
Ris et al. 2021 <sup>35</sup>	2327	Danish GLA:D Back Cohort	Denmark	1069 (45.9% [43.9 – 48.0])	663 (28.5% [26.7 – 30.4])	595 (25.6% [23.8 – 27.4])
Kongstead et al. 2020 <sup>32</sup>	2828	Danish Chiropractic LBP Cohort (ChiCo)	Denmark	1328 (47.0% [45.1 – 48.8])	1006 (35.6% [33.8 – 37.4])	494 (17.4% [16.1 – 18.9])
Field and Newell 2012 <sup>33</sup>	404	Patients visiting one of 6 chiropractic clinics in the south of England	United Kingdom	168 (41.6% [36.7 – 46.6])	129 (31.9% [27.4 – 36.7])	107 (26.5% [22.2 – 31.1])
Newell D et al. 2015 <sup>34</sup>	749	Patients recruited at 11 chiropractic clinics in the UK	United Kingdom	292 (39.0% [35.5 – 42.6])	277 (37.0% [33.5 – 40.6])	180 (24.0% [21.0 – 27.3])
Kongsted et al 2016 <sup>36</sup>	765	Patients visiting one of 40 chiropractors at 17 Danish chiropractic clinics	Denmark	412 (53.9% [50.3 – 57.4])	291 (38.0% [34.6 – 41.6])	62 (8.1% [6.3 – 10.3])
Field and Newell 2016 <sup>31</sup>	3537 (Private)	Chiropractic Clinics	United Kingdom	1639 (46.3% [44.7 – 48.0])	1133 (32.0% [30.5 – 33.6])	765 (21.6% [20.3 – 23.0])
Field and Newell 2016 <sup>31</sup>	2591 (NHS)	Chiropractic Clinics	United Kingdom	684 (26.4% [24.7 – 28.1])	894 (34.5% [32.7 – 36.4])	1013 (39.1% [37.2 – 41.0])
Fritz J et al. 2011 <sup>38</sup>	214	Physical Therapy Clinic	United States	71 (33.2% [26.9 – 39.9])	102 (47.7% [40.8 – 54.6])	41 (19.1% [14.1 – 25.1])
Beneciuk et al. 2012 <sup>37</sup>	146	Physical Therapy Clinic	United States	53 (36.3% [28.5 – 44.7])	55 (37.7% [29.8 – 46.1])	38 (26.0% [19.1 – 33.9])
Kneeman J et al. 2021 <sup>7</sup>	546	Primary Care Veterans Administration	United States	93 (17.0% [13.4 – 20.5])	193 (35.4% [31.3 – 39.5])	260 (47.6% [43.4 – 51.9])
Suri P et al. 2018 <sup>6</sup>	1218	General Primary Care Clinics in the Group Health integrated healthcare system (MATCH Cohort)	United States	510 (41.9% [39.1 – 44.7])	447 (36.7% [34.0 – 39.5])	261 (21.4% [19.2 – 23.8])
Current Study Results	251	Chiropractic Clinic Veterans Administration	United States	51 (20.3% [15.5 – 25.8])	107 (42.6% [36.4 – 49.0])	93 (37.1% 31.0 – 43.4)

care pathways.<sup>5-7,9,33,37,38</sup> These contextual differences underscore the importance of evaluating the SBT's performance within specific clinical environments, such as chiropractic care in the VHA.

Our chart review found that only 65% of Veterans with LBP were administered a SBT questionnaire. Considerable potential remains to administer the questionnaire more routinely in clinical practice. In contrast, a PRO was collected in every medical record reviewed. This may speak to the known utility of these measures compared to the SBT. Notably, while the SBT was collected in only 65% of eligible Veterans, PROs were documented in every chart reviewed. This may reflect the greater clinical utility of PROs in guiding care and tracking outcomes, whereas the SBT remains primarily a prognostic tool. The consistent differences in PROs across SBT subgroups in our sample suggest that the tool may still offer value in identifying Veterans at risk for greater pain and disability, even if its predictive validity for treatment response remains to be established in this setting.

The SBT is a prognostic tool without known clinical utility in the VHA clinical setting, whereas PRO collected repeatedly helps to inform the effectiveness of care for each individual. We found divergent use of PRO; however, it is unknown why differential selections were made. While speculative, shorter measures may have been used more often when appointment time was constrained due to external factors such as patients arriving late or complex histories, while longer measures may have been used in more straightforward cases. Although it is beyond the scope of this article, further assessment of facilitators and barriers to implementation of routine collection of the SBT is an area for further exploration. While we are the first to describe the distribution of SBT subgroups in this setting, its clinical utility remains uncertain. It remains unknown if the results of questionnaire impacted clinical decision making or clinical outcomes. Our results do, however, suggest the prognosis of improvement from a treatment may be lower in Veterans with LBP presenting for care in the VHA chiropractic healthcare setting compared to non-VHA settings (see Figure 2 and Table 5).

### Limitations

While the data from our sample of Veterans receiving on-station chiropractic care provides preliminary insights on the distribution of SBT subgroups, there are limita-

tions. First, data are from an EHR that was not primarily intended for research and may be subject to the errors inherent in all clinical and administrative data, including missing or miscoding of diagnoses, procedures, and medications. In our data we found a variety of PRO measures were collected. Although every chart reviewed had PRO which is consistent with CPG, the relative frequency of any one PRO was low. Thus, unlike prospective studies, where the uniform data collection is planned, retrospective studies may be impacted by changes in clinical practice patterns. For example, in this study, the PROMIS measures were implemented over more familiar measures because they are condition agnostic.

Although the information is available in the medical charts of the VHA, this chart review did not capture several salient features often used to further describe samples such as race, ethnicity, duration of LBP, concomitant treatments, and the presence of leg pain. In the present study, the medical record corresponding to initial intake is documented in narrative format. Thus, without interpretation it was impractical to extract whether a Veteran met generally accepted definitions of LBP duration such as "acute", "sub-acute", "chronic", "recurrent", "chronic-recurrent", "flare", "exacerbation of chronic condition", or another clinical LBP trajectory.<sup>39-43</sup> The included sample did appear different from the excluded sample on some demographic (age) and clinical (CCI) variables as well as PROs. Considering percentage of Veterans who did not have the SBT score in the EHR, a bias may be impacting the distribution, where individuals likely to be in the "low risk" group were not administered or did not complete the SBT. Further, CCI was utilized from ICD-10 codes extrapolated during the chart review as proxy in order to assess trends between the questionnaire distribution and the magnitude of overlapping health conditions. However, this practice is not a true indicator of comorbidities. The mean CCI of our sample was less than previously published results<sup>44</sup>, which is likely the result of not including an age adjustment that was used in the prior work. Both samples however had roughly 70% of the sample > 0 CCI. The distribution of BMI categories in our sample is similar to published results of Veterans with LBP receiving chiropractic care.<sup>45</sup>

### Conclusion

The distribution of prognostic subgroups in Veterans

presenting to a VHA chiropractic clinic has a greater frequency of medium and high-risk patients compared to low risk. On average, Veterans in the “high-risk” group report higher pain and disability ratings at baseline compared to the “low-risk” and “medium-risk” subgroups.

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### Contributions

Concept development: CWP, CJR. Design: CWP, CJR, SMS. Supervision: CWP. Data collection/processing: CWP, SMS. Analysis/interpretation: CWP, CJR, MJB. Literature search: CJR, CWP. Writing: CJR, CWP. Critical review: CJR, SMS, MRC, MJB, AMCW.

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# Impact of the MAINTAIN instrument on clinical decision-making for new spinal pain patients: a cross-sectional study

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*Objective: This quantitative pilot study with a qualitative adjunct aimed to characterize patients at two U.S.-based chiropractic teaching clinics using the novel MAINTAIN instrument, and to assess clinicians' and interns' initial clinical impressions based on patients' MAINTAIN scores.*

*Methods: Between February and September 2022, 597 spinal pain patients were screened. Eligible patients (n=91) completed demographic and health questionnaires, including the MAINTAIN instrument. Clinicians and interns completed surveys to assess treatment plans and expectations for recovery. A qualitative analysis assessed clinicians' and interns' initial impressions based on patients' MAINTAIN scores.*

*Répercussions de l'instrument MAINTAIN sur la prise de décisions clinique pour les nouveaux patients souffrant de douleurs vertébrales: une étude transversale*

*Objectif: Cette étude pilote quantitative, avec un complément qualitatif, visait à définir les patients dans deux cliniques de formation en chiropratique des États-Unis à l'aide du nouvel instrument MAINTAIN et à évaluer les premières impressions cliniques des cliniciens et des résidents en fonction des notes des patients dans l'instrument MAINTAIN.*

*Méthodes: Entre février et septembre 2022, 597 patients souffrant de douleurs vertébrales ont été dépistés. Les patients admissibles (n = 91) ont rempli des questionnaires de démographie et de santé, y compris l'instrument MAINTAIN. Les cliniciens et les résidents ont rempli des sondages pour évaluer les plans de traitement et les attentes en matière de rétablissement. Une analyse qualitative a évalué les impressions initiales des cliniciens et des résidents en fonction des notes des patients dans l'instrument MAINTAIN.*

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**Results:** *The mean MAINTAIN score was 15.06 (SD: 9.03, range -7 to 32), with 39.6% of participants identified as potential candidates for maintenance care. Qualitative analysis identified several themes and subthemes which describe how clinicians and interns used patients' MAINTAIN scores.*

**Conclusions:** *Despite limitations, these findings highlight the value of integrating the MAINTAIN instrument in chiropractic teaching clinics to enhance clinical decision-making and patient management.*

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**KEY WORDS:** chiropractic, maintenance care, prevention, spinal pain, qualitative research

## Introduction

Non-specific low back pain (LBP) is a highly prevalent condition with profound personal and societal consequences. It ranks among the leading causes of economic burden in Western countries.<sup>1</sup> LBP is frequently recurrent<sup>2</sup>, with estimates that over two-thirds of individuals will experience a recurrence within 12 months<sup>3</sup>. Given its disabling nature and associated costs, implementing preventive strategies to reduce recurrence and long-term impact is both logical and necessary.<sup>4</sup>

Psychological<sup>5,6</sup>, behavioral<sup>7</sup>, and social characteristics<sup>8</sup> are known to influence the progression from acute to recurrent or persistent pain states<sup>5-12</sup>, supporting the biopsychosocial model as a foundational framework for LBP management<sup>8, 13-15</sup>. Chiropractors often serve as first-contact providers for both primary and recurrent spine-related pain.<sup>16</sup> Chiropractic maintenance care (MC) is an approach to LBP management that involves scheduled follow-up visits aimed at preventing relapse and deterioration, regardless of a patient's symptoms.<sup>17-28</sup> MC is typically initiated after the patient has achieved maximum therapeutic benefit.<sup>17-28</sup> Research indicates that the effectiveness of MC may be influenced by patients' psychological, behavioral, and social profiles<sup>29</sup>, which led to the development of the MAINTAIN instrument—a brief

**Résultats:** *La note moyenne de l'instrument MAINTAIN était de 15,06 (écart type : 9,03, s'étendant de -7 à 32), et 39,6 % des participants étaient identifiés comme des candidats potentiels pour les soins d'entretien. L'analyse qualitative a identifié plusieurs thèmes et sous-thèmes qui décrivent comment les cliniciens et les résidents utilisaient les notes des patients dans l'instrument MAINTAIN.*

**Conclusions:** *Malgré leurs limites, ces résultats soulignent la valeur de l'intégration de l'instrument MAINTAIN dans les cliniques de formation en chiropratique afin d'améliorer la prise de décisions clinique et la gestion des patients.*

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**MOTS CLÉS:** chiropratique, soins d'entretien, prévention, douleur vertébrale, recherche qualitative

clinical tool designed to identify patients who may benefit from ongoing maintenance care<sup>4</sup>.

Educational programs in chiropractic play a crucial role in shaping clinician behavior and, consequently, patient outcomes.<sup>30,31</sup> Therefore, it is important that curricula incorporate emerging evidence and tools, such as the MAINTAIN instrument, early and consistently. To our knowledge, no studies have explored how chiropractic clinicians and students use the MAINTAIN instrument to inform clinical decision-making. The primary aim of this study was to describe the demographic and pain-related characteristics of patients presenting to chiropractic teaching clinics with recurrent or persistent spine pain, including data derived from the MAINTAIN instrument. The secondary aim was to assess clinicians' and interns' initial clinical impressions based on patients' MAINTAIN scores.

## Methods

### Study design

This study presents cross-sectional findings from patients enrolled in a preliminary study assessing the implementation of the MAINTAIN instrument at two chiropractic teaching clinics. The methodology used a cross-sectional survey with a complementary qualitative exploration. The

multi-site design involved patients, interns, and clinicians from Parker University (Dallas, TX) and Logan University (Chesterfield, MO). The study protocol was approved by the Parker University Institutional Review Board (IRB #PUIRB-2021-16) and is reported in accordance with the STROBE guidelines to ensure transparency and reproducibility of the research.<sup>32</sup>

*Patient participation*

New patients presenting with recurrent or persistent spinal pain, defined as occurring on at least 30 days in the past 12 months, were screened by participating clinicians and interns during their initial clinic visit between February and September 2022. Clinicians and interns screened patients by informing them of the study and directing them to scan a QR code on their mobile device, which was linked to the screening questionnaire. Detailed inclusion and exclusion criteria are provided in Table 1.

*Patient consent and characteristics*

Eligible and interested patients provided informed consent and completed a baseline questionnaire prior to their initial treatment. The questionnaire included the MAINTAIN instrument and demographic and health-related outcome measures. The MAINTAIN instrument is a 10-item clinical decision aid designed to identify a patients’ like-

lihood of benefiting from MC with very good diagnostic accuracy.<sup>4</sup> Scores of -12 to 17 indicate a low likelihood of benefiting from MC; 18 to 21 indicate possible suitability, and 22 to 48 suggest a high likelihood of benefiting from MC.<sup>4</sup> The instrument consists of five subdomains—pain severity, interference, life control, affective distress, and support—each item scored from 0 to 6 . Low scores are preferred for pain severity, interference, support, and affective distress subdomains, whereas higher scores are favorable for life control.

Pain intensity and disability were assessed using the Numerical Pain Rating Scale (NPRS)<sup>33</sup> and Roland-Morris Disability Questionnaire (RMDQ)<sup>34</sup>, respectively. Additional outcome measures included:

- Recovery expectation, rated from 0 (no chance) to 10 (very likely)
- General health, rated on a five-point scale (poor to excellent)
- Pain Self-Efficacy Questionnaire (PSEQ),<sup>35</sup> to assess confidence in performing activities while experiencing pain, rated from 0 (not at all confident) to 6 (completely confident).
- EuroQol 5D (EQ-5D-5L),<sup>36</sup> to assess health-related quality of life, with responses dichotomized into “no problems” or “some problems”

Table 1.  
*Inclusion and exclusion criteria*

<b>Inclusion</b>	<b>Exclusion</b>
Age 18-65 years of age, English speaking	Non-English speaker
Neck pain, mid back pain, and/or low back pain with or without arm or leg pain	Pregnant
Pain for more than 30 days during the past year, previous episodes	Serious pathology (i.e., acute trauma, cancer, infection, cauda equina, osteoporosis, vertebral fractures, whiplash-associated disorder) or contraindications to manual therapy
Ability to accommodate data collection procedures: <ul style="list-style-type: none"> <li>• Access to a mobile phone</li> <li>• Ability to send and receive SMS (text messages)</li> <li>• Ability to receive and respond to web questionnaires (working e-mail)</li> </ul>	

### Clinician and intern participation

This study was conducted as part of a larger research project investigating the implementation of the MAINTAIN tool into chiropractic teaching clinics.<sup>37</sup> As part of the project, participating interns and clinicians were randomized into one of three groups whereby they received training on the utilization of the MAINTAIN tool in a stepwise fashion. Training consisted of either written information only in the form of an instructional handout, a one-time focused lecture on the MAINTAIN tool, or an in-depth workshop series.<sup>37</sup>

Clinicians and interns completed follow-up questionnaires designed to capture their clinical impressions and care planning decisions based on patient presentation and questionnaire data. The questionnaire was developed by the study authors—a multidisciplinary team of clinicians, educators, researchers, and administrators—and underwent iterative piloting and revision until consensus was achieved. Surveys were distributed via email, and respondents indicated whether the form was completed by the clinician alone, the intern alone, or collaboratively.

Each questionnaire included five closed-ended and two open-ended questions:

- Closed-ended
  1. Who is completing the survey? (clinician only/ intern only/both).
  2. Do you think the patient is a good candidate for manual treatment? (yes/no)
  3. Do you think the patient is a good candidate for an exercise intervention? (yes/no)
  4. Will you treat the patient? (yes/no)
  5. Do you expect the patient to respond to the treatment offered? (yes/no)
- Open-ended
  1. How do you plan to use the MAINTAIN score (and 5 dimensions) with this patient?
  2. What are the treatment goals you have for this patient?

### Qualitative analysis

Open-ended responses were analyzed using Braun and Clarke's thematic analysis framework.<sup>38</sup> Researchers

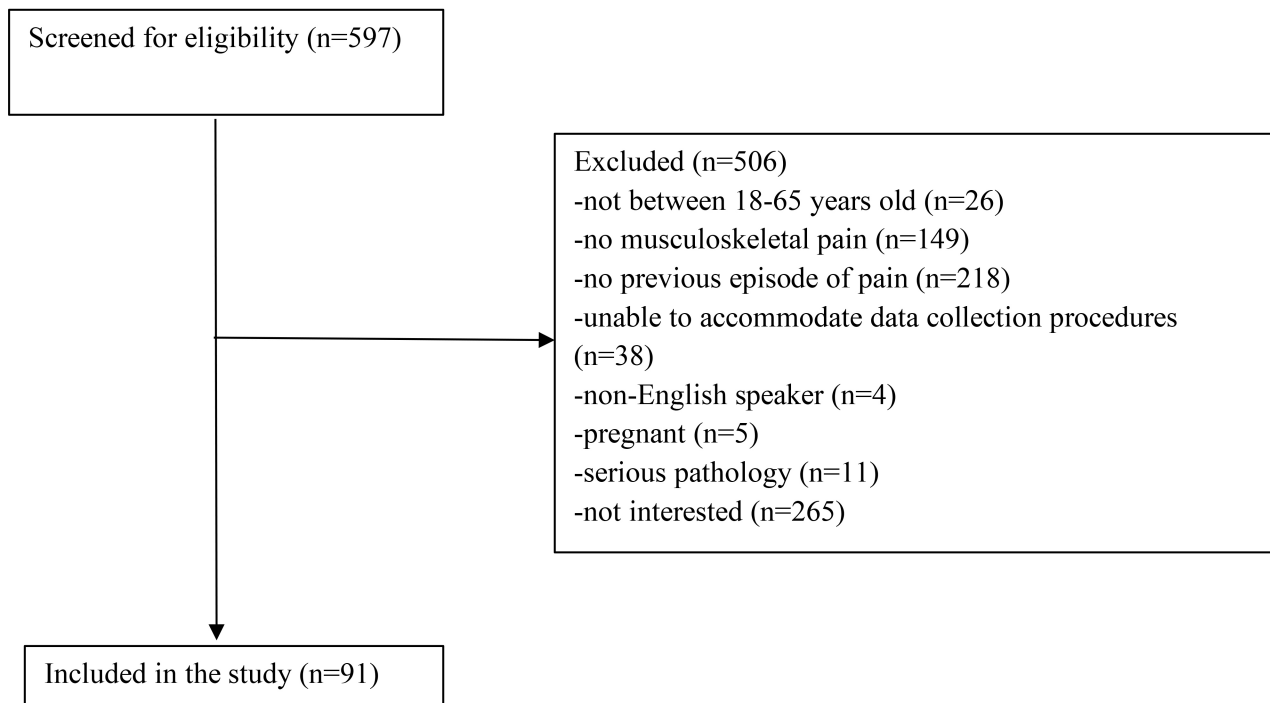


Figure 1.  
STROBE flow diagram.

Table 2.  
Participants' pain and previous treatment characteristics (n=91).

		Neck Pain	Mid-Back Pain	Low Back Pain
Spinal pain location	n (%)	56 (58.3%)	38 (39.6%)	70 (72.9%)
Previous episodes	n (%)	56 (100%)	37 (97.4%)	69 (98.6%)
# days with activity limitation in the past 12 months	mean (SD)	46.0 (86.90)	51.8 (99.08)	49.7 (95.52)
# days work missed due to pain in the past 12 months	mean (SD)	8.6 (48.90)	1.6 (3.29)	8.1 (44.11)
Pain radiation to "XX"	n (%)	Arms: 16 (28.6%) Hands: 10 (17.9%)	NA	Thighs: 24 (34.3%) Calf: 23 (32.9%)
Had previous treatment	n (%)	34 (60.7%)	21 (55.3%)	48 (68.6%)
Chiropractor	n (%)	30 (53.6%)	19 (50.0%)	40 (57.1%)
PT	n (%)	10 (17.9%)	8 (21.1%)	19 (27.1%)
MD	n (%)	8 (4.3%)	3 (7.9%)	13 (18.6%)
Osteopath	n (%)	0	0	1 (1.4%)
Massage Therapist	n (%)	12 (21.4%)	11 (29.0%)	15 (21.4%)
Other*	n (%)	2 (3.6%)	0	1 (1.4%)

Values are presented as n (%) unless otherwise noted; mean (SD) for continuous variables.

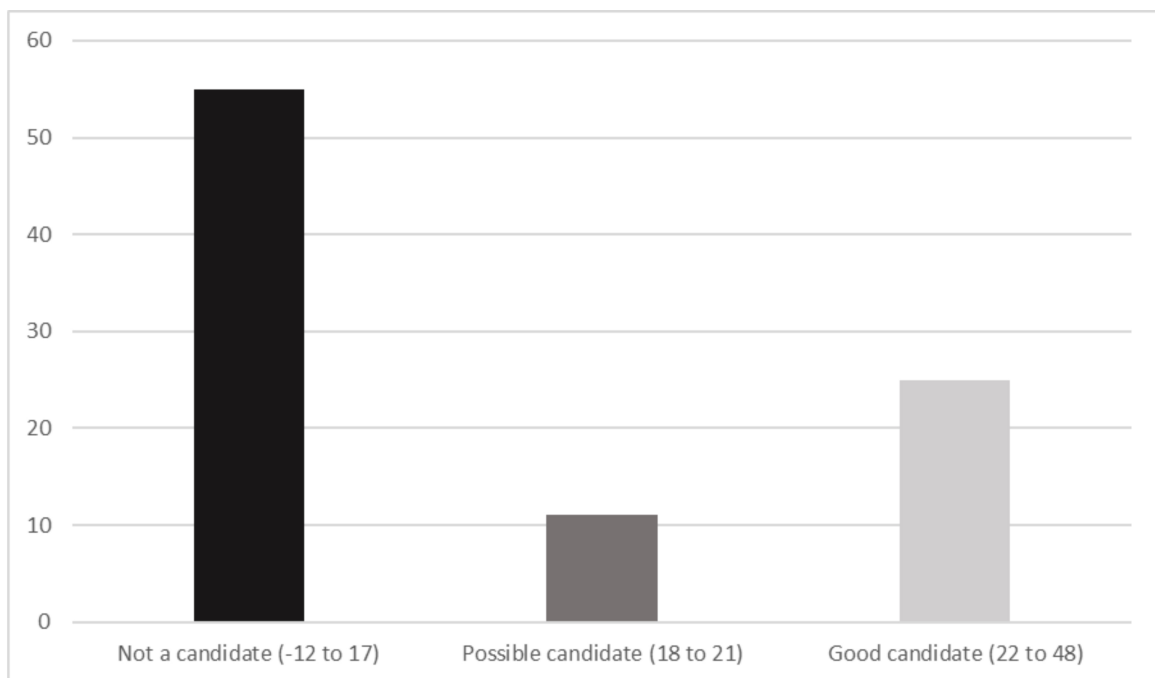


Figure 2.  
MAINTAIN Overall Score Distribution

Table 3.  
Participant health characteristics stratified by MAINTAIN findings (n=91).

	Not a candidate (n=55)	Possible candidate (n=11)	Candidate (n=25)	Possible Candidate/ Candidate (n=36)	Total (n=91)
Roland Morris: mean, SD (range)	3.2, SD: 3.38 (range: 0-17)	6.5, SD: 4.55 (range: 0-17)	8.2, SD: 4.71 (range: 3-22)	7.7, SD: 4.66 (range:0-22)	5.1, SD: 4.48 (range: 0-22)
Numerical Pain Rating Scale					
Right now	2.6, SD: 1.82 (range: 0-9)	4.5, SD: 1.69 (range: 1-7)	5.2, SD: 1.47 (range: 3-8)	5.0, SD: 1.55 (range: 1-8)	3.6, SD: 2.11, (range: 0-9)
Worst	5.9, SD: 2.07 (range: 0-10)	7.7, SD: 1.42 (range: 5-9)	8.3, SD: 1.25 (range: 6-10)	8.1, SD: 1.31 (range: 5-10)	6.8, SD: 2.07 (range: 0-10)
Least	1.0, SD: 1.51 (range: 0-8)	2.6, SD: 1.29 (range: 1-5)	2.8, SD: 1.59 (range: 0-6)	2.7, SD: 1.48 (range: 0-6)	1.8, SD: 1.74 (range: 0-8)
Average – 24 hours	2.5, SD: 1.75 (range: 0-7)	5.3, SD: 1.27 (range: 3-7)	5.6, SD: 1.88 (range: 3-10)	5.5, SD: 1.69 (range: 3-10)	3.8, SD: 2.32 (range:0-10)
EQ-5D-binary*: n (%)					
Mobility	14 (25.4%)	5 (45.5%)	12 (48.0%)	17 (47.2%)	31 (36.9%)
Self-care	6 (10.9%)	3 (27.3%)	6 (24.0%)	9 (25.0%)	15 (16.5%)
Usual Activities	19 (34.5%)	10 (90.9%)	18 (72.0%)	28 (77.8%)	47 (51.6%)
Pain / Discomfort	46 (83.6%)	11 (100%)	22 (88.0%)	33 (91.7%)	79 (86.8%)
Anxiety / Depression	21 (38.2%)	7 (63.6%)	14 (56.0%)	21 (58.3%)	51 (56.0%)
Pain Self-Efficacy Questionnaire (PSEQ): mean, SD (range)	54.5, SD: 8.59 (range: 16-60)	38.7, SD: 14.05 (range: 17-60)	46.2, SD: 11.95 (range: 15-60)	43.7, SD: 12.97 (range: 15-60)	50.2, SD: 11.78 (range: 15-60)
Expectation: mean, SD (range)	6.8, SD: 6.80 (range: 1-10)	7.9, SD: 1.45 (range: 6-10)	6.6, SD: 2.98 (range: 0-10)	7.1, SD: 2.62 (range: 0-10)	6.9, SD: 2.81 (range: 0-10)
Expectations					
Excellent	10 (18.2%)	1 (9.1%)	3 (12.0%)	4 (11.1%)	14 (17.1%)
Good	32 (58.2%)	7 (63.6%)	11 (44.0%)	18 (50.0%)	50 (61.0%)
Neither good nor bad	6 (10.9%)	1 (9.1%)	7 (28.0%)	8 (23.6%)	14 (71.1%)
Bad	1 (1.8%)	2 (18.2%)	1 (4.0%)	3 (8.3%)	4 (4.9%)
Poor	0	0	0	0	0

Legend: \*- n indicates that the participant had identified this as a problem (slight to extreme is not differentiated here).

began by reviewing the responses for familiarization, followed by systematic coding of key concepts. These codes were then organized into preliminary themes, which were reviewed, refined, and defined collaboratively. The analysis process was iterative and recursive rather than strictly linear. No software was used; all coding and theme development were conducted manually. All investigators reviewed the final themes to ensure consensus. The analysis included triangulation of data and collaborative coding to ensure qualitative rigor.

**Data management and analysis**

All data were collected using Research Electronic Data Capture (REDCap) software.<sup>39,40</sup> A convenience sampling strategy was employed, wherein participants were recruited based on their availability and willingness to participate during routine visits to the participating chiropractic teaching clinics. Descriptive statistics were calculated using STATA 14 (StataCorp. 2015. College Station, TX: StataCorp LP.). All data were stored on a secure server by one researcher (KP) to ensure confidentiality of patient information.

**Results**

As shown in Figure 1, 597 patients were screened for eligibility during the enrollment period. Of those, 91

(15.2%) completed the questionnaire and were included in the analysis. Participants had a mean age of 33.7 (SD: 11.5, range: 21.1–65.7), and slightly more than half (n=51, 56.0%) were male. Pain characteristics and details of previous treatment for enrolled participants are presented in Table 2.

**MAINTAIN instrument findings**

Figure 2 illustrates the distribution of MAINTAIN scores among the participants. The overall mean MAINTAIN score was 15.06 (SD = 9.03), with individual scores ranging from -7 to 32. The mean (SD) subscale scores were pain severity, 5.7 (3.04); interference, 4.7 (3.01); affective distress, 5.8 (3.18); life control, 6.9 (4.80); and support, 8.1 (2.49).

**Participant health characteristics**

Table 3 summarizes participant health characteristics. Patients identified by the MAINTAIN instrument as possible or definite candidates for MC had comparatively poorer scores across the health-related outcome measures than those classified as not suitable candidates for MC.

**Clinician and intern impressions**

Table 4 summarizes the clinical impression questionnaire responses of clinicians and interns. Out of 91 baseline

Table 4.  
*Intern/clinician quantitative impression response data*

	<b>Clinician Only</b>	<b>Intern Only</b>	<b>Both</b>	<b>TOTAL</b>
Frequency	20 (41.7%)	6 (12.5%)	22 (45.8%)	48
Do you think the patient is a good candidate for manual treatment?	100%	100%	100%	100%
Do you think the patient is a good candidate for an exercise intervention/treatment (irrespective of the answer on the previous question)?	100%	100%	100%	100%
Will you treat the patient?	100%	100%	95.5%*	97.9%
Expectation patient will respond to treatment offered:				
1 – Not at all	0	0	0	0
2	0	0	0	0
3	4 (20.0%)	3 (50.0%)	0	7 (14.9%)
4	7 (35.0%)	2 (33.3%)	10 (47.6%)	19 (40.4%)
5 – Definitely	9 (45.0%)	1 (16.7%)	11 (52.4%)	21 (44.7%)

\*Reason marked: ‘Patient does not need treatment’

questionnaires distributed, 48 responses (52.7%) were received. The majority of responses were completed by the clinician only (41.7%) or by both the clinician and intern together (45.8%). All respondents deemed the patient a good candidate for manual therapy/exercise interventions. Expectations of treatment response differed between respondent groups, with expectations being lower when completed by the intern alone.

### **Qualitative Findings: Use of the MAINTAIN instrument**

The thematic analysis of Open-ended Question 1 (How do you plan to use the MAINTAIN score (and 5 dimensions) with this patient?) revealed two overarching themes, each comprising two subthemes. The first theme, *Patient Perspective*, included the subthemes: *Facilitating interpretation of patients' needs* and *Planning for care informed by the MAINTAIN instrument*. The second theme, *Treatment Management*, encompassed *Scaffolding communication strategies with the MAINTAIN instrument* and *Monitoring progress based on MAINTAIN scores*. The themes and subthemes are described below with representative quotes.

#### **Patient Perspective**

This theme reflects how clinicians and interns used the MAINTAIN instrument to better understand and interpret patients' individual needs, preferences, and clinical contexts. Clinicians and interns used patient-reported experiences to guide treatment decisions, prioritize care, and plan for Maintenance Care or referrals.

#### **Facilitating interpretation of patients' needs**

Participants frequently indicated that the MAINTAIN instrument helped identify suitable candidates for MC and provided insight into additional patient considerations. For instance, one respondent noted:

*“Once this patient is off of active care, we hopefully will use this questionnaire for determining proper maintenance care for her as she has other confounding issues.”*

Participants also discussed using MAINTAIN subdomain scores to interpret patient needs by linking them with patient-specific clinically relevant information:

*“Pain Severity: patient has severe pain after lifting heavy weights and standing more than 20 min. Interference: Unable to workout as he would like due to pain. Life Control: able to help pain with stretches and chiropractic treatments in the past. Affective Distress: Anxiety in general that is medicated but not due to pain complaint. Support: Not aware of support from significant others.”*

#### **Planning for care informed by the MAINTAIN instrument**

Participants described using MAINTAIN scores to prioritize care, guide treatment planning, and consider referrals to other healthcare professionals:

*“Decrease pain and use affirmative language to her ADLs. Depending on patient interaction and openness, referral to mental health expert.”*

Detailed treatment planning informed by MAINTAIN scores included specific interventions and visit frequencies:

*“He should be a good candidate (for Maintenance Care) – we will eventually have tapering manual treatments and a home exercise program when the optimum effect of care has been achieved. They will be recommended Maintenance Care with pre-planned visits at 4-12-week intervals (aiming at increasing the interval as soon as possible).”*

#### **Treatment Management**

This theme captures how participants used the MAINTAIN instrument to guide communication strategies and enhance patient engagement by addressing psychosocial factors and fostering self-management. It also reflects the use of MAINTAIN scores to monitor patient progress, adjust treatment plans, and evaluate the effectiveness of care over time.

#### **Scaffolding communication strategies with the MAINTAIN instrument**

Participants used the MAINTAIN tool to determine effective communication approaches and discussion topics with patients, enhancing patient-provider interactions:

*“Provide patient with positive feedback and encouragement during visits to show support.”*

*“I plan on using this (MAINTAIN) score to measure the need for this patient to be on a wellness plan after her initial 4-week treatment or not.”*

Psychosocial factors identified through the MAINTAIN instrument were integrated into discussions to foster patient self-management and address underlying stressors:

*“Knowing that he ranks Life Control and Support (from the MAINTAIN instrument) highly is very helpful, and I can focus my treatment plan on helping him better understand back pain and work toward self-management so that interference and distress are minimized.”*

#### **Monitoring progress based on MAINTAIN scores**

Participants frequently reported intentions to use MAINTAIN scores to monitor patient progress, adjust treatments, and evaluate long-term benefit:

*“We will use the Maintain score to see how the patient is progressing and make changes to their treatment accordingly.”*

Participants also described selectively monitoring specific MAINTAIN subdomains to evaluate progress:

*“The Support category will be used to monitor the patient’s potential BPS factors that may delay or hamper the patient’s response to care. We will utilize the Pain Severity as a baseline for which we can observe how the patient is responding to care. Life Control will be utilized to observe how the patient is responding to care. We will not utilize the Interference for this patient’s care. We will not utilize affective distress for this patient’s care.”*

#### **Discussion**

To our knowledge, this study represents the first prospective evaluation of the novel MAINTAIN instrument within chiropractic teaching clinics in the United States.

It is also the first to explore how clinicians and interns employed the new instrument to inform clinical decision-making. In recent years, there has been a growing emphasis on integrating evidence-based practice into chiropractic curricula.<sup>41</sup> The MAINTAIN instrument may support this goal by providing an evidence-informed method to identify patients most likely to benefit from chiropractic MC.

We observed several demographic and clinical differences between the current patient sample and the original cohort used to develop the MAINTAIN instrument. Participants in the current study were predominantly male and generally younger than those in the Nordic Maintenance Care study conducted in Sweden.<sup>4</sup> Additionally, the overall MAINTAIN scores were lower in the current study, with the majority of patients having a low likelihood of benefiting from MC. Subdomain scores also varied: participants in this study reported higher scores in pain severity, interference, support, and affective distress (subdomains where lower scores are preferred), yet also scored higher in life control (subdomains where higher scores are desirable). These differences may be attributable to variations in demographic profiles and health characteristics between patients seen in chiropractic teaching clinic settings in the United States and typical clinical practice environments in Sweden.

Patient-centered care is characterized by care that respects and responds to individual patient preferences, needs, and values, ensuring that patient values guide all clinical decisions.<sup>42</sup> This approach has been increasingly recognized as vital in managing chronic and recurrent pain conditions, where treatment effectiveness often hinges on active patient engagement.<sup>43,44</sup> Shared decision-making, a collaborative process in which clinicians and patients jointly consider evidence-based treatment options alongside the patient’s preferences and circumstances, has also been identified as essential for effective chronic pain management.<sup>45,46</sup> The structured application of the MAINTAIN instrument aligns well with these patient-centered principles. Qualitative findings from this study suggest that the instrument provides individualized data that may support meaningful clinical conversations and facilitate shared decision-making. However, we did not directly observe whether this occurred during consultations.

The qualitative findings from this study also complement previous research investigating patient perceptions

of MC.<sup>47</sup> Earlier qualitative studies involving semi-structured patient interviews identified facilitators and barriers to successful MC implementation, with patient-centered care frequently cited as a significant facilitator. Patients consistently valued care plans tailored to their circumstances and preferences, highlighting the importance of patient-centered interactions and communication strategies. Our results similarly suggest that the systematic use of the MAINTAIN instrument supports clinicians and interns in recognizing and addressing patient-specific needs and preferences, thus enhancing the potential for successful and patient-valued MC implementation within chiropractic settings.

In addition to using MAINTAIN scores to facilitate communication and foster patient-centered clinical decision-making, our qualitative analysis shows that some participants planned to use the scores to monitor treatment effectiveness over time, which the tool has currently not been validated to do. While this could be a future direction of study in the field of MC, to date the MAINTAIN tool has not been validated for this purpose. Clinicians and educators should exercise caution to not be overly confident in MAINTAIN scores to inform clinical decisions outside of the selection of MC candidates. A recent mixed-methods study highlights the confusion that exists regarding MC throughout chiropractic training programs<sup>48</sup>, which could explain the misguided use of the tool observed in the current study.

### *Strengths and limitations*

This study had several strengths. It is the first prospective evaluation of the MAINTAIN instrument in United States chiropractic teaching clinics and was conducted in a real-world clinical setting, enhancing the ecological validity of the findings. It also supports the integration of evidence-based care, aligning with current healthcare priorities. Lastly, a cross-sectional survey using quantitative and qualitative approaches was used, combining both types of data to provide richer insights.

Several limitations must be acknowledged. First, limited engagement by clinicians and interns resulted in a low screening rate, leading to low patient enrollment. Conducting research in chiropractic teaching clinics often presents unique challenges, including limited prioritization of research, inadequate institutional resources, insufficient training and faculty availability, and variable

student interest.<sup>49</sup> Similar obstacles were encountered in the current project, which may have contributed to the limited engagement and enrollment.

Another limitation involves the generalizability of findings, as the patient health characteristics observed in chiropractic teaching clinic populations differ from those typically encountered in general clinical practice. Additionally, readers should be aware that while the MAINTAIN tool has been developed and tested on patients with low back pain, this study also included patients with neck and mid back pain, so findings should be interpreted cautiously. Furthermore, this study employed a cross-sectional design, which restricts the ability to infer causality or evaluate changes over time. Lastly, qualitative data were obtained exclusively through written responses, which may have limited the depth of insights compared to more interactive methods such as one-to-one semi-structured interviews or focus group discussions.<sup>50</sup> These limitations likely impacted the study's findings by reducing their generalizability, depth, and transferability.

### *Future directions*

Future research should focus on improving clinician engagement through targeted training, institutional support, and practical integration of research activities into clinical routines. Including a wider variety of clinical environments, such as private practices and community-based settings, would help ensure that findings are more broadly applicable. Additionally, longitudinal study designs could offer deeper insights into how the MAINTAIN instrument influences clinical decision-making and patient outcomes over time. For qualitative research, more in-depth approaches like individual interviews or focus group discussions are recommended to capture richer, more nuanced, and transferable perspectives from both clinicians and patients.

### *Conclusion*

This study presents the first evaluation of the MAINTAIN instrument used within chiropractic teaching clinics in the United States. It provides valuable insights into its applicability for evidence-based patient selection and tailored care planning in chiropractic MC. Despite observed demographic and clinical differences between this study's participants and prior research populations, the results underscore the utility of the MAINTAIN instrument in

promoting patient-centered care. Specifically, the instrument facilitates the integration of psychological, social, and behavioral considerations into clinical decision-making processes. The qualitative analysis further emphasizes the instrument's role in enhancing patient-provider communication, establishing clear treatment goals, and systematically monitoring patient progress. Although limitations related to participant engagement and uptake were encountered, this research established a foundational understanding that future investigations can build upon, exploring broader applications in clinical practice and educational contexts and informing ongoing refinement of its integration into chiropractic curricula.

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# Value propositions of chiropractic specialties: a national survey of regulators and specialists, informed by practicing chiropractors in Ontario and Quebec

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*Background: Canadian chiropractic specialties have evolved over five decades with varied provincial recognition. This study assesses how regulators, specialists, and chiropractors perceive the value and future development of chiropractic specialties.*

*Methods: We conducted a bilingual, cross-sectional online survey. Respondents rated agreement with 12 value propositions (5-point Likert), and open-ended comments were analyzed thematically.*

*Results: 248 respondents completed our survey (response rate of 5%): 12 regulators from 9 provinces, 58 specialists from 7 provinces, and 178 chiropractors from Ontario and Quebec. Agreement was consistently high (58.5–91.1%), with no significant differences between groups ( $F=1.85$ ,  $p=0.160$ ). Top future priorities: Paediatrics and Neurology (71%), Chronic Pain Management (65%), Geriatrics (56%). Qualitative analysis identified barriers (limited recognition, restricted scope, underutilization) alongside strong support for specialization.*

*Propositions de valeur des spécialités en chiropratique: une enquête nationale auprès des organismes de réglementation et des spécialistes, éclairée par des chiropraticiens en pratique, en Ontario et au Québec*

*Contexte: Les spécialités en chiropratiques au Canada ont évolué au cours de cinq décennies avec une reconnaissance provinciale variable. Cette étude évalue comment les organismes de réglementation, les spécialistes et les chiropraticiens perçoivent la valeur et le développement futur des spécialités en chiropratique.*

*Méthodes: Nous avons mené une enquête transversal bilingue en ligne. Les répondants ont indiqué leur niveau d'accord avec 12 propositions de valeur (échelle de Likert à cinq points), et les commentaires ouverts ont été analysés de manière thématique.*

*Résultats: Deux cent quarante-huit (248) répondants ont rempli le sondage (taux de réponse de 5 %) : 12 organismes de réglementation de neuf provinces, 58 spécialistes de sept provinces, et 178 chiropraticiens de l'Ontario et du Québec. Le niveau d'accord était*

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Conflicts of Interest:

The study was conducted in collaboration with the Specialty Colleges Council of the Federation of Canadian Chiropractic (FCC). The authors have no disclaimers, competing interests, or sources of support or funding to report in the preparation of this manuscript. MAB has received research grants from: Canadian Chiropractic Research Foundation (CCRF), Fondation Chiropratique du Québec (FCQ), Association des chiropraticiens du Québec (ACQ), Ordre des chiropraticiens du Québec, and Fondation de l'Université du Québec à Trois-Rivières. MAB has also received speaker honorarium from the Canadian Chiropractic Association, OCQ and ACQ.

*Conclusion: Despite reported consensus on specialization's value among respondents, structural barriers appear to limit integration within the healthcare system. Proposed solutions for advancing chiropractic specialties included national accreditation standards for postgraduate specialty programs, harmonized provincial recognition, and strengthened visibility.*

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KEY WORDS: chiropractic, specialties professional, surveys and questionnaires, attitude of health personnel, professional recognition, healthcare systems

## Introduction

Over the past five decades, chiropractic specialty education and training in Canada has evolved through the development of structured graduate programs at Canadian academic institutions, establishing defined competency expectations for specialist practice.<sup>1</sup> In parallel, the Federation of Canadian Chiropractic (FCC), through its Specialty Colleges Council (SCC), and the Council on Chiropractic Education Canada (CCEC) have worked to formalize a nationally recognized framework for advanced competencies and credentialing.<sup>2,3</sup> Five specialty colleges—Chiropractic Sciences, Orthopaedics, Radiology, Rehabilitation, and Sports Sciences—currently represent the established branches of Canadian chiropractic specialization, with recent competency standards further defining expectations for specialist practice.<sup>2,4</sup>

However, significant disconnects exist between the institutional maturation of specialty frameworks and

*constamment élevé (58,5 % à 91,1 %), sans différences significative entre les groupes ( $F = 1,85$ ;  $p = 0,160$ ). Voici les principales priorités pour le développement de nouvelles spécialités : pédiatrie et neurologie (71 %), gestion de la douleur chronique (65 %), gériatrie (56 %). L'analyse qualitative a identifié des obstacles (reconnaissance limitée, champ d'exercice restreint et sous-utilisation,) ainsi qu'un fort soutien à la spécialisation.*

*Conclusion: Malgré un consensus déclaré sur la valeur de la spécialisation parmi les répondants, des obstacles structurels semblent limiter l'intégration au sein du système de santé. Les solutions proposées pour faire progresser les spécialités en chiropratique comprenaient l'établissement de normes nationales d'accréditation pour les programmes spécialisés de deuxième et troisième cycles une reconnaissance provinciale harmonisée et une visibilité renforcée.*

(JCCA. 2026;70(1):94-106)

MOTS CLÉS: chiropratique, spécialités professionnelles, sondages et questionnaires, attitude du personnel de santé, reconnaissance professionnelle, systèmes de santé

their practical implementation. Provincial and territorial differences in recognition, limited title protection for specialists, and low public and interprofessional awareness have created a fragmented environment in which specialist training is not consistently valued in clinical practice or reflected in compensation.<sup>5,6</sup> Integration into broader healthcare systems remains inconsistent despite the profession's documented contributions to patient care.<sup>7,8</sup> These implementation challenges persist even as CCEC finalizes new accreditation standards for postgraduate specialty programs<sup>3</sup> and despite advanced practice frameworks being successfully implemented in other regulated health professions such as nursing and physiotherapy.<sup>9-12</sup>

Understanding stakeholder perceptions of specialty value is essential because the adoption of professional innovations depends on shared commitment among practitioners, specialists, and regulators.<sup>13,14</sup> Similar concerns

about advanced practice integration have emerged in related professions,<sup>15</sup> and empirical data describing how Canadian chiropractic professionals view their specialization efforts are currently lacking. This study addresses that gap by providing the first national assessment of perceptions surrounding chiropractic specialization in Canada.

This study had three specific aims:

1. Quantify agreement with twelve value propositions describing chiropractic specialist education, competencies, and contributions to professional practice.
2. Document regulator-reported recognition of chiropractic specialties
3. Identify priorities for emerging specialty areas.

By addressing these aims, this survey provides strategic information to inform ongoing initiatives in accreditation, regulatory recognition, and professional integration of chiropractic specialties across Canada.

## Methods

### *Study design*

We conducted a cross-sectional, bilingual (English and French) online survey of chiropractors, chiropractic specialists, and regulatory board representatives in Canada.

### *Population and eligibility*

The survey was distributed to three target groups:

1. Regulatory authorities (provincial chiropractic licensing boards): All provincial and territorial regulatory authorities in Canada were invited to participate.
2. Chiropractic specialists: Members of the five Canadian specialty colleges recognized by the FCC.
3. Registered chiropractors: Members of provincial chiropractic regulatory boards.

Eligible participants were adults 18 years of age or older who self-identified as regulators, chiropractic specialists, or licensed chiropractors. The survey was administered anonymously in both English and French using the Banque Interactive de Questions (BIQ), an online survey platform created by the Université du Québec à Trois-Rivières (<https://confluence.uqtr.ca/display/AOPSP/BIQ>).

### *Data collection*

All participants were recruited between November 2024 and September 2025. Regulatory authorities in all Canadian provinces and territories were invited directly by

email using publicly available contact information. They were asked to complete the survey and forward it to their licensees. Among all provincial regulatory authorities, only the Quebec regulatory board distributed the survey to approximately 1,350 chiropractors practicing in the province. Alternatively, the Ontario Chiropractic Association offered its collaboration to distribute the survey to its 3,800 members. The five Canadian specialty colleges were asked to send our survey invitation to their members (N=263 specialists). Up to three reminder emails were sent to participating organizations and asked them to do the same with their membership. Chiropractors in Quebec and Ontario were invited to participate on two distinct occasions. All participants were invited to complete the survey anonymously.

### *Survey instrument*

The instrument was co-developed by the Specialty Colleges Council of the FCC and two researchers from UQTR (FH and MAB). It included 21 items across three sections:

#### Section 1 – Value Propositions (12 Likert-scale items)

The 12-item value proposition scale consisted of twelve value propositions developed and approved in 2024 by the FCC's Specialty Colleges Council members representing the five recognized Canadian Chiropractic Specialties. Their design was based on the Competency Profile for Chiropractic Specialists framework approved in November 2023 by the FCC. Items were organized around five domains: education/competency (2 items), clinical contributions (3 items), interprofessional collaboration (3 items), knowledge development (2 items), and professional recognition (2 items). Respondents indicated agreement using a five-point Likert scale (1 = Strongly disagree to 5 = Strongly agree), with a neutral midpoint option. The five-point scale was selected to provide sufficient discrimination while remaining interpretable and includes a neutral option to allow expression of genuine uncertainty. Internal consistency was assessed using Cronbach's alpha coefficient, which yielded  $\alpha = 0.93$ , indicating strong inter-item correlation.

#### Section 2 – Recognition and Legislation (8 items on provincial recognition and future specialties).

### Section 3 –

Open-Ended field for additional comments (1 item) (please contact the authors for additional information).

#### Data analysis

Descriptive statistics (means, SDs, frequencies) were calculated for all items. Composite scores for the 12-item scale were computed (range 12–60). Internal consistency of the 12 items assessing the agreement with the value proposition was assessed using Cronbach's alpha. Values were interpreted using established guidelines, with  $\alpha \geq 0.90$  considered excellent.<sup>16</sup> Exploratory comparisons across designations and provinces were conducted via one-way ANOVA. All analyses were completed in SPSS v30.0 (IBM Corporation, Armonk, NY). A p-value  $\leq 0.05$  was used as the level of statistical significance. French open-ended responses to the survey question “Do you have any other suggestions or comments?” were translated to English for analysis. The 132 open-ended responses were analyzed using AI-assisted coding with Claude.ai (Anthropic, Claude Sonnet 4.5), followed by validation through independent human review. This approach was adopted due to the unexpected volume of qualitative data exceeding planned resources. A subset of 30 responses (22.7%) was independently coded by a human researcher to verify consistency with the AI-generated themes;

high concordance was observed. The analysis presents both qualitative content (theme descriptions with representative quotations) and quantitative context (theme frequency), resulting in a hybrid approach providing both interpretive depth and systematic documentation of response patterns. Themes were also categorized by sentiment (critical, concern, positive, suggestion, mixed) and illustrated by representative quotations.

#### Ethics and consent

The study protocol was reviewed and approved by the Research Ethics Committee of the Université du Québec à Trois-Rivières (CER-24-310-07.08). Respondents provided consent online and their participation was voluntary and uncompensated.

#### Results

##### Respondent characteristics and geographic distribution

A total of 248 individuals participated in the survey, representing an approximate response rate of 5%. Respondents included 12 provincial or territorial regulators (5%), 58 chiropractic specialists (23%), and 178 chiropractors (72%). Participation was geographically diverse but concentrated in Ontario (48.4%; n = 120) and Québec (38.7%; n = 96). A detailed breakdown by role and province is provided in Table 1.

Table 1.  
Geographic distribution of the respondents (N=248)

Province/Territory	Regulator		Chiropractic Specialist		Chiropractor		Total	
	n	%	n	%	n	%	n	%
Alberta	1	8.3%	5	8.6%	1	0.6%	7	2.8%
British Columbia	0	0.0%	3	5.2%	0	0.0%	3	1.2%
Manitoba	1	8.3%	2	3.4%	0	0.0%	3	1.2%
New Brunswick	1	8.3%	0	0.0%	0	0.0%	1	0.4%
Newfoundland and Labrador	1	8.3%	0	0.0%	0	0.0%	1	0.4%
Nova Scotia	2	16.7%	2	3.4%	4	2.2%	8	3.2%
Ontario	2	16.7%	37	63.8%	81	45.5%	120	48.4%
Prince Edward Island	1	8.3%	0	0.0%	4	2.2%	5	2.0%
Quebec	2	16.7%	8	13.8%	86	48.3%	96	38.7%
Saskatchewan	1	8.3%	1	1.7%	2	1.1%	4	1.6%
TOTAL	12	100.0%	58	100.0%	178	100.0%	248	100.0%
Agreement score <sup>1</sup> ; mean (95% CI)	52	(47 -57)	50	(48-53)	48	(47-50)	49	(48-50)

CI: confidence interval

<sup>1</sup> No statistically significant between group difference: ANOVA: F= 1.85, p = 0.160

Table 2.  
Provincial recognition of chiropractic specialties based on regulators respondents.

Province/Territory	Specialties recognized by regulatory board <sup>1</sup>	New / expected legislation likely to change the recognition status of chiropractic specialists	Would you recommend the development of additional chiropractic specialties?
Nova Scotia	Yes	No	Yes
Ontario	Yes	No	No
Quebec	No	No	Yes
Saskatchewan	Yes	No	Yes
Prince Edward Island	Yes	No	No
Alberta	Yes	No	Yes
New Brunswick	Yes	No	Yes
Manitoba	Yes	No	Yes
British Columbia*	No	No	No

\* Response from chiropractic specialist in the absence of regulator respondent from this province.

<sup>1</sup> All the provinces that recognize chiropractic specialties, recognized the following specialties and no other: College of Chiropractic Sciences (Canada), College of Chiropractic Orthopaedics Specialists (Canada), College of Chiropractic Radiologists (Canada), Canadian Chiropractic College of Physical and Occupational Rehabilitation, Royal College of Chiropractic Sports Sciences (Canada).

The response rate among regulators was 100%, as responses were obtained from all surveyed provincial and territorial regulators. The survey was also distributed to the 263 members of the five recognized specialty colleges with a response rate of 22% (n=58). In Quebec, the response rate was 6.37% (n=86) among the 1,350 chiropractors invited to participate. In Ontario, the response rate was 2.23% (n=81) among the 3,800 invited participants.

#### Recognition of chiropractic specialties by regulators

Among the twelve regulators who completed our survey, most reported formal recognition of chiropractic specialties and no pending legislative changes affecting their status (see Table 2). All jurisdictions with recognition identified the same five FCC-recognized specialty colleges—Chiropractic Sciences, Orthopaedics, Radiology, Rehabilitation, and Sports Sciences—and none cited additional specialty groups (see Table 2). The majority of regulators expressed support for developing additional specialties.

#### Priorities for developing new specialties

Of the 206 respondents who completed the question on new specialty development priorities, the most frequently endorsed areas were Paediatrics (71%; n = 146) and Neurology (71%; n = 146), followed by Chronic Pain Manage-

ment (65%; n = 134) and Geriatrics (56%; n = 115). Less frequently cited were Nutrition (23%; n = 47) and other topics (13%; n = 26), which included applied kinesiology, maternal and perinatal care, behavioral health, acupuncture, and disability assessment (see Table 3).

Table 3.

#### Development of new chiropractic specialty (n=206)

Specialty	n	%
Chronic pain management	134	65
Geriatrics	115	56
Neurology	146	71
Paediatrics	146	71
Nutrition	47	23
Others	26	13
Applied Kinesiology/DIBAK	8*	-
Maternal & Pregnancy/Perinatal Care	5*	-
Psychology/Behavioral Health	2*	-
Knowledge Translation	1*	-
Acupuncture	1*	-
Chiropractic Internist	1*	-
Disability Expert	1*	-
Veterinary	1*	-

\*Number of mentions in the open field

Excludes Sports Chiropractic and Rehabilitation which already exist as recognized specialties

### Agreement with value propositions of chiropractic specialists

Overall, respondents demonstrated strong agreement with the 12 value propositions describing the roles and contributions of chiropractic specialists (see Table 4). The highest levels of agreement were observed for propositions stating that specialists complete accredited postgraduate programs (91.1% agreement), possess advanced practice competencies (90.0%), require formal recognition and regulation (82.1%), and are qualified to provide expert opinions (80.8%). The 12-item value-proposition scale demonstrated excellent internal consistency (Cronbach's  $\alpha = 0.93$ ), confirming that items collectively measured a cohesive underlying construct of perceived value of chiropractic specialties.

Composite agreement scores (range = 12–60) were compared across respondent categories using one-way ANOVA (see Table 4). No statistically significant group differences were observed ( $F = 1.85$ ,  $p = 0.160$ ), indicating a broadly shared consensus across professional roles regarding the value of chiropractic specialization.

### Qualitative themes from open-ended comments

A total of 132 respondents (53%) provided open-ended comments. The analysis identified 9 major themes and 22 subthemes (see Table 5) reflecting both positive and critical perspectives on chiropractic specialization. Thematic coding yielded a total of 134 distinct coded mentions, distributed as follows by sentiment: Critical/Negative: 35%; Concerns: 22%; Positive: 21%; Suggestions: 6%; Mixed: 16%.

Table 4.  
Level of Agreement with Value Propositions of Chiropractic Specialists (N=248).

Value Proposition Statement	Strongly Disagree n (%)	Somewhat Disagree n (%)	Neither n (%)	Somewhat Agree n (%)	Strongly Agree n (%)	Total Agreement (%)
Complete postgraduate educational programs	7 (2.8%)	5 (2.0%)	10 (4.0%)	35 (14.1%)	191 (77.0%)	91.1%
Possess advanced practice competencies	7 (2.8%)	7 (2.8%)	11 (4.4%)	52 (21.0%)	171 (69.0%)	90.0%
Need recognition and regulation	11 (4.5%)	9 (3.6%)	24 (9.7%)	49 (19.8%)	154 (62.3%)	82.1%
Qualified for expert opinions	8 (3.3%)	9 (3.7%)	30 (12.2%)	69 (28.0%)	130 (52.8%)	80.8%
Essential role in teaching	8 (3.2%)	14 (5.7%)	30 (12.1%)	73 (29.6%)	122 (49.4%)	79.0%
Provide evidence-based interpretation	11 (4.4%)	15 (6.0%)	27 (10.9%)	78 (31.5%)	117 (47.2%)	78.7%
Contribute to scientific knowledge	7 (2.8%)	12 (4.9%)	41 (16.6%)	73 (29.6%)	114 (46.2%)	75.8%
Work collaboratively	10 (4.1%)	19 (7.8%)	43 (17.6%)	69 (28.3%)	103 (42.2%)	70.5%
Skilled communicators	12 (4.9%)	17 (6.9%)	65 (26.4%)	71 (28.9%)	81 (32.9%)	61.8%
Provide advanced practice services	19 (7.7%)	36 (14.5%)	43 (17.3%)	59 (23.8%)	91 (36.7%)	60.5%
Possess leadership skills	14 (5.7%)	29 (11.7%)	55 (22.3%)	59 (23.9%)	90 (36.4%)	60.3%
Provide referral network	13 (5.2%)	40 (16.1%)	50 (20.2%)	59 (23.8%)	86 (34.7%)	58.5%

Table 5.

Thematic analysis of the responses to the open-ended question “Do you have any other suggestions or comments?”  
(N=132)

Subtheme	n	Representative Quotes
<b>THEME 1: Lack of Recognition &amp; Value (29 mentions)</b>		
No financial benefit	13	<p>“Feel like being a specialist has not given any financial benefit... Patients don’t pay more if you are a specialist”</p> <p>“They are not treated any differently by insurers, the regulator, government funding”</p> <p>“Chiropractic specialty colleges should be more active in advocacy work that would create reimbursement for chiropractic specialists based on their advanced training in a category that is separate from general chiropractic services”</p>
Not recognized outside profession	8	<p>“Chiropractic specialists are only recognized WITHIN our profession. Good luck outside our small group”</p> <p>“Specialties are not known outside of the chiropractic world so hold little weight”</p>
Public/medical unaware	8	<p>“The public and medical profession/insurance companies have no knowledge of Chiro Specialists”</p> <p>“They are a well kept secret in health care!”</p>
<b>THEME 2: Scope of Practice Limitations (18 mentions)</b>		
No enhanced scope	12	<p>“Specialists are useless without regulations that provide them with an enhanced scope. In Ontario, there is nothing a specialist can do for a patient that a non specialist can do”</p> <p>“Having a speciality does not increase scope of practise. So it raises the question on the purpose of a specialty”</p>
Need imaging/lab rights	6	<p>“Chiropractors should be able to request and refer for diagnostic ultrasound imaging and blood labs”</p> <p>“If the radiology specialty could order additional imaging, eg. US or MRI, this would be a sensible solution”</p>
<b>THEME 3: Underutilization &amp; Accessibility (15 mentions)</b>		
Not used as referral resource	8	<p>“Chiropractic specialists are not used to their potential by other chiropractors”</p> <p>“Many specialties are not consistently leveraged and are fairly inaccessible as a referral source – especially in smaller provinces”</p>
Too few for impact	4	<p>“Too few specialists to make an impact on the public and greater profession”</p> <p>“I see a declining interest in specialty programs”</p>
Rural barriers	3	<p>“All focused in major cities... I’m not going to send a patient there. I’d worry I would never get them back”</p>

Subtheme	n	Representative Quotes
<b>THEME 4: International/Interprovincial Recognition (14 mentions)</b>		
US credentials not recognized	8	<p>“International designations should be appropriately recognized”</p> <p>“The Royal College of Chiropractic Sports Sciences of Canada has created an undue monopoly that penalizes sports specialization completed in the USA”</p>
ICA/ICPA programs excluded	4	<p>“I completed the International Chiropractic Sports Physician course/diplomate – why is it not considered a specialty?”</p> <p>“Do not create a structure without reciprocity with American counterparts”</p>
Need reciprocity	2	“Simple recognition and reciprocity are essential”
<b>THEME 5: Program Quality &amp; Standards (14 mentions)</b>		
Inconsistent rigor	6	<p>“Except for Clinical Sciences (residency program), all other programs should have better standards”</p> <p>“Orthopaedic and rehabilitation specialties do not have the same rigor as clinical sciences, sports, or radiology – should be sunset”</p>
Need accreditation oversight	6	<p>“No clear indication that programs are undergoing accreditation/oversight to ensure curriculum meets standards”</p> <p>“Program outcomes and success rates need to be transparent”</p> <p>“At present, there are considerable gaps in how specialists are being engaged within our jurisdiction, with limited evidence of their roles being meaningfully integrated into clinical practice... Another significant barrier is the absence of finalized standards for specialties. While it is encouraging that such standards are under development, they have not yet been implemented”</p>
Need ongoing CPD	2	<p>“Not all chiropractic specialists are research leaders. Ongoing professional development requirements needed”</p> <p>“I am not aware of any formal assessment mechanism that has been established for long-standing practitioners”</p>
<b>THEME 6: Alternative Credentials (8 mentions)</b>		
Prefer Masters/PhD	5	<p>“Eliminate specialties in favour of masters/PHD degrees. Specialties unknown outside chiropractic”</p> <p>“Other professions recognize masters/phd but could care less about specialty programs”</p>
Advanced Practice model	3	“Shift away from ‘specialties’ towards ‘advanced practice’ terminology – industry standard used by nursing and physiotherapy”
<b>THEME 7: Pediatric/Perinatal Priority (11 mentions)</b>		
Need pediatric specialty	7	<p>“Essential to confirm a pediatric specialty for public protection – specific clientele that cannot be treated by just any chiropractor”</p> <p>“Several Quebec chiropractors develop rigorous clinical expertise with children over decades, but without formal framework”</p>

Subtheme	n	Representative Quotes
ICPA recognition needed	4	“Need clear standard: completing ICA or ICPA plus continuing education hours” “Need to advertise ourselves as pediatric specialists as physiotherapists do”
THEME 8: Philosophical Concerns (6 mentions)		
Disconnected from philosophy	4	“They lack fundamental understanding of chiropractic’s natural philosophy... This is the essence of what we are” “Strong push to make us a sort of medical therapy positioning us on par with physiotherapists. One of them is redundant and it won’t be the PTs”
Creates division	2	“This exercise will further divide the profession” “Questions were demeaning towards chiropractors without specialties”
THEME 9: Positive Support & Advocacy (18 mentions)		
Important for profession	10	“Specialists are so very important to our professional development, research, education and identity” “Their training and advanced knowledge are vital to elevating the standard of care”
Need better marketing	8	“Greater advertising of specialist services to promote collaboration and referral” “OCA needs to educate the public. Market these specialties as THE authoritative NMSK doctors above even MDs”

Respondents articulated a consistent vision of specialization’s essential value to the chiropractic profession, while identifying substantial barriers to advancement. Three overarching themes emerged: (1) Specialization as Advanced Expertise and Professional Distinction, (2) Systemic and Regulatory Barriers to Implementation, and (3) Emerging Opportunities and Strategic Priorities.

**Theme 1: Specialization as advanced expertise and professional distinction**

Respondents across all groups emphasized that specialization represents a necessary evolution of the profession, enabling practitioners to develop deep expertise in specific areas and to position chiropractic care as a sophisticated healthcare service. As one specialist noted, “Specialization allows chiropractors to develop expertise that rivals other regulated professions, which strengthens our credibility in the healthcare system.” Regulators similarly recognized that specialization creates professional distinction, with one regulator stating, “Specialists pro-

*vide the profession with depth of knowledge that generalists cannot offer—it raises the profile of the entire profession.”*

Respondents described how specialization facilitates interdisciplinary collaboration. A practicing chiropractor commented, “When I refer a complex patient to a specialist, it changes how other healthcare providers view us. They see that we have expertise, not just general practitioners.” This theme reflects a shared belief that specialization elevates chiropractic’s position within the broader healthcare system by demonstrating sophisticated professional capacity.

Several respondents noted that specialization also benefits patients by ensuring access to advanced care. One specialist explained, “Patients benefit from knowing there are practitioners with specialized training in their particular condition. It provides confidence in the care they receive.” This perspective positions specialization not merely as professional advancement but as an ethical responsibility to patients.

### *Theme 2: Systemic and regulatory barriers to implementation*

Despite recognition of specialization's value, respondents identified substantial structural barriers that constrain advancement. These barriers fell into several sub-categories: regulatory fragmentation across provinces, economic disincentives, lack of public awareness, and ambiguous scope of practice.

*Regulatory fragmentation:* Respondents from multiple provinces described inconsistent recognition of specialties across provincial jurisdictions. As one regulator stated, *"We recognize these specialties, but three provinces over they don't. This creates confusion in the healthcare system about what a specialist can do."* This fragmentation creates practical obstacles for specialists seeking interprovincial mobility and limits the profession's collective advancement. Several respondents emphasized that national alignment would strengthen both the profession and patient access to specialized care.

*Economic disincentives:* Multiple respondents identified economic barriers to specialty development and practice. One specialist noted, *"The additional education required for specialization is substantial, but there's often no financial return for the investment—many general practitioners earn as much as specialists."* This economic reality creates a disincentive for advanced training despite professional value. Another respondent commented, *"Insurance coverage for specialist services is inconsistent, which limits both the development of specialty practices and patient access."*

*Public awareness and professional identity:* Several respondents emphasized that lack of public awareness limits specialization's impact. As one practicing chiropractor noted, *"Most patients don't know that specialties exist. Even when I refer them to a specialist, they see it as just another chiropractor."* This gap between professional specialization and public understanding limits the practical value specialization provides to patients and practitioners.

### *Theme 3: Emerging opportunities and strategic priorities*

Respondents identified several strategic areas for advancing specialization. These included expansion of specialty fields, integration with healthcare systems, and professional development pathways.

*Emerging specialty areas:* When asked about priorities for new specialties, respondents frequently mentioned chronic pain management, geriatric care, and neurology. One specialist explained, *"Chronic pain management is increasingly recognized as a complex multidisciplinary condition. If chiropractic had depth of expertise in this area, we could occupy an important role in pain management teams."* Several respondents noted that development of specialties addressing healthcare system needs would strengthen chiropractic's position within broader care delivery.

*Professional development and education:* Respondents emphasized the importance of ensuring that specialty education remains rigorous and evidence-based. A regulator stated, *"If we're going to have specialties, the education must be truly advanced and must prepare practitioners for the complexity of their role."* This reflected concern that specialty development should advance the profession's scientific foundation, not merely create credential options.

*System integration:* Several respondents articulated a vision of specialties contributing to integrated healthcare delivery. One specialist noted, *"The future isn't chiropractors in isolation—it's chiropractors with specialized expertise working within teams. That's where real advancement happens."* This theme suggests that specialization's greatest potential lies in positioning chiropractic within broader healthcare systems rather than developing isolated specialist practices.

The qualitative data reveal a profession in transition, with strong consensus regarding specialization's value alongside recognition of substantial systemic barriers. Respondents consistently identified specialization as essential to professional advancement and patient care, yet described a landscape fragmented by regulatory inconsistency, economic disincentives, and limited public awareness. The most forward-looking respondents articulated a vision of specialization as a mechanism for integrating chiropractic into broader healthcare delivery systems rather than as an end in itself.

### **Discussion**

This study provides an initial assessment of stakeholder perceptions regarding chiropractic specialization value propositions among regulatory authorities, specialists,

and practicing chiropractors in Ontario and Quebec. The findings demonstrate broad endorsement of chiropractic specialization while simultaneously revealing persistent systemic barriers that constrain its practical implementation. This duality—strong conceptual support yet limited structural integration—reflects a profession in transition.

### *Consensus on specialization value and professional alignment*

Respondents across all categories reported strong agreement that chiropractic specialization supports professional development and clinical excellence, aligning with established advanced-practice models in nursing<sup>12</sup> and physiotherapy.<sup>9-11</sup> This unified perspective validates the formalization efforts of the Federation of Canadian Chiropractic (FCC), Specialty Colleges Council (SCC), and Council on Chiropractic Education Canada (CCEC), providing a collaborative foundation for policy and regulatory advancement as the profession develops its healthcare system identity. However, this consensus must be interpreted cautiously given the overall low response rate, which may overrepresent perspectives from practitioners more engaged with and supportive of specialization.

### *Persistent barriers: recognition, scope, and integration gaps*

Despite reported agreement with specialization's value, respondents identified three systemic barriers that may be limiting functional integration: regulatory inconsistency provides no formal specialty differentiation or expanded scope in most provinces, economic disincentives result in no fee differentiation<sup>17</sup> by third-party payers, and inter-professional awareness gaps impede referrals and collaboration. Addressing these barriers may require coordinated national action on regulatory reform to formalize specialty recognition, policy engagement with payers for equitable compensation, and interprofessional education to increase awareness of specialist contributions.

### *Provincial fragmentation and emerging priorities for development*

Canadian provinces lack harmonized specialty recognition frameworks, with Quebec and British Columbia providing no formal recognition and other jurisdictions offering inconsistent regulatory and reimbursement treatment. Establishing a pan-Canadian recognition framework anchored

in the Competency Profile for Chiropractic Specialists and CCEC accreditation standards could potentially promote interprovincial mobility and professional clarity.<sup>2</sup>

Respondents identified Paediatrics, Neurology, Chronic Pain Management, and Geriatrics as priority specialties, aligning with Canada's evolving health system needs: aging populations,<sup>18,19</sup> chronic pain prevalence,<sup>20</sup> and demand for evidence-based pediatric care<sup>21</sup>. These priorities reflect the profession's commitment to adapting to emerging healthcare needs and contributing to system-wide goals of accessibility, safety, and effectiveness in musculoskeletal care.

The strong interest in Paediatric and Perinatal Chiropractic was especially pronounced among Quebec respondents, many emphasizing patient safety and the need for formal education and credentialing. Practitioners noted that numerous chiropractors already focus on pediatric populations but lack recognized advanced training pathways, standardized assessment, or professional recognition.<sup>21,22</sup> A pediatric specialty could strengthen public confidence and ensure consistency in care standards.

Interest in a Neurology specialty reflected the profession's increasing engagement with neuroscience, pain science, and neurorehabilitation.<sup>19</sup> Neurology is a domain that has the potential to bridge chiropractic practice with contemporary interdisciplinary models of neuromusculoskeletal care, potentially enhancing collaboration with neurologists and physiatrists in managing concussion,<sup>23</sup> balance disorders,<sup>23</sup> neuropathic pain, and functional neurological syndromes<sup>24</sup>.

Chronic Pain Management emerged as a high-priority area, reflecting a shift toward population-level strategies for pain and disability reduction.<sup>20</sup> Chronic pain is a key public health challenge for which chiropractic specialists could contribute substantially—particularly through integrated care models emphasizing non-pharmacologic management and interdisciplinary collaboration.<sup>7</sup>

Geriatrics as a potential specialty reflects awareness of Canada's aging population and the increasing burden of musculoskeletal and mobility-related conditions in older adults, requiring advanced training in frailty assessment, fall prevention, and multi-morbidity management.<sup>25</sup>

### *Pathways forward: accreditation, advanced practice models, and system integration*

Three integrated, mutually reinforcing strategies suggested

by respondent comments for advancing chiropractic specialization include: First, establishing rigorous national accreditation standards for postgraduate specialty programs. While respondents demonstrated strong agreement that chiropractic specialization has substantial professional value, the qualitative data revealed concurrent concerns about consistency and rigor of current standards across different specialty colleges and provinces. Specifically, when discussing priorities for advancing specialization, respondents emphasized the importance of ensuring that specialty education must be truly advanced and must prepare practitioners for the complexity of their role. CCEC, FCC, and SCC might consider establishing explicit competency requirements and standardized curriculum depth, assessment rigor, and continuing education requirements, addressing perceived variability across existing specialties and enhancing public and interprofessional trust. Second, adopting an “advanced practice” framework as documented in other regulated health professions.<sup>9-12</sup> In Quebec, advanced practice nurses and physiotherapists have recently gained credibility with policymakers, payers, and other health professionals and represent a promising solution to the challenges experienced in the first line of care.<sup>9-12,26</sup> This framework might position chiropractic specialists more effectively within interprofessional healthcare systems. By aligning chiropractic language and structure with that used in other regulated health professions, the profession could improve credibility with policymakers, payers, and other health professionals while maintaining its unique contribution to neuromusculoskeletal care. Third, addressing advocacy and visibility gaps identified by respondents. Chiropractic specialists remain a “well-kept secret” within the profession and broader healthcare system. Strategies might include internal referral guidelines, professional development modules, and consistent use of specialty titles across provinces. Together, accreditation provides credibility, advanced practice frameworks create policy language for integration, and visibility efforts address the knowledge gaps respondents identified as barriers to referral and collaboration.

### Limitations

Our findings should be interpreted with significant caution due to multiple methodological limitations. The overall response rate of approximately 5% is notably low and substantially limits the generalizability and reliability of

these findings. Respondents may not be representative of the broader populations of Canadian chiropractors. Voluntary participation through professional associations and regulatory boards may overrepresent perspectives from chiropractors more engaged with specialization, potentially underrepresenting skeptical viewpoints. Geographic distribution was dominated by Ontario (48%) and Quebec (39%), limiting generalizability to smaller jurisdictions. The survey instrument was not formally pre-tested. Self-reported recognition and legislation data may reflect perception rather than formal legal status; regulator responses were analyzed separately to mitigate this, though discrepancies may remain. Qualitative interpretation of open-ended comments relied on AI-assisted coding rather than traditional manual analysis, and uneven provincial distribution could limit thematic saturation. Finally, as a cross-sectional design, this survey captures a single point in time; perspectives may evolve as CCEC finalizes accreditation standards and provincial regulators revisit specialty recognition frameworks, requiring future longitudinal studies to track implementation impact.

### Conclusion

This initial assessment of chiropractors, specialists, and regulators reveals what appears to be a significant tension between reported support for specialization’s value and identified structural and systemic barriers that appear to limit integration into the healthcare system. Realizing specialization’s potential would likely require not only national accreditation standards for postgraduate specialty programs, harmonized regulatory frameworks, and strengthened visibility efforts, but also sustained political advocacy. Successfully addressing these barriers would position chiropractic specialists as meaningful contributors to Canada’s evolving healthcare priorities around chronic pain, aging populations, and conservative care innovation.

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# Chiropractic utilization at the International Workers and Amateurs in Sports Confederation (CSIT) 6th World Sport Games 2019

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**Objectives:** *To describe utilization of sports chiropractic treatment and injury statistics provided by Federation Internationale de Chiropratique du Sport (FICS) delegation at the International Workers and Amateurs in Sports Confederation 6th World Sport Games 2019 in Catalunya, Spain.*

**Methods:** *This historical case-series study analysed clinical encounters of participants seeking sports chiropractic services during the 2019 WSG event. Descriptive statistical data included: participant demographics, utilization rate (proportion of accredited participants who sought chiropractic treatment), frequency (number of treatment sessions per individual), conditions per sport, treatment provided, and Numerical Rating Scale (NRS) for pain intensity (0-10 scale) before/after treatment provided by the FICS Chiropractic delegation.*

**Utilisation de la chiropratique lors des 6<sup>e</sup> Jeux mondiaux du sport de 2019 de la Confédération internationale des travailleurs et amateurs du sport (CSIT)**

**Objectifs:** *Décrire l'utilisation de statistiques sur le traitement de chiropratique sportive et les blessures fournies par la délégation de la Fédération Internationale de Chiropratique du Sport (FICS) lors des 6<sup>e</sup> Jeux mondiaux du sport de 2019 de la CSIT en Catalogne (Espagne).*

**Méthodes:** *Cette étude de cas historiques a analysé les rencontres cliniques des participants demandant des services de chiropratique sportive lors de l'événement Jeux mondiaux du sport de 2019. Les données statistiques descriptives comprenaient : les caractéristiques démographiques des participants, le taux d'utilisation (proportion des participants accrédités qui ont demandé un traitement de chiropratique), la fréquence (nombre de séances de traitement par personne), les conditions de chaque sport, le traitement fourni, et l'échelle numérique d'évaluation (ENE) pour l'intensité de la douleur (échelle de 0 à 10) avant et après le traitement fourni par la délégation de chiropratique de la FICS.*

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Conflicts of Interest:

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**Results:** Of a total of 2566 participants, 406 adults (accredited athletes and non-athletes over 18 years who provided informed consent) sought treatment from FICS; the overall utilization rate was 15.8%. We collected 623 forms; 602 met the inclusion criteria (complete treatment records from consenting adults). The FICS delegation provided services at centralized locations servicing 9 of 30 available sports. Primary body regions treated were shoulder (13.9%), neck (13.6%), knee (10.7%), thoracic spine (10.1%), and lumbar spine (10.1%), representing 58.4% of all treatments. The remaining 41.6% included ribs, sacroiliac joint, extremities, and other regions. Treatment modalities included: myotherapy (38.8%), manipulation (34.3%), taping (15.6%), and mobilization (8.2%). Participants receiving chiropractic treatment reported statistically significant pain reduction (average decrease of 2.8 NRS points,  $p < 0.001$ , 95% CI: 2.6-3.0), though the contribution of natural healing processes and concurrent interventions cannot be excluded. Volleyball (49.6%), beach volleyball (49.4%), and tennis (49.1%) showed the highest utilization rates.

**Conclusion:** Participants receiving sports chiropractic treatment reported clinically significant pain reduction, with 90% experiencing immediate improvement. However, the single-arm observational design precludes definitive attribution to chiropractic intervention alone. The utilization rates varied by sport with volleyball, beach volleyball, and tennis showing the highest rates among sports with access to treatment centres. These findings provide valuable insights for future integration of sports chiropractic services at international sporting events.

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**KEY WORDS:** sports injury; chiropractic; multi-sport event; clinical encounters; international competition

**Résultats:** Sur un total de 2 566 participants, 406 adultes (athlètes accrédités et non-athlètes de plus de 18 ans ayant donné leur consentement éclairé) ont demandé un traitement auprès de la FICS; le taux d'utilisation global était de 15,8 %. Nous avons recueilli 623 formulaires; 602 répondaient aux critères d'inclusion (dossiers de traitement complets d'adultes ayant donné leur consentement). La délégation de la FICS a fourni des services dans des endroits centralisés desservant 9 des 30 sports offerts. Les régions principales traitées étaient l'épaule (13,9 %), le cou (13,6 %), le genou (10,7 %), la colonne thoracique (10,1 %) et la colonne lombaire (10,1 %), représentant 58,4 % de tous les traitements. Les 41,6 % restants comprenaient les côtes, les articulations sacro-iliaques, les extrémités et d'autres régions. Les modalités de traitement comprenaient : la myothérapie (38,8 %), la manipulation (34,3 %), des bandages (15,6 %) et la mobilisation (8,2 %). Les participants qui ont reçu un traitement de chiropratique ont déclaré une réduction de la douleur statistiquement importante (diminution moyenne de 2,8 points sur l'ENE,  $p < 0,001$ , intervalle de confiance [IC] à 95 % : 2,6 à 3,0), bien que la contribution des processus naturels de guérison et des interventions simultanées ne puisse être exclue. Le volleyball (49,6 %), le volleyball de plage (49,4 %) et le tennis (49,1 %) ont montré les taux d'utilisation les plus élevés.

**Conclusion:** Les participants recevant un traitement de chiropratique sportive ont déclaré une réduction cliniquement importante de la douleur, 90 % éprouvant une amélioration immédiate. Cependant, limiter les observations à un seul groupe exclut une attribution définitive à l'intervention chiropratique seule. Les taux d'utilisation variaient selon le sport; le volleyball, le volleyball de plage et le tennis présentent les taux les plus élevés parmi les sports ayant eu accès aux centres de traitement. Ces résultats fournissent de précieux renseignements en vue de l'intégration future des services de chiropratique sportive lors d'événements sportifs internationaux.

(JCCA. 2026;70(1):107-118)

**MOTS CLÉS:** blessures sportives, chiropratique, événement multisports, rencontres cliniques, compétition internationale

## Introduction

The primary responsibility of healthcare providers involved in athlete medical services during competition is to protect the health of the athlete.<sup>1</sup> The provision of treatment surveillance provides important epidemiological information and allows the monitoring of the frequency and characteristics of injury.<sup>2-5</sup> While injury surveillance research is relatively common, there are few which evaluate multi-sport games and less which investigate sports chiropractic service provision at these venues.<sup>6-8</sup> Research on utilization of chiropractic services at multi-sport events provides valuable evidence for service integration planning, resource allocation, and understanding of healthcare delivery patterns in international sporting environments.

Sports chiropractors who are part of FICS teams receive post-graduate training in neuromusculoskeletal care for athletes.<sup>9</sup> Federation Internationale de Chiropratique du Sport (FICS) teams are trained to participate within a multi-disciplinary treatment environment as a collaborative, integral component of sports medicine services in contributing a holistic approach to the treatment of the athlete.<sup>10</sup> The objective of this research was to analyze utilization patterns, prevalence of conditions treated, treatment modalities employed, and immediate pain response associated with sports chiropractic clinical encounters provided at the 2019 6th World Sport Games.

The International Workers and Amateurs in Sports Confederation (CSIT) operates as a foundational multi-sports organization. It is built upon principles of tolerance, respect, and intercultural integration through athletic participation. CSIT has maintained International Olympic Committee recognition since 1986; this established framework encompasses 44 national member unions across 35 countries, representing approximately 230 million individual participants.<sup>11</sup> Such organizational breadth provides substantial opportunity for examining sports medicine service delivery across diverse competitive environments.

The CSIT World Sport Games began in 2008 as a biennial competitive platform. The sixth iteration took place in Catalunya, Spain during July 2-7, 2019. This five-day event spanned four geographic locations and accommodated 2203 registered athletes (803 females, 1400 males) alongside 363 credentialed officials across 30 competitive and non-competitive sporting disciplines. Such demo-

graphic diversity presents unique healthcare challenges while offering valuable opportunities for systematic treatment utilization analysis.

The Federation Internationale de Chiropratique du Sport (FICS) is composed of national chiropractic sports councils and individual members. It is recognized as an associate member of the General Assembly of International Sports Federations<sup>12</sup> and in partnership with the International Council on Sport Sciences and Physical Education.<sup>13</sup>

## Methods

### *Study design*

This historical case-series study received research ethics approval from the University of Western States Institutional Review Board (IORG #0001188, July 30, 2021) for retrospective analysis of clinical data originally collected during July 2-7, 2019.

### *Participants*

This historical case-series study evaluated treatment forms of sport chiropractic clinical encounters provided at the 2019 6th World Sport Games (WSG). Participants were limited to 2019 World Sport Games accredited athletes and non-athletes (volunteers, coaches, medical, and officials) over 18 years of age who provided informed consent. A total of 623 clinical encounter forms were recorded by the FICS team (n=2566 total accredited participants). Twenty-one (3.4%) of treatment forms were excluded due to incomplete clinical encounter records by patient or provider, and minors (under the age of consent) were excluded through IRB restriction. Our final analysis included 406 individual patients, with 602 clinical encounters recorded (n=535 athlete encounters, 88.8%; n=67 non-athlete encounters, 11.2%) (Figure 1).

### *Consent process and data collection ethics*

Athletes and credentialed personnel received notification regarding voluntary FICS clinical encounter availability through multiple channels during the event registration process. Participants provided informed consent for clinical treatment and potential research use of anonymized data, as was standard practice for FICS delegations at international sporting events. Formal research ethics approval for retrospective academic analysis was subsequently obtained in July 2021 when academic publication

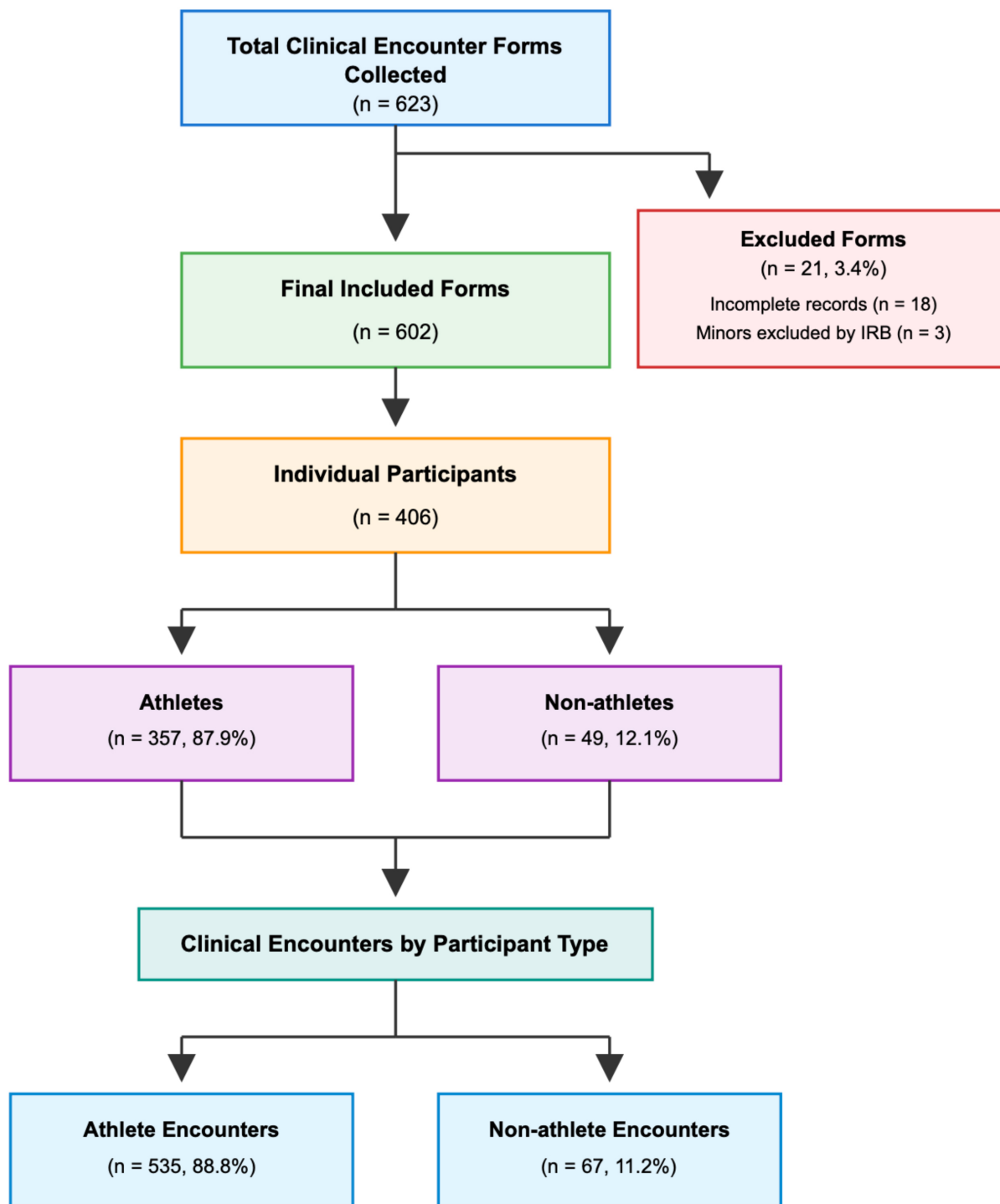


Figure 1.

Study flow diagram showing the selection and categorization of clinical encounter forms from the 2019 6th World Sport Games. The diagram illustrates data exclusion criteria and final participant distribution between athletes and non-athletes, with corresponding clinical encounter frequencies.

was pursued. This chronological sequence represents a study limitation that will be discussed.

**FICS team organization**

FICS selection criteria required specialty training through post graduate sport science certification (ICSSP) through FICS, current basic life support certification (CPR), licensure in the country of residence and valid malpractice coverage within Spain or European Union.

FICS organized a team of 22 doctors (15 male, 7 female) from seven countries. Temporary registration was granted international doctors from the Asociacion Espanola de Quiropractica for the duration of the games. The

team was deployed into three central clinical encounter centres placed at various locations within the same venue complex as competition sites (defined as proximate), contrasting with sports conducted at distant venues requiring transportation (defined as non-proximate) designed to provide inclusive support for nine sports (Athletics, Basketball, Soccer Football, Mamanet, Swimming, Tennis, Volleyball, Beach Volleyball, and others) of 30 sports held at these games (Figure 2). Each of the three central clinical encounter centres was strategically positioned to service multiple sports, collectively providing coverage for nine of the 30 sports at the games. Each provider was required to work daily for the duration of the event.

**FICS Organizational Structure  
2019 6th World Sport Games - Catalunya, Spain**

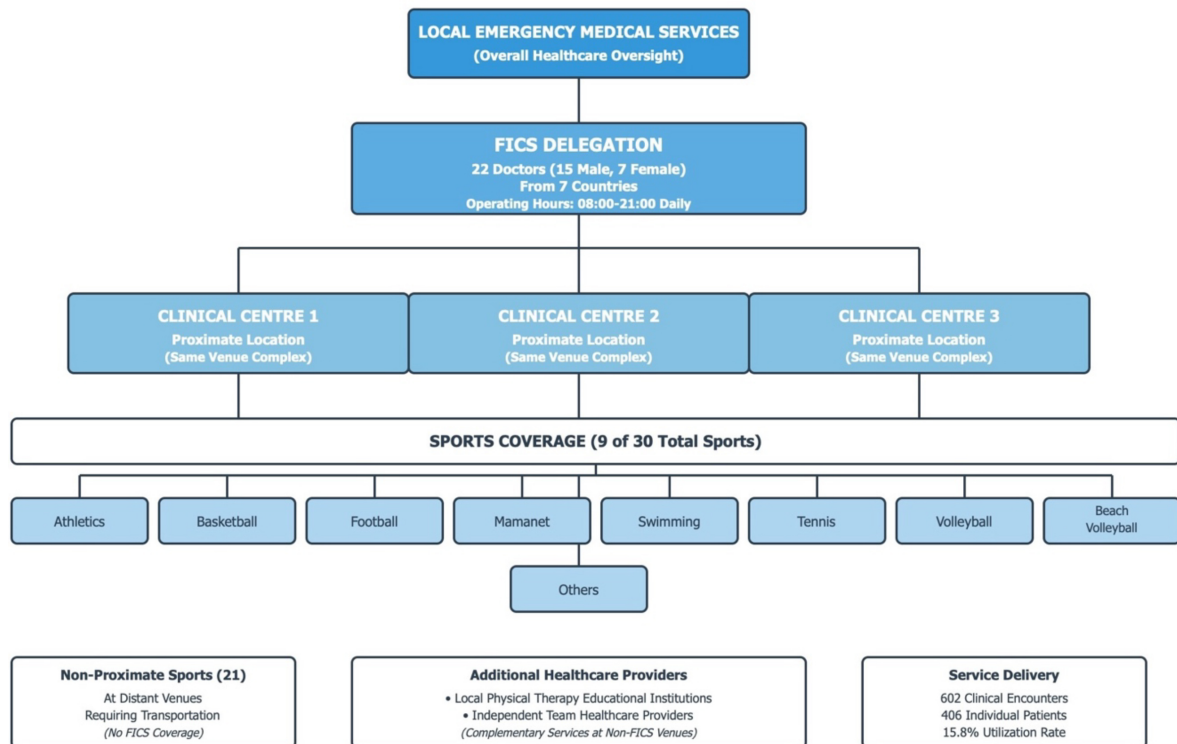


Figure 2.

*FICS Organizational Structure at the 2019 6th World Sport Games. The diagram illustrates the hierarchical healthcare delivery model with local emergency medical services providing overall oversight, the FICS delegation of 22 doctors from seven countries operating through three central clinical encounter centres at proximate venues, and coverage of nine of 30 total sports. The remaining 21 sports at non-proximate venues were serviced by complementary healthcare providers including local physical therapy educational institutions and independent team healthcare arrangements.*

The FICS delegation operated under comprehensive healthcare oversight provided by local emergency medical services. Clinical encounter availability extended daily from 08:00-21:00 hours for major championship-determining sports. This operational framework recognized the temporal demands of international competition while ensuring consistent service delivery.

Local physical therapy educational institutions provided complementary services at venues where FICS deployment was not administratively directed by CSIT leadership. Several member teams additionally maintained independent healthcare provider arrangements. This created a complex multi-provider environment typical of international sporting events, representing a significant study limitation as participants may have received concurrent care from multiple healthcare disciplines.

#### *Provider training and standardization*

All FICS practitioners received standardized training regarding data collection procedures prior to the event. Training included instruction on proper completion of clinical encounter forms, pain assessment protocols using the Numerical Rating Scale, and consistent documentation of treatment modalities and anatomical regions. Despite this standardization effort, implementation across nine treatment centres with multiple healthcare providers introduces inherent variability in data collection procedures and therapeutic approaches, which represents a methodological limitation.

#### *Treatment protocols*

The clinical encounters provided by the FICS contingent were limited to manual therapy for musculoskeletal complaints without the use of modalities or tools to ensure compliance with the regional scope of practice guidelines. Adjunctive clinical encounters included supportive, kinaesthetic, and biomechanical taping. Reported illnesses, trauma incidents and musculoskeletal injuries not amendable to conservative approaches were referred to medical, physical therapy and EMT service providers via immediate clinical encounter triage by FICS providers.

Musculoskeletal conditions amenable to conservative clinical encounters were accomplished through the evaluation of acute variables of somatic kinetic chain dysfunction in the performance of the sport. Individualized manual therapy protocols were used to optimize the ability of

the musculoskeletal system to perform required tasks with optimal structural efficiency and postural control.<sup>14</sup>

#### *Data collection procedures*

This survey tracked sport chiropractic clinical encounters as the athlete or non-athlete voluntarily requested this service. Clinical encounters were defined as all clinical services provided by a FICS team provider including evaluation, treatment, and prophylactic services. Non-athlete groups were comprised of credentialed personnel, team officials, workforce volunteers, press and technical officials. Information for all clinical encounters were manually entered on a paper form by the treating practitioner. The form was anonymized to record each clinical encounter with a coded parameter to protect identifying information. Voluntary informed consent forms were obtained from participants for clinical interventions and intended research use of anonymized data.

Patient contact documentation occurred when subjects received clinical intervention from FICS team members. This occurred irrespective of subsequent competition or training participation consequences.<sup>15</sup> The definition ensured comprehensive capture of healthcare encounters; it maintained consistency with established international sporting event surveillance protocols.

#### *Research protocol*

The clinical encounter form was modified for these games from previous FICS treatment forms utilized in previous multi-sport games, based on established protocols described in Nook *et al.* (2011) and Nook *et al.* (2016).<sup>7,8</sup> On each individual clinical encounter form the FICS provider recorded: the patient's reference number, age, gender, country of accreditation, sport, patient's accredited role such as athlete or non-athlete (coach, official, medical, or volunteer), if the injury prevented event participation, whether it was an initial visit, follow up for continuation of clinical encounters, or follow up for a new complaint.

The mechanism of injury was divided by the incident occurring during participation or practice for the event and if it prevented them from participating. A clinical diagnosis of the injury and categorizing it as acute or persistent in nature. Acute conditions were defined as immediate onset, and persistent conditions were defined as lasting over three weeks in duration. This three-week threshold was selected based on established clinical practice pat-

terns for distinguishing acute from chronic musculoskeletal conditions, though we acknowledge this represents an arbitrary cutoff without specific literature validation.

Sports chiropractic practitioners completed systematic clinical encounter documentation using standardized paper forms during each patient encounter. These instruments captured patient demographic characteristics, injury presentation patterns, and clinical diagnostic assessments. Treatment modality implementation included anatomical region specifications and therapeutic approach categorization. Return-to-participation protocols, medical referral procedures, and pre-treatment/post-treatment Numerical Rating Scale (NRS) measurements for pain assessment were also documented.

Patients who sought clinical encounters received written information about the study including its aims and methods. Prior to rendering clinical encounters, interested patients read and signed a consent form with translator assistance available to limit language barriers. Each individual patient was assigned a unique identifying number to protect confidentiality and allow recognition of patients who returned for additional clinical encounter sessions.

### *Treatment assessment*

The treating FICS provider performed an assessment to determine the appropriate clinical encounter modality for the patient or referral to another medical provider. The body region treated was selected from a list of 20 regions. Clinical encounter modality provided was selected between manipulation (high-velocity low-amplitude), mobilization (passive movement of a joint within its physiological range of motion), myotherapy (including static/dynamic stretching, cryotherapy, myo-manipulation (active, passive, cross (deep) transverse (superficial) friction), and taping (kinesiology, biomechanical, or supportive).

Clinical encounter forms included a pre- and post-clinical encounter Numerical Rating Scale (NRS) to measure patient's pain levels using a 0-10 discrete numerical scale. The NRS scale measured 9.56cm including a range of 0 to 10 numerically, with no pain (0) and severe pain (10) as descriptions.<sup>16</sup> The pretreatment NRS was completed prior to the FICS provider delivering any clinical encounter, and the post clinical encounter NRS was completed immediately by the patient following clinical encounter.

### *Statistical methods*

Data from the completed forms were scanned and entered in Microsoft Excel spreadsheets. We analysed patterns of patient demographics, utilization rates, and clinical encounter characteristics using descriptive statistics. CSIT provided the records for total number of individual athletes and officials from each sport accredited for the WSG 2019. Utilization rates were defined as the proportion of accredited individuals who received clinical encounters out of the total number of individuals who were accredited for a specific sport in an athlete or official role.

We utilized Stata/MP (StataCorp, College Station, TX Version16) to conduct statistical analyses. A paired-samples t-test was used to assess whether pretreatment NRS pain levels differed significantly from post clinical encounter pain levels across all clinical encounters provided by the DCs. Chi squared ( $\chi^2$ ) was used to assess whether the proportion of patients who returned for follow-up visits differed between athletes and non-athletes. 95% confidence intervals were calculated for all pain reduction measurements.

### *Results*

#### *Voluntary utilization of chiropractic clinical encounters*

Of those who voluntarily requested chiropractic clinical encounters, completed a consent form, and agreed to participation in this study, 602 clinical encounter forms met the inclusion criteria from 406 individual participants. A total of 535 (88.8%) clinical encounters were for athletes and 67 (11.2%) were for non-athletes. A total of 406 individuals sought clinical encounters, with 142 having multiple clinical encounters. Of the total accredited athletes (n=2203), 357 (16.2%) sought chiropractic clinical encounters at the WSG 2019.

Table 1.  
*Patient demographics (n=406 individuals).*

Role	Sample Size (n)	Age, Mean (SD)
Athletes	357	35.2 (10.3)
Non-Athletes	49	
• Coaches	18	48.7 (9.9)
• Officials	17	47.4 (13.8)
• Volunteers	6	34.2 (13.5)
• Medical**	4	[Age data not available]
• Other	4	[Age data not available]

**Athlete utilization by sport**

The utilization rates for athletes varied across sports and venues. The highest chiropractic clinical encounter utilization rates were found among athletes from Volleyball (49.6%), Beach Volleyball (49.4%), Tennis (49.1%), Mamanet (47.4%), Basketball (27.9%), Swimming (15.8%), Athletics (15.6%) and Football (2.1%). Proximity of FICS

clinical encounter centres to competition venues (defined as same venue complex) demonstrated significant association ( $\chi^2 = 42.3, p < 0.001$ ) with increased utilization rates compared to sports at distant venues requiring transportation. This geographic accessibility factor represents a critical determinant in healthcare service delivery effectiveness.

Table 2.  
*Athlete utilization of chiropractic clinical encounters by sport.*

Sport	No. Accredited Athletes	First-Visit Clinical Encounters	Follow-Up Clinical Encounters	Total Clinical Encounters	% Utilization Rate	% Of Total Athlete Clinical Encounters
Athletics	186	29	9	38	15.6	7.1
Basketball	140	39	14	53	27.9	9.9
Beach volleyball	89	44	28	72	49.4	13.5
Football	188	4	1	5	2.1	0.9
Mamanet	116	55	19	74	47.4	13.8
Swimming	297	47	15	62	15.8	11.6
Tennis	53	26	14	40	49.1	7.5
Volleyball	141	70	74	144	49.6	26.9
Other sports	1193	40	7	47	3.4%	8.8
Total	2203	354	181	535	--	100

Table 3.  
*Non-athlete utilization of chiropractic clinical encounters*

Roles	No. Accredited	First-Visit Clinical Encounters	Follow-Up Clinical Encounters	Total Clinical Encounters	% Utilization Rate	% Of Total Non-Athlete Clinical Encounters
Coach	--	12	6	18	--	26.9
Medical	--	4	0	4	--	6.0
Official	363	11	6	17	4.7	25.4
Volunteer	--	6	0	6	--	9.0
Other	--	4	0	4	--	6.0
Total	--	37	12	49	--	73.1

Note: The remaining 18 non-athlete clinical encounters (total 67 – shown 49 = 18) represent multiple encounters by the same individuals already counted in the first-visit category.

### *Non-athlete utilization by role*

Non-athlete sports chiropractic clinical encounter utilization rates were only available for officials, as we did not have complete population data for all accredited non-athletes with other roles at the WSG 2019. The utilization rate for officials was 4.7% (17 clinical encounters from 363 accredited officials). The non-athletes who received the largest number of clinical encounters were coaches (18 clinical encounters, 26.9% of non-athlete clinical encounters), officials (17 clinical encounters, 25.4%), volunteers (6 clinical encounters, 9.0%), medical personnel (4 clinical encounters, 6.0%), and other roles (4 clinical encounters, 6.0%). Total non-athlete clinical encounters: n=67.

### *Follow-up clinical encounters for athletes and non-athletes*

A Chi-squared analysis revealed no statistically significant difference between the proportion of athletes (33.8%, 181/535 clinical encounters) and non-athletes (26.7%, 18/67 clinical encounters) who sought follow-up clinical encounters after their initial visit ( $\chi^2 = 1.24$ ,  $p = 0.27$ ).

### *Prevalence of acute and persistent conditions*

There were differences between athletes and non-athletes in the prevalence of acute and ongoing conditions. For accredited athletes presenting for sports chiropractic clinical encounters, 313 (58.5% of 535 athlete clinical encounters) presented with acute conditions, 148 (27.7%) presented with persistent/ongoing conditions, with 74 (13.8%) having unspecified condition duration. For non-athletes, 18 (26.9% of 67 non-athlete clinical encounters) presented with acute conditions, 39 (58.2%) presented with persistent/chronic conditions, with 10 (14.9%) having unspecified condition duration.

### *Treatment region across all athletes*

The most frequently treated regions across all clinical encounters (n=602) were the shoulder (84 clinical encounters; 13.9%), neck (82 clinical encounters; 13.6%), knee (65 clinical encounters; 10.7%), thoracic spine (61 clinical encounters; 10.1%), and lumbar spine (61 clinical encounters; 10.1%). For extremities, the most frequently treated regions were the shoulder (84 clinical encounters; 13.9%) and the knee (65 clinical encounters; 10.7%).

### *Treatment modality across all clinical encounters*

The most frequently used clinical encounter modality across all clinical encounters (n=602) was myotherapy (388 applications, 38.8%), followed by manipulation (343 applications, 34.3%), taping (156 applications, 15.6%), mobilization (82 applications, 8.2%), and other (30 applications, 3.0%). Multiple clinical encounter modalities were counted when performed in an individual clinical encounter session. Total modality applications: n=999.

### *Clinical encounter reduction of reported pain*

An average decrease in reported pain by patients seeking sports chiropractic clinical encounters was 2.8 NRS points after clinical encounters (95% CI: 2.6-3.0,  $p < 0.001$ ). Pain reduction measurements demonstrated regional variation in clinical encounter effectiveness. Shoulder complex interventions achieved 3.1 points reduction (95% CI: 2.8-3.4); cervical spine clinical encounters yielded 3.0 points reduction (95% CI: 2.7-3.3); thoracic spine management produced 2.9 points reduction (95% CI: 2.6-3.2). These represented the most substantial improvements across anatomical regions.

Among sports categories with adequate statistical sampling (n≥40 clinical encounters), volleyball demonstrated 3.2 points reduction (95% CI: 2.9-3.5), beach volleyball achieved 3.0 points reduction (95% CI: 2.6-3.4), while swimming showed 2.9 points reduction (95% CI: 2.5-3.3).

An immediate pain reduction was experienced in 482 individuals receiving clinical encounters (90.1% of 535 athlete clinical encounters), 18 coaches (100% of coach encounters), 16 officials (94.1% of official encounters), and 6 volunteers (100% of volunteer encounters). Including both athletes and non-athletes, 522 clinical encounters (86.7% of 602 total clinical encounters) resulted in immediate pain reduction following sports chiropractic clinical encounters.

### *\*\*Utilization analysis by nationality*

Utilization analysis revealed distinct national participation patterns. French athletes received 107 clinical encounters, Mexican participants 74 clinical encounters, Italian competitors 59 clinical encounters, and Austrian athletes 53 clinical encounters. These represented the highest FICS service utilization rates by nationality at the Games.\*\*

Sport-specific utilization patterns identified volleyball (26.9% of total athlete clinical encounters), Mamanet (13.8%), and beach volleyball (13.5%) as the disciplines with greatest clinical encounter volume requirements. These patterns reflect both accessibility factors and sport-specific injury susceptibility.

## Discussion

We provide the first utilization data for chiropractic services at the CSIT Games. The results show that out of 2566 accredited participants, 406 (15.8%) utilized the FICS delegation. The most frequently treated body regions were the shoulder (13.9%), neck (13.6%), knee (10.7%), thoracic spine (10.1%), and lumbar spine (10.1%). The most frequent clinical encounter modalities were myotherapy (38.8%), manipulation (34.3%), taping (15.6%), and mobilization (8.2%). Participants receiving chiropractic clinical encounters reported statistically significant pain reduction (average decrease of 2.8 NRS points,  $p < 0.001$ , 95% CI: 2.6-3.0), with 86.7% of all clinical encounters resulting in immediate pain reduction. However, the single-arm observational design precludes definitive attribution to chiropractic intervention alone.

These findings document injury patterns and healthcare utilization specific to this event and contribute to the understanding of sports chiropractic service delivery in multi-sport international competitions. The study documents the integration of sports chiropractic as part of a multi-disciplinary sports medicine team.<sup>17,18</sup> This role focuses on managing acute, overuse and ongoing musculoskeletal complaints that may affect performance or limit participation in practices or competition.<sup>19</sup>

Utilization rates among sports with immediate geographic proximity to FICS clinical encounter facilities substantially exceeded those of sports conducted at distant competition venues. Volleyball achieved 49.6% utilization, beach volleyball reached 49.4%, and tennis attained 49.1%. This geographic accessibility factor emerges as a primary determinant of clinical encounter utilization patterns. It highlights the critical importance of strategic healthcare service placement within multi-venue international competitions.

At the 6th CSIT World Sport Games chiropractic utilization was 15.8%. This is consistent with the findings of chiropractic services in other multinational, multisport games.<sup>7,8,20</sup> The proportion of clinical encounters deliv-

ered between athletes and non-athletes were 535 (88.8%) for athletes and 67 (11.2%) for non-athletes.

Previous multi-sport international competitions have documented comparable utilization patterns across similar competitive environments. Nook demonstrated utilization rates of 15.31% for athletes and 16.00% for non-athletes at the 2009 World Games.<sup>7</sup> Subsequent findings showed 18.1% for athletes and 9.8% for non-athletes at the 2016 World Games.<sup>8</sup> The current investigation's findings align consistently with these established patterns. This suggests reproducible utilization trends within international multi-sport competitive settings.

Participants receiving sports chiropractic clinical encounters reported an average decrease in pain of 2.8 NRS points (95% CI: 2.6-3.0,  $p < 0.001$ ).<sup>21</sup> The observed 2.8 NRS point reduction exceeds the established minimal clinically important difference (MCID) for numerical rating scales. The MCID ranges between 1-2 points for musculoskeletal pain conditions. This finding indicates that clinical encounter interventions achieved clinically meaningful improvements for participating athletes and support personnel within this competitive environment. However, given the absence of a control group and the multi-provider healthcare environment, these improvements cannot be definitively attributed to chiropractic intervention alone.

## Strengths and limitations

The significant strength of this study is the collection of analysed data on chiropractic utilization during a World Sport Games for the first time. The percentage of useable data (96.6% completion rate) of consultation records enhances the reliability of our findings. Another strength is that information was collected by credentialed healthcare providers rather than self-reported.

Implementation of nine clinical encounter centres with multiple healthcare providers introduces inherent variability in data collection procedures and therapeutic approaches. This occurred despite standardized documentation forms, clinical encounter protocols, and provider training. The decision to maintain comprehensive multi-centre coverage represented a deliberate methodological trade-off. It prioritized clinical service availability over methodological precision while balancing procedural standardization with complete event coverage.

FICS clinical encounter centres were not evenly dis-

tributed across all sports or competition locations as directed by CSIT administration. This may have affected the utilization of sports chiropractic clinical encounters. Additionally, a limited number of accredited FICS providers may have influenced participant access to clinical encounters and recording of data.

Concurrent provision of services by local physical therapy educational institutions and independent team healthcare providers existed alongside FICS operations. However, this investigation focused exclusively on FICS-delivered clinical encounters. No systematic data collection occurred regarding participants who potentially received interventions from multiple provider categories during the competition period. This limitation restricts determination of isolated chiropractic clinical encounter effects. The broader multi-provider healthcare environment characteristic of international sporting events creates complex clinical encounter attribution challenges and represents a fundamental study limitation.

The Numerical Rating Scale (NRS) scoring was offered immediately after clinical encounters with no long-term follow-up. The nature of a multi-sport international event does not allow for long-term follow-up beyond event dates. Current methodology employed immediate post-clinical encounter NRS assessment without extended follow-up evaluation. Multi-sport international competition constraints preclude long-term outcome monitoring beyond event duration parameters. This study quantified pain reduction through NRS measurement but did not incorporate direct functional improvement assessment or athletic performance metrics.

Pain reduction demonstrates statistical significance and exceeds established MCID thresholds. However, the relationship between pain improvement and subsequent athletic performance remains inferential rather than directly established. The single-arm observational design without control group prevents definitive attribution of pain reduction to chiropractic intervention, as improvements may result from natural healing processes, concurrent interventions from other providers, or placebo effects. This represents a significant limitation in determining clinical encounter effectiveness.

Paper based data collection is prone to missed values as evidenced by 21 (3.4%) excluded records. Time necessary to complete the paper records may limit the providers time spent with participants.

The chronological sequence of data collection (July 2019) and formal research ethics approval (July 2021) represents a methodological limitation. While participants provided informed consent for clinical treatment and potential research use of anonymized data as per standard FICS protocol, the retrospective nature of formal academic research approval limits the study design options.

Subsequent investigations should incorporate objective functional assessment measures and performance metrics. This would establish direct correlations between chiropractic interventions and athletic outcomes. Implementation of digital electronic medical record systems rather than paper-based documentation is recommended. Such systems would enhance healthcare delivery efficiency and facilitate comprehensive data capture accuracy.

Future studies must address the multi-provider clinical encounter environment typical of international competitions. Systematic tracking of all healthcare encounters would provide clearer attribution of clinical encounter effects and optimize integrated care delivery models. Prospective study designs with control groups would strengthen causal inference regarding treatment effectiveness.

## Conclusion

The collaboration between the Federation Internationale de Chiropratique du Sport (FICS) and the International Workers and Amateurs in Sports Confederation (CSIT) at the 2019 6th World Sport Games provides valuable insights into sports chiropractic utilization patterns. This study documents that sports chiropractic clinical encounters were utilized by 15.8% of participants, with significantly higher rates among sports with proximal access to clinical encounter centres. Participants receiving chiropractic interventions reported clinically significant pain reduction (average decrease of 2.8 NRS points, 95% CI: 2.6-3.0), with 86.7% of clinical encounters resulting in immediate improvement. However, the single-arm observational design precludes definitive attribution of these improvements to chiropractic intervention alone. These findings provide descriptive baseline data regarding utilization patterns and immediate patient-reported outcomes that may inform future service integration planning for sports chiropractic services as a component of comprehensive sports medicine provision at international multi-sport events.

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# Mechanical diagnosis and therapy in chronic postpartum isolated coccygeal pain: a case report

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**Objective:** *To describe the use of Mechanical Diagnosis and Therapy in evaluating and treating a patient with chronic postpartum isolated coccygeal pain.*

**Clinical features:** *A 30-year-old female presented with isolated coccygeal pain that began after a vaginal birth 4 months prior. Aggravating factors included sitting and standing upright. She also expressed fear of transitioning from sitting to standing.*

**Intervention/outcome:** *A directional preference for lumbar extension with right lateral flexion was identified, leading to a diagnosis of lumbar derangement and initiation of reductive forces. At follow-up, she maintained reduction and reported periods of being pain free with less fear of movement. Subsequently,*

**Diagnostic et thérapie mécaniques dans la douleur coccygienne isolée chronique post-partum: un rapport de cas**

**Objectif:** *Décrire l'utilisation du diagnostic et de la thérapie mécaniques dans l'évaluation et le traitement d'un patient souffrant de douleur coccygienne isolée chronique post-partum.*

**Caractéristiques cliniques:** *Une femme de 30 ans s'est présentée avec une douleur coccygienne isolée qui a commencé après une naissance vaginale il y a quatre mois. Les facteurs aggravants comprenaient les actions de s'asseoir et de se lever à la verticale. Elle a également exprimé craindre d'avoir à passer de la position assise à la position debout.*

**Intervention et résultat:** *Une préférence directionnelle pour l'extension lombaire avec une flexion latérale vers la droite a été identifiée, menant à un diagnostic de déplacement lombaire et d'initiation de forces réductrices. Lors du suivi, elle a maintenu la réduction et a déclaré des périodes d'absence de douleur avec moins de crainte de mouvement. Par la suite, des progressions*

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Conflicts of Interest:

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force progressions were implemented. By visit 6, she was discharged with symptom resolution and functional improvement.

**Summary:** *This case demonstrates the utility of applying the principles of Mechanical Diagnosis and Therapy in the evaluation and treatment of a patient with chronic postpartum isolated coccygeal pain who failed previous treatments.*

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**KEY WORDS:** physical therapy modalities; chiropractic; pelvic pain; classification; exercise therapy; mechanical diagnosis and therapy

## Introduction

Coccydynia, or tailbone pain, is a condition characterized by pain in the coccyx region.<sup>1</sup> It is often exacerbated by sitting, leaning back while seated, or transitioning from sitting to standing.<sup>2</sup> Pain may also be worsened with defecation or sexual intercourse.<sup>2</sup> The exact prevalence of coccydynia is unknown, but it is more common in women than men.<sup>2</sup> It is present in nearly 50% of women with pelvic pain and in women presenting with coccydynia up to 7.3% have postpartum coccydynia.<sup>3,4</sup>

Common etiologies include fracture or dislocation due to direct trauma from falls or childbirth and pelvic floor dysfunction.<sup>1</sup> Treatment for coccydynia typically consists of physical therapy, pelvic floor rehabilitation, intrarectal manipulation, utilization of donut cushions while sitting and use of nonsteroidal anti-inflammatory medication (NSAID).<sup>5-7</sup> In patients that are unresponsive to conservative care, interventional procedures such as epidural steroid injections, ganglion impar blocks, or radiofrequency ablations and surgical options such as coccygectomy may be considered.<sup>5,6</sup>

The McKenzie method of Mechanical Diagnosis and Therapy (MDT) is a validated and reliable classification-based system, when implemented by a credentialed or diplomate level clinician, designed to assess and treat spinal and extremity musculoskeletal conditions.<sup>8,9</sup> This system is not reliant on pathoanatomical findings and involves a mechanical examination that assesses symp-

de forces ont été mises en œuvre. À la sixième visite, elle a été libérée en raison de la résolution des symptômes et de l'amélioration fonctionnelle.

**Résumé:** *Ce cas démontre l'utilité d'appliquer les principes de diagnostic et de thérapie mécaniques dans l'évaluation et le traitement d'un patient atteint de douleur coccygienne isolée chronique post-partum qui n'a pas répondu aux traitements antérieurs.*

(JCCA. 2026;70(1):119-131)

**MOTS CLÉS:** modalités de thérapie physique, chiropratique, douleur pelvienne, classification, rééducation par l'exercice, diagnostic et thérapie mécaniques

tomatic and mechanical responses via a response-based repeated movement assessment.<sup>10</sup> A response-based repeated movement assessment test the symptomatic and mechanical responses to repetitive or sustained mid-range and end-range movements of the spine or afflicted joint.<sup>11,12</sup> Responses to such movements allow for the classification of musculoskeletal complaints into either categories of derangement syndrome, dysfunction syndrome, postural syndrome, or other.<sup>11-13</sup> Treatment is then tailored to the specific classification, often involving directional preference exercises that aim to centralize pain and improve function. Furthermore, the system emphasizes active self-management of the patient's condition, recognition of psychosocial factors and discourages reliance on the clinician and passive care options.<sup>10,14</sup> An overview of the approach to care with definitions of terminology utilized within the MDT system are detailed in Figure 1.

The utilization of MDT has not yet been sufficiently examined as an option for the assessment or management of coccydynia. With this case, we aim to expand on previously established findings that the spine can produce referred pain symptoms without local spinal pain symptoms.<sup>15</sup> This concept has been demonstrated in upper and lower extremity isolated joint pain originating from the cervicothoracic and lumbar spine respectively.<sup>15</sup> Additionally, it has been demonstrated in non-cardiac chest pain originating from the cervicothoracic spine.<sup>16</sup> This

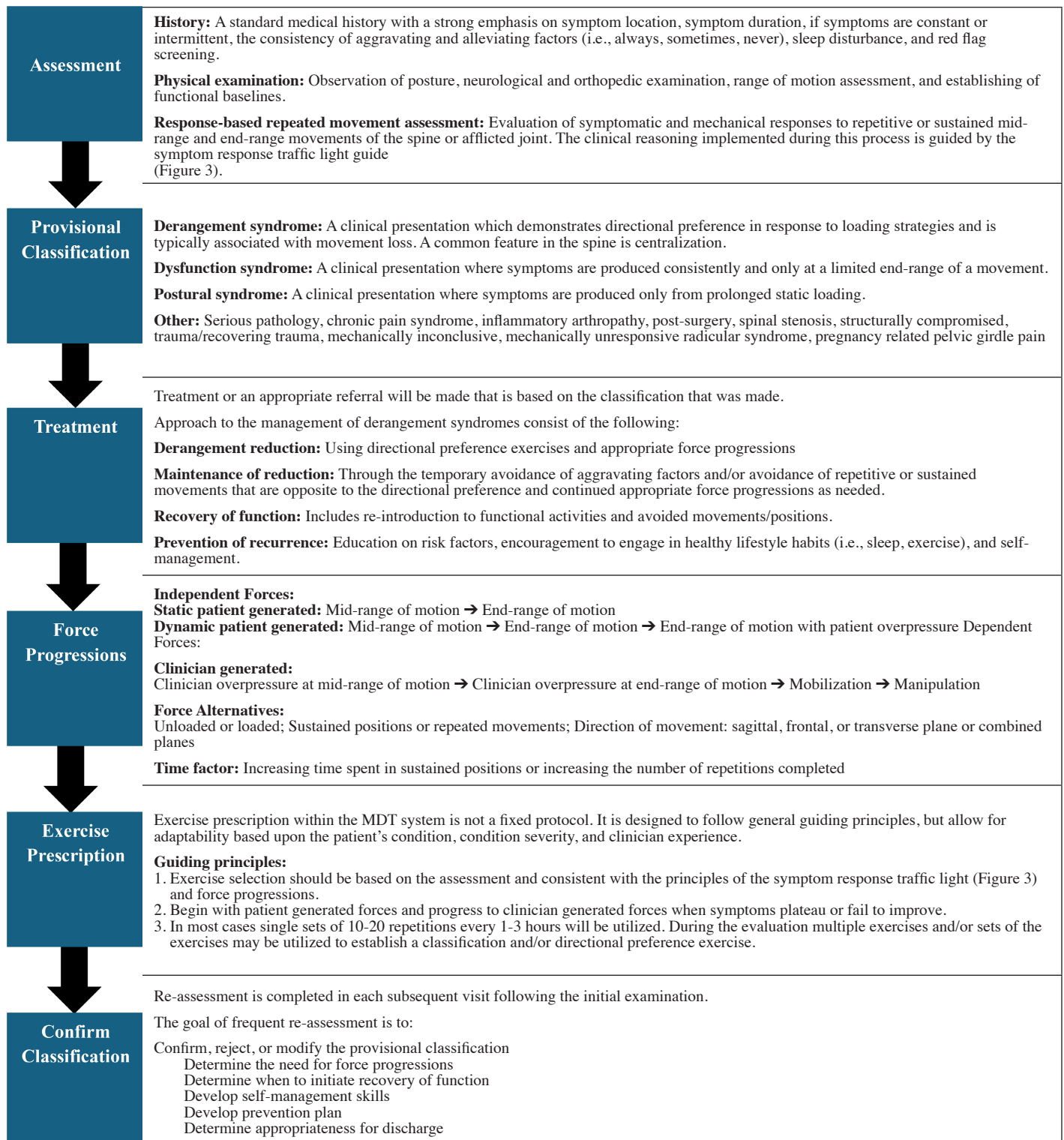


Figure 1.  
Overview of the Mechanical Diagnosis and Therapy approach.10-12

case describes how the principles of MDT assisted in identifying referred pain from the lumbar spine as a likely pain generator in a case of chronic postpartum isolated coccygeal pain who failed previous treatments.

### Case Presentation

A 30-year-old female presented with isolated coccygeal pain that started 4 months prior following a vaginal delivery (Figure 2). The care for this patient took place within a hospital-based healthcare system that utilizes EPIC, an electronic health record (EHR) keeping system. This EHR is utilized by all healthcare providers within this healthcare system to document patient encounters. This allowed for a detailed chart review of the EHR to be conducted prior to her initial visit. The chart review revealed that the delivery occurred without complications, and no episiotomy was required. During her six-week follow-up with her gynecologist she was referred to pelvic

floor therapy for her coccygeal pain. This gynecological encounter revealed no diagnosis of pelvic floor dysfunction. She then completed 4 weeks of pelvic floor physical therapy which consisted of pelvic floor and core strengthening, diaphragmatic breathing, coccyx mobilization, and internal and external soft tissue mobilization. During this time, she also met with a family medicine nurse practitioner who recommended the utilization of NSAIDs, a donut cushion, and made a referral to a pain management specialist. In the consultation with the pain management specialist, it was noted that there was only focal tenderness over the coccyx and no tenderness to the lumbar paraspinal musculature or sacroiliac joints. A referral was then made for chiropractic care and a recommendation for a sacrococcygeal ligament injection pending her response to chiropractic care. The chiropractor she was referred to was credentialed in MDT with the McKenzie Institute USA.

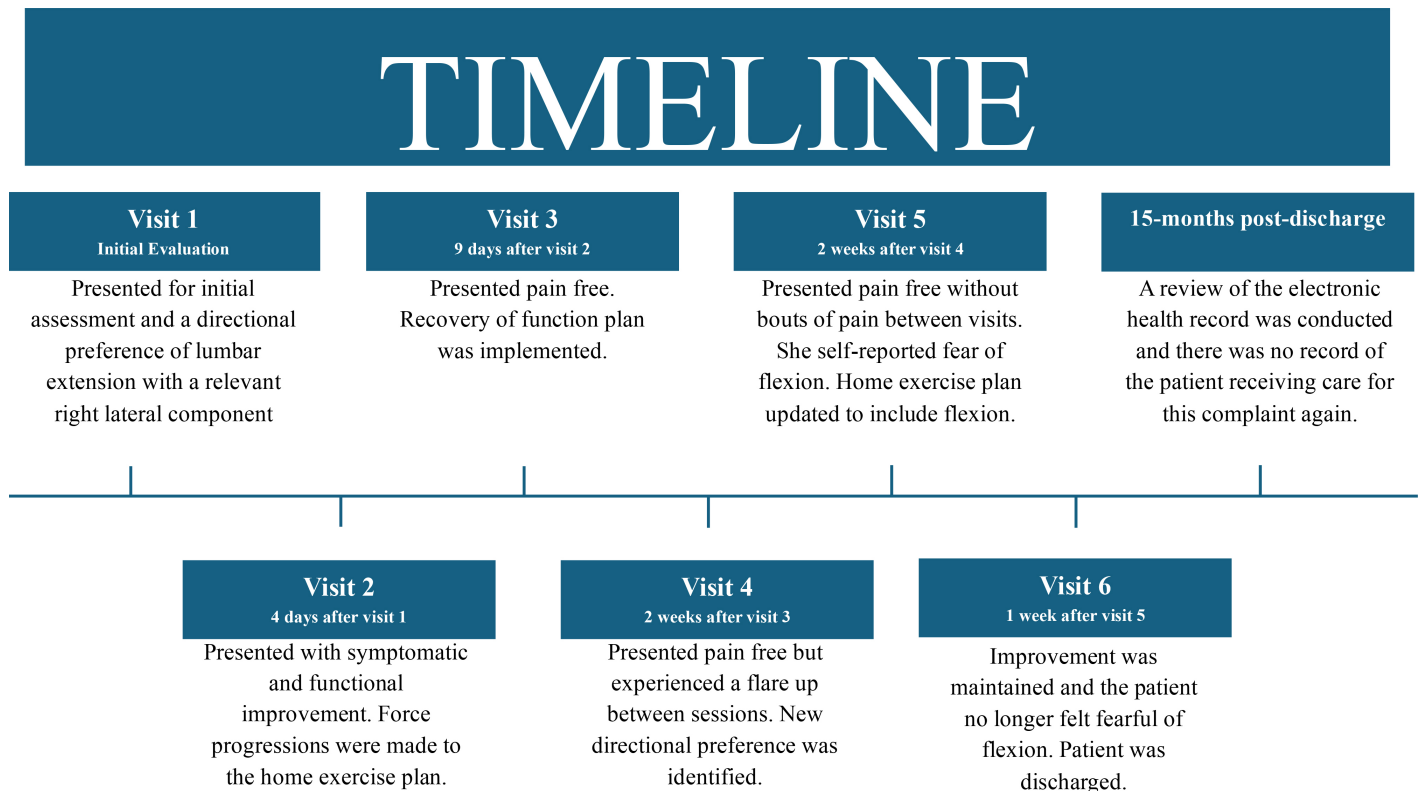


Figure 2.

Timeline of patient management from initial presentation to discharge with a brief synopsis of progress at each time point.

### *Initial visit*

At presentation of her initial chiropractic visit, her pain was a 4/10 on an 11-point Likert Numerical Pain Rating Scale (NPRS) and ranged from a 2/10 at its best to a 7/10 at its worst (0 being no pain, 10 being worst pain).<sup>17</sup> She described the pain as a constant sharp achy pain and stated, “it felt as if her sacral region was being pulled apart”. Aggravating factors included prolonged sitting, transitioning from sitting to standing, and contracting her glutes. Alleviating factors included being bent forward. When questioned further on the pain with transition from sitting to standing, she clarified that there was only coccyx pain and no lower back pain. Additionally, she reported feeling fearful of having to stand up after sitting.

During the intake she completed a Patient Specific Functional Scale (PSFS) and a Yellow Flag Risk Form (YFRF).<sup>18,19</sup> On her PSFS, she reported having an impaired ability to “sit in a hard back chair”, “stand for long periods”, and “feed her baby in the rocker” with impairment scores of 3/10, 8/10, and 3/10 respectively (0-10; 0= completely unable to perform activity, 10= able to perform activity fully at the same level as before complaint). On the YFRF, she scored a 38/130 indicating that she was at a low risk for psychosocial and pain related disability risk factors.

### *Examination and diagnosis*

Consistent with the principles of MDT, physical examination started with establishing symptomatic and mechanical baselines.<sup>11</sup> Symptomatic baselines are established from the history. Mechanical baselines are typically based on movement (i.e., range of motion or quality of movement) and functional activities or tasks.<sup>11</sup> When combined with the rest of the clinical examination, establishing baselines is intended to inform the clinician of the patient's load tolerances, movement tolerances, and potential MDT classification.<sup>11,12</sup> It also aids in choosing a starting point for the response-based repeated movement assessment.<sup>11,12</sup>

In this case it was observed that attempts to sit upright were not tolerable and forward flexion was required to tolerate sitting during the history intake, the ability to sit erect in a chair was established as a functional baseline. Range of motion baselines were established with active range of motion (AROM) testing (Table 1). AROM deficits of the lumbar spine with symptom provocation

were identified. Lumbar extension and right-side glide demonstrated a moderate loss and mild loss of AROM respectively. Both caused an increase in coccygeal pain, concordant with the chief complaint. Lumbar flexion and left side glide were full, with no effect on symptoms. Additionally, an extension-rotation test to the right was provocative of symptoms and not provocative on the left.

After establishing symptomatic and mechanical baselines and clinically correlating that information with her history, several things were determined. She had an intolerance to extension-based movements and an intolerance for loads in a seated or standing position (i.e., inability to sit erect, increased pain when transitioning from sitting to standing, and moderate loss of lumbar extension AROM). It was also concluded that the most likely classification would be derangement or other, based on the pain being constant. Both classifications of dysfunction and postural can only present with intermittent pain.<sup>11</sup>

It was selected to begin the response-based repeated movement assessment with testing the response to repeated end-range extension in lying (REIL) for 10 repetitions (Table 2). REIL was selected for two reasons. The first reason was that if a directional preference was present, it would most likely be extension based. Within the MDT system directional preferences will often be identified in the direction of greatest movement loss.<sup>11,12</sup> The second reason being that it was demonstrated that extension in sitting (i.e., sitting erect) and standing were not tolerated well by the patient and according to the force progression principles of MDT (Figure 1), patient generated movements in an unloaded position are of lower force than loaded movements.<sup>11,12</sup> Therefore, opting for an extension based movement in lying was hypothesized to be a more tolerable starting point for the patient. The 10 repetitions of REIL resulted in an increase in symptoms during the performance of the exercise that was no worse after completion. Within the MDT system's symptom response traffic light guide (Figure 3) this pain response is designated as an amber light, indicating that force progressions (i.e., more repetitions, load, or duration) or alternatives would be appropriate.<sup>12</sup> Subsequently, 10 more repetitions of REIL were performed, which again yielded the same response. Based on the AROM baseline of coccygeal pain being increased during right side glide AROM and the provocative right sided extension-rotation

tion test, movement testing was progressed to REIL with her hips off center to the left for 10 repetitions (Table 2). This resulted in her pain decreasing during the exercise which remained better after. This pain response was designated as a green light and suggested the presence of a directional preference for extension with a relevant right lateral component. Seeking continued pain reduction, this was followed by three more sets of 10 repetitions which did result in continued pain reductions. After completing the exercise, her functional baselines were re-evaluated, and she was asked to attempt sitting erect in the chair. She was now able to sit erect without increased pain.

Based on the response of symptom reduction and functional improvement following testing of REIL with hips off center to the left, a provisional diagnosis of a lumbar derangement with a relevant right lateral component was made. A home exercise plan (HEP) of REIL with hips off center to the left for 15 repetitions, six-to-eight times per day was recommended. Consistent with the principles of MDT, education on temporary avoidance of lumbar flexion was provided as this is would be expected to pot-

entially worsen her pain symptoms as it is the opposite direction of her demonstrated directional preference.<sup>11,20</sup> Additionally, education on posture modification through the utilization of a McKenzie lumbar roll to promote lumbar extension while sitting was provided. To avoid unintentionally promoting maladaptive fear avoidance of flexion, it was reiterated that avoidance of flexion is only temporary.

*Follow-up*

*Visit 2*

Four days later, she returned to the clinic reporting compliance with the HEP, a NPRS score of 2/10, and that she no longer felt fearful of transitioning from sitting to standing. AROM and functional baselines from the initial visit were reassessed. The new AROM baselines were a mild loss of lumbar extension that no longer caused symptom provocation and full lumbar flexion, right side glide, and left side glide motions with no symptom provocation. The improved tolerance for sitting achieved during the last visit was maintained. To continue progressing reductive forces, tolerance to repetitive extension in standing

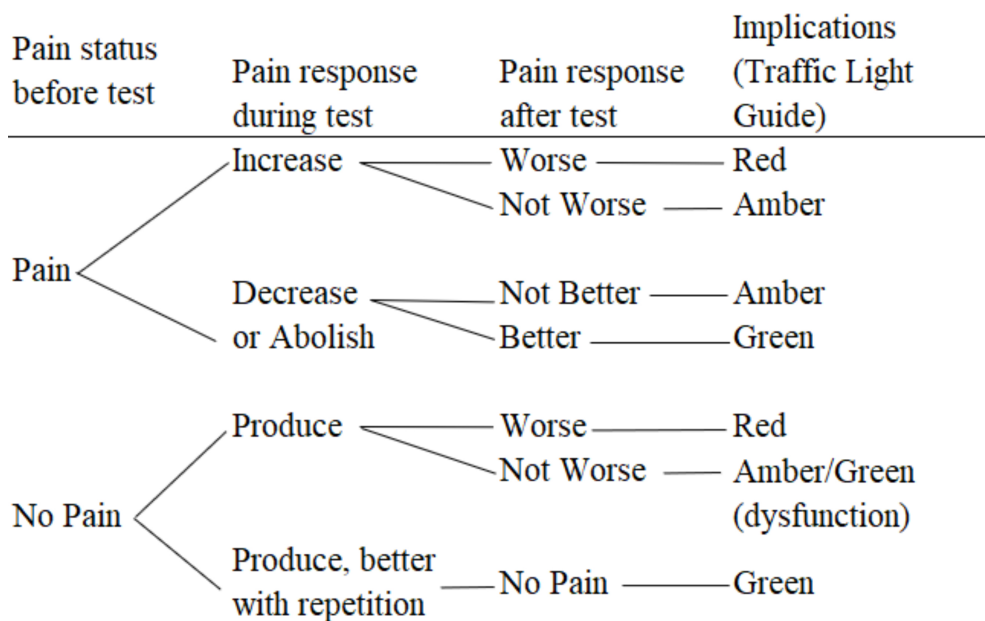


Figure 3. Symptom response traffic light guide<sup>12</sup>.

Table 1.  
Baseline range of motion assessment.





Direction (Lumbar)	Range of Motion	Symptom Response
Extension 	Moderate Loss	Increased Coccyx Pain
Flexion 	Full	No Effect on Coccyx Pain
Right Side Glide 	Mild Loss	Increased Coccyx Pain
Left Side Glide 	Full	No Effect on Coccyx Pain

Table 2.  
Summary of initial response-based repeated movement assessment.

Movement Testing	Sets and reps	Symptomatic Response		Functional Response
		During	After	
<p>Repeated Extension in Lying</p> 	2 sets of 10 reps	Increase	No Worse	No Effect
<p>Repeated Extension in Lying with Hips off Center Left</p> 	4 sets of 10 reps	Decrease	Better	Could sit erect more tolerably

(REIS) over a fulcrum was tested (Figure 4). She responded positively with a reduction in pain and increased AROM into extension. Her HEP was updated to REIS over a fulcrum for 10 repetitions, six times per day and

REIL with hips off center to the left was discontinued. Based on the maintenance of improvement from the initial visit and continued improvement established at follow-up, the provisional diagnosis was confirmed.



Figure 3.

*Repetitive extension in standing over a fulcrum*

### Visit 3

Nine days later, she presented pain free, with intermittent periods of a 1/10 pain and continued compliance with the HEP. Lumbar AROM assessment demonstrated full and pain free motion in all directions. Considering the continued progress, a recovery of function plan was implemented. To guide the recovery of function, a single-leg bridge with leg extension was performed (Figure 5).



Figure 4.


Single-leg bridge

gle-leg bridge with leg extension was performed (Figure 5). The single-leg bridge with leg extension was used as a functional assessment to evaluate stabilizing strategies utilized by the patient. During this testing it was noted that she had difficulty controlling her body in the transverse and sagittal planes. Subsequently, a HEP (Table 3) targeting these deficits was recommended to be completed one-to-two times per day in addition to the previously established HEP.

### Visit 4

Two weeks later, she returned for care pain free and reported continuing to be predominately pain free with intermittent periods of a 1/10 pain. However, she reported that she was not compliant with the HEP and had an episode of a minor flare after a 3-hour car ride. In response to the flare, she reinitiated the HEP which resulted in symptom reduction. Additionally, she reported that when the pain was present it was on the left side of the coccyx. AROM baselines were reassessed. All lumbar movements were full and pain free. However, an extension-rotation test to the left was provocative of her 1/10 left sided coccyx pain and not provocative when completed on the right. This was opposite to her presentation at the initial visit. Further investigation with a response-based repeated movement assessment was conducted utilizing the extension-rotation test as the mechanical baseline. Testing began with 10 repetitions of REIL with the hips off center to the right. The response to this was not provocative of symptoms and did not change the extension-rotation test results. A progression of forces was implemented and 10 repetitions of REIL with the hips off center to the right with the utilization of a belt for overpressure were completed. There was no symptom provocation during this exercise. Upon completion of the force progressed exercise, the extension-rotation test was no longer provocative of symptoms. Improvement in the extension-rotation test was used to indicate the presence of a new directional preference to extension with a relevant lateral component to the left. She was then taught how to implement REIL with the hips off center to the right with belt overpressure at home. The HEP was updated to 10 repetitions of REIL with the hips off center to the right with belt overpressure followed by 10 repetitions of REIS over a fulcrum 3-5 times per day and continuation of the lumbopelvic exercises one-to-two times per day.

Table 3.  
Home exercise plan.

Exercise	Sets	Reps
<p>Supine 3-month hold</p> 	1	20 diaphragmatic breaths
<p>Supine 3-month hold with anti-rotation</p> 	2	10
<p>Lock clam</p> 	2	10
<p>Half side bridge</p> 	2	30 seconds
<p>Bird dog</p> 	2	5, 5 second holds

### Visit 5

Two weeks later, she presented pain free and reported compliance with the HEP. During this visit she mentioned having a sense of being hesitant to stand after sitting for periods when her posture was more flexed. She stated that despite not having pain she was anticipating the pain to return after sitting like this. To address this concern, she was informed that flexion is not an inherently unsafe position for the spine to be in and the fact that she has been doing this and not having a recurrence of pain is supportive of that. Additionally, it was reiterated that during the initial visit we discussed that we would not plan to avoid flexion long-term and that it would be reintroduced. It was agreed that testing flexion tolerance would be the goal for this session. Prior to testing, AROM baselines were evaluated and all lumbar AROM directions were full and pain free. Testing began with 10 repetitions of repetitive flexion in sitting (RFISit). This had no effect on her symptoms or mechanical baselines. She was then progressed to 10 repetitions of repetitive flexion in standing (RFIS). Again, this had no effect on her symptoms or mechanical baselines. Lastly, 10 repetitions of RFISit with patient overpressure was implemented. This did not produce pain but created a sensation that was described as “not painful but just feels uncomfortable”. Subsequently, 10 repetitions of REIL were completed which abolished the uncomfortable sensation. Her HEP was updated to 10 repetitions of RFISit followed by 10 repetitions of REIS 3-4 times per day and to continue the lumbopelvic HEP as previously established. She was informed that avoidance of flexion was no longer necessary and that following up in one week would be sufficient to test her tolerance for flexion.

### Visit 6

One week later, she returned pain free and reported having no increases in pain since the previous visit. She stated that she was compliant with the HEP and felt confident in her movement ability. She was then encouraged to engage in increasing her physical activity, continued implementation of extension exercises either REIL or REIS once per day as a preventative measure, and educated on self-management if a flare of coccyx pain occurred in the future. She was agreeable to this, reported feeling confident in her ability to self-manage if needed, and was discharged from care.

### Outcomes

Over the span of six visits, her 11-point Likert NPRS decreased from a 7/10 to a 0/10 at its worst. Her impaired ability to “sit in a hard back chair”, “stand for long periods”, and “feed her baby in the rocker” on the PSFS at baseline was a 3/10, 8/10, and 3/10 respectively. At visit five, one week prior to discharge, the PSFS was updated which showed improved scores to a 7/10, 9/10, and 10/10 respectively. These scores were not updated at discharge due to clinical time constraints. However, on a phone call six weeks after discharge, she reported continued improvement and stated the week prior she completed a road trip which required four hours of uninterrupted sitting in the car, pain free. Despite not having an updated PSFS, these reports are consistent with a continued improvement in her functional ability. The YFRF was not updated as it was utilized to screening for psychosocial and pain related disability risk factors. Additionally, a chart review of her EHR revealed that over the past 15 months since being discharged from care for this complaint she has not sought care with a provider within the hospital-based healthcare system that this case took place for a recurrence of her coccygeal pain.

### Discussion

Coccydynia, particularly in postpartum populations, is commonly attributed to local trauma or pelvic floor dysfunction.<sup>1,2</sup> Treatment is often focused on physical treatments targeting the coccygeal region directly or on symptom management.<sup>2,5,6</sup> Unfortunately, we were unable to identify any published literature on the rate of transition from acute to chronic coccydynia. However, in a prospective cohort, it was found that 51% of individuals with chronic coccydynia who received conservative treatment still had persistent symptoms three years later.<sup>21</sup> This suggests that current management options are inadequate for many patients with chronic coccydynia.

Pain localized to upper and lower extremity joints have been shown to have symptomatic and functional improvements when a directional preference of the cervicothoracic or lumbar spine is identified, despite the absence of spinal pain.<sup>15</sup> This has also been demonstrated in a case of non-cardiac chest pain.<sup>16</sup> While the differential diagnosis of postpartum coccygeal pain typically centers on localized mechanical or soft tissue causes,<sup>1,2</sup> it is reasonable to explore the possibility of referred pain from the lum-

bar spine in cases of coccydynia that have failed standard management strategies, similar to what has been describe in the upper and lower extremity joints.

To our knowledge there are no controlled trials or large cohort studies evaluating the use of MDT for chronic postpartum coccygeal pain. Additionally, there are no established MDT protocols for coccygeal pain.<sup>11,12</sup> Despite this, the MDT principles adhered to in this report were able to guide the identification of a movement strategy that satisfied the criteria for derangement syndrome of the lumbar spine in this patient with chronic postpartum isolated coccygeal pain who failed previous treatments.<sup>11</sup> The recurrence of mild symptoms during follow-up and the identification of a new directional preference later in care reflect the dynamic nature of derangements and the adaptability of MDT principles. This is important to note as MDT is first a method for evaluating musculoskeletal complaints with the goal of classifying the complaint into categories of derangement syndrome, dysfunction syndrome, postural syndrome, or other. Once a classification is made then treatment is tailored to the specific classification.

Not only did the MDT system aid in identifying a directional preference that produced symptom relief and functional gains, but it also aided in decreasing fear of movement and allowed for a process to reintroduce previously avoided movements (i.e., spinal flexion) without symptom recurrence. This is particularly relevant in populations with chronic musculoskeletal pain, where pain-related fear and functional limitations can negatively impact quality of life and caregiving roles. This emphasizes the biopsychosocial benefits of the MDT system which is often overlooked.<sup>14</sup>

### **Limitations**

We do acknowledge that there are significant limitations to consider when interpreting the results of this case report. First, this case report is inherently limited by the lack of generalizability, inability to establish causality, and cannot be extrapolated to broader populations with chronic postpartum coccygeal pain.<sup>22</sup> Second, it is not possible to rule out the effect of placebo or natural history. Third, there was a short follow-up period of direct communication with the patient. We were able to track care seeking within the EPIC EHR for 15 months post discharge. However, this does not adequately capture long-

term efficacy as it is possible that she may have received care for recurrence at an institution that does not utilize the EPIC EHR and allowed care seeking to go undetected. Lastly, the MDT system has been shown to be a valid and reliable method of assessment for spinal and extremity musculoskeletal complaints, when implemented by a credentialed or diplomate level clinician.<sup>8,9</sup> The treating clinician for the patient in this report was a credentialed level MDT provider which does strengthen the reliability of the results found in this report but makes our findings less generalizable to clinicians without a background in MDT. This case report was also strengthened by following the CARE checklist for case reports.<sup>23</sup>

### **Summary**

This case demonstrates the utility of the MDT system in the evaluation and treatment of a patient with chronic postpartum isolated coccygeal pain who failed previous treatments. The patient's symptomatic and functional improvement following the identification of a directional preference of lumbar spine extension with a relevant lateral component supports the theory that lumbar derangements may present with distal symptoms and the absence of local symptoms. In cases of coccydynia that have been unresponsive to standard care options, lumbar sources of pain should be considered, and the MDT system may be of benefit to evaluate that possible source of symptoms. Further research is needed to better understand the relationship between coccydynia and lumbar derangements.

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# Thoracic spondylodiscitis following acupuncture in an immunocompetent middle-aged male: a case report

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*We present the case of a 43-year-old male with progressive thoracic spine pain and bilateral intercostal referral who was ultimately diagnosed with spondylodiscitis. Despite red flag features such as night pain, functional decline, and significant unintentional weight loss, the patient lacked traditional risk factors for spinal infection. He had previously received acupuncture for lumbar radiculopathy, which had since resolved. Magnetic resonance imaging revealed vertebral body involvement and disc space destruction at the T8–T9 level, consistent with spondylodiscitis. The patient underwent surgical decompression, washout, and fusion, followed by a course of intravenous and oral antibiotics. He achieved full symptomatic resolution at follow-up. This case underscores the importance of early imaging and diagnostic suspicion in patients with spinal pain and red flags, even in the absence of conventional risk*

*Spondylodiscite thoracique consécutive à une séance d'acupuncture chez un homme d'âge moyen immunocompétent: présentation de cas*

*Nous présentons le cas d'un homme de 43 ans souffrant de douleurs thoraciques progressives et de douleurs intercostales bilatérales, chez qui une spondylodiscite a finalement été diagnostiquée. Malgré des signes d'alerte tels que des douleurs nocturnes, une diminution de l'autonomie fonctionnelle et une perte de poids involontaire importante, le patient ne présentait aucun facteur de risque classique d'infection rachidienne. Il avait bénéficié de séances d'acupuncture pour une radiculopathie lombaire, maintenant guérie. L'imagerie par résonance magnétique a révélé une atteinte du corps vertébral et une destruction de l'espace discal au niveau T8-T9, compatibles avec une spondylodiscite. Le patient a subi une décompression chirurgicale, un lavage et une arthrodèse, suivis d'une antibiothérapie intraveineuse et orale. Il a présenté une disparition complète des symptômes lors du suivi.*

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factors, and highlights the potential infectious risks of acupuncture performed outside clinical settings.

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KEY WORDS: acupuncture, acupuncture-related infection, discitis, chiropractic, red flag symptoms, spinal infection, spondylodiscitis, thoracic spine pain

## Introduction

Acupuncture is a widely used complementary therapy employed to manage various conditions, particularly musculoskeletal disorders such as low back pain, neck pain, and osteoarthritis. In Canada, acupuncture is commonly integrated into chiropractic practice, often for neuromusculoskeletal complaints including radiculopathy and myofascial pain syndromes.<sup>1</sup> Although generally regarded as safe when performed by trained professionals under sterile conditions, acupuncture is not without risks. Minor adverse events include local bleeding, bruising, or mild discomfort. However, serious complications—though rare—have been reported, including pneumothorax, spinal epidural hematoma, and deep infections such as spondylodiscitis and spinal epidural abscesses.<sup>2</sup> Infectious complications are most often attributed to poor disinfection practices or the use of non-sterile equipment and may be exacerbated when acupuncture is performed in non-clinical environments or by unregulated individuals.<sup>2</sup> Spondylodiscitis is an uncommon but potentially life-threatening infection involving the intervertebral disc and adjacent vertebral bodies, with an estimated incidence ranging from four to 24 cases per million annually.<sup>3</sup> It most commonly results from hematogenous dissemination of pathogens—*Staphylococcus aureus* being the predominant organism—and frequently presents with non-specific symptoms such as localized back pain, which may worsen at night, radicular pain, and generalized malaise. Fever is observed in only about 50% of patients, which may

*Ce cas souligne l'importance d'un examen d'imagerie précoce et d'une suspicion diagnostique chez les patients souffrant de douleurs rachidiennes et présentant des signes d'alerte, même en l'absence de facteurs de risque conventionnels, et met en évidence les risques infectieux potentiels liés à la pratique de l'acupuncture en dehors d'un cadre médical.*

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MOTS-CLÉS: acupuncture, infection liée à l'acupuncture, discite, chiropratique, signes d'alerte, infection de la colonne vertébrale, spondylodiscite, douleur de la colonne thoracique

further obscure the diagnosis.<sup>3</sup> Without timely diagnosis and appropriate management, spondylodiscitis can lead to permanent neurological deficits, vertebral instability, and systemic sepsis.

The diagnosis of spondylodiscitis is particularly challenging in patients without traditional risk factors, which include diabetes, older age, male sex, immunosuppression, malignancy, obesity, intravenous drug use, chronic renal or hepatic disease, and recent spinal surgery or systemic infection.<sup>3,4</sup> In such cases, diagnostic delays are common. Radiographs are often normal in early stages and are insufficiently sensitive to detect disc space or vertebral changes.<sup>5</sup>

Magnetic resonance imaging (MRI) is the most sensitive modality and can typically detect changes consistent with infection within approximately 3-5 days after the onset of infection with a sensitivity of 96% and a specificity of 93%.<sup>6</sup>

This case report describes an otherwise healthy middle-aged male who developed spondylodiscitis following acupuncture treatment for lumbar radiculopathy. The infection occurred in the thoracic spine and presented with progressive pain, functional decline, and systemic symptoms in the absence of conventional risk factors. The case highlights the importance of maintaining a high index of suspicion for spinal infection, particularly in patients with red flag features and recent exposure to invasive procedures such as acupuncture, even when performed for a resolved complaint.

### Case Presentation

A 43-year-old Caucasian male architect was referred to an advanced practice provider in the Rapid Access Clinic for Low Back Pain for further evaluation of persistent thoracic spine pain. He was otherwise healthy, with no history of diabetes, cardiovascular disease, hypertension, obesity, rheumatological conditions, surgical interventions, injections, cancer, sickle cell anemia, renal or liver failure, skin lesions, recent dental procedures, immunosuppression, or recent infections. He denied smoking, alcohol consumption, and intravenous drug use. The patient had not been inoculated against COVID-19, given that vaccines were not publicly accessible during this period. The referring primary care provider initially evaluated him for back-dominant pain that began insidiously and had progressively worsened over two to three months. Initial

plain radiographs were unremarkable, and an MRI was ordered with a two-month waiting period.

Due to restrictions related to the COVID-19 pandemic, the patient was assessed virtually. He reported a resolved episode of left lumbar radiculopathy three months earlier, which had been managed with a single session of at-home physical therapy and acupuncture administered by a friend who is a chiropractor. Acupuncture was applied to the left lumbar spine, with the skin surface cleaned using alcohol before sterile acupuncture needles were inserted. Approximately one week later, he developed new, progressively worsening mid-thoracic pain radiating bilaterally around the rib cage. The pain was constant and aggravated by sitting, standing, walking, lifting, and coughing or sneezing. Partial relief was achieved with rest and medications. He denied bowel or bladder dysfunction, fe-

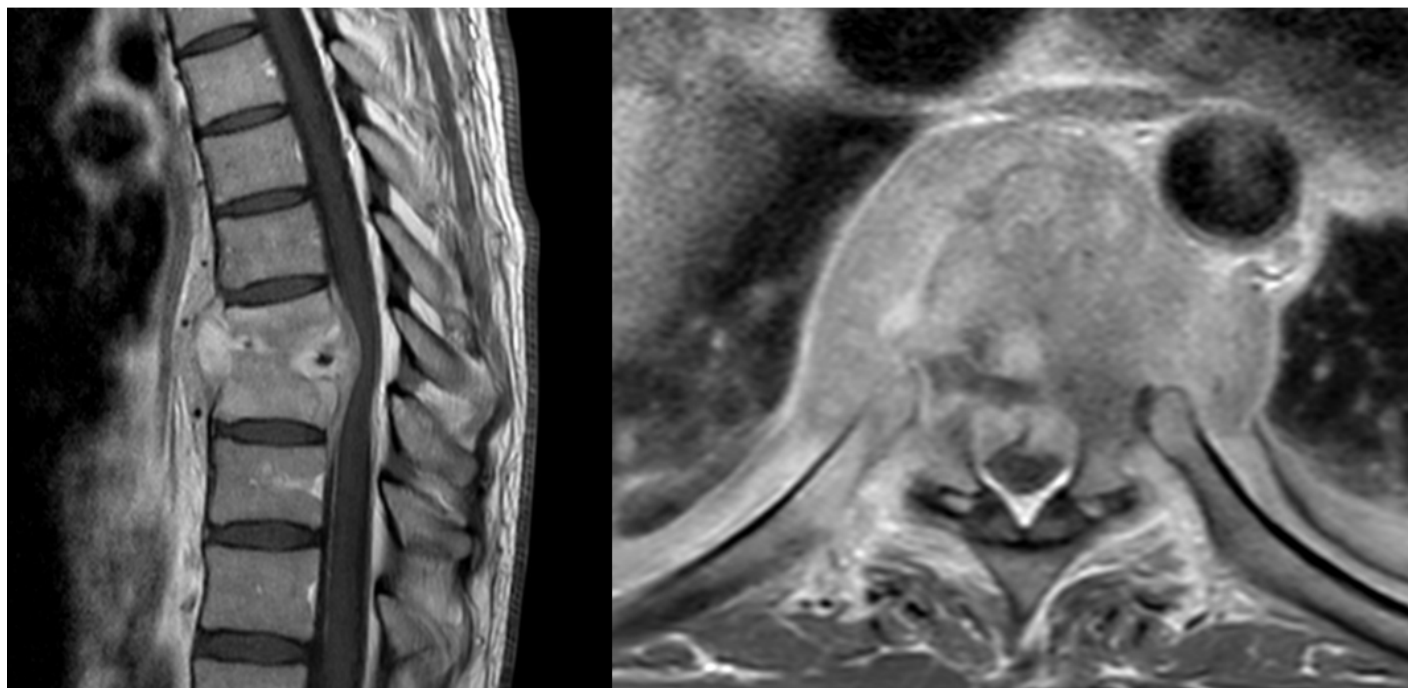


Figure 1.

*T1 images with gadolinium contrast. Destruction of the inferior endplate of T8 and the superior endplate of T9, with diffuse marrow enhancement following the administration of gadolinium at both of these levels. Altered signal is noted within the bilateral pedicles and lamina, as well as within the bilateral posterior margins of the eighth and ninth ribs. There is peripherally enhancing fluid at the T8-9 disc space, which is extending into the anterior prevertebral soft tissues by approximately 1.3 cm. Posteriorly, there is peripherally enhancing epidural collection displacing the posterior longitudinal ligament by roughly 6mm, as well as abutting and posteriorly displacing the spinal cord. This extends over a vertical distance of approximately 5.2 cm extending to the T7-8 and the T9-10 disc spaces.*

ver, or chills, but reported significant night pain and 18 lbs of unintentional weight loss over a three-month period.

At the time of consultation, the patient was taking Tylenol, a prescribed NSAID, Tramadol, and Cyclobenzaprine. He had undergone six sessions of chiropractic treatment, including manipulation and cold laser therapy, as well as six sessions of physiotherapy involving manipulation. Following these treatments, he consulted a rheumatologist. Home-based management included topical creams, a heating pad, and use of an inversion table. On an 11-point NPRS, where 0 is no pain and 10 is the worst pain ever experienced, he rated his pain as fluctuating between 3 and 8 out of 10. His Oswestry Disability Index (ODI) score was 41 out of 50, indicating severe disability, and his STarT Back Tool score was 8 out of 9, suggesting a high risk of chronicity.

During the virtual examination, the patient was bedridden and appeared visibly distressed. He was accompanied by his wife, who reported that his legs appeared to have atrophied over the past few months. Ranges of motion were all painful, worse with flexion and extension in the

lower thoracic spine, which recreated intercostal radicular pain bilaterally. The patient was able to heel walk, toe walk, and perform a tandem gait without difficulty. He also completed a full squat independently, demonstrating retained lower limb strength. Self-administered sensory examination of the lower extremity dermatomes was reported as normal. Straight leg raise and femoral nerve stretch tests were negative bilaterally. A hip examination could not be completed due to the virtual format and the severity of his symptoms. Deep tendon reflexes and upper motor neuron signs were not assessed during the virtual exam but were reportedly normal during a consultation with a sports medicine physician two weeks earlier.

Given the concerning red flag features and rapidly declining function, the advanced practice provider contacted the referring physician and an MSK radiologist. The MRI was expedited and completed within five days. Imaging revealed destruction of the T8–T9 intervertebral disc space, altered marrow signal in the T8 and T9 vertebral bodies, and a pre- and paravertebral soft tissue component that caused anterior indentation of the spinal cord. There

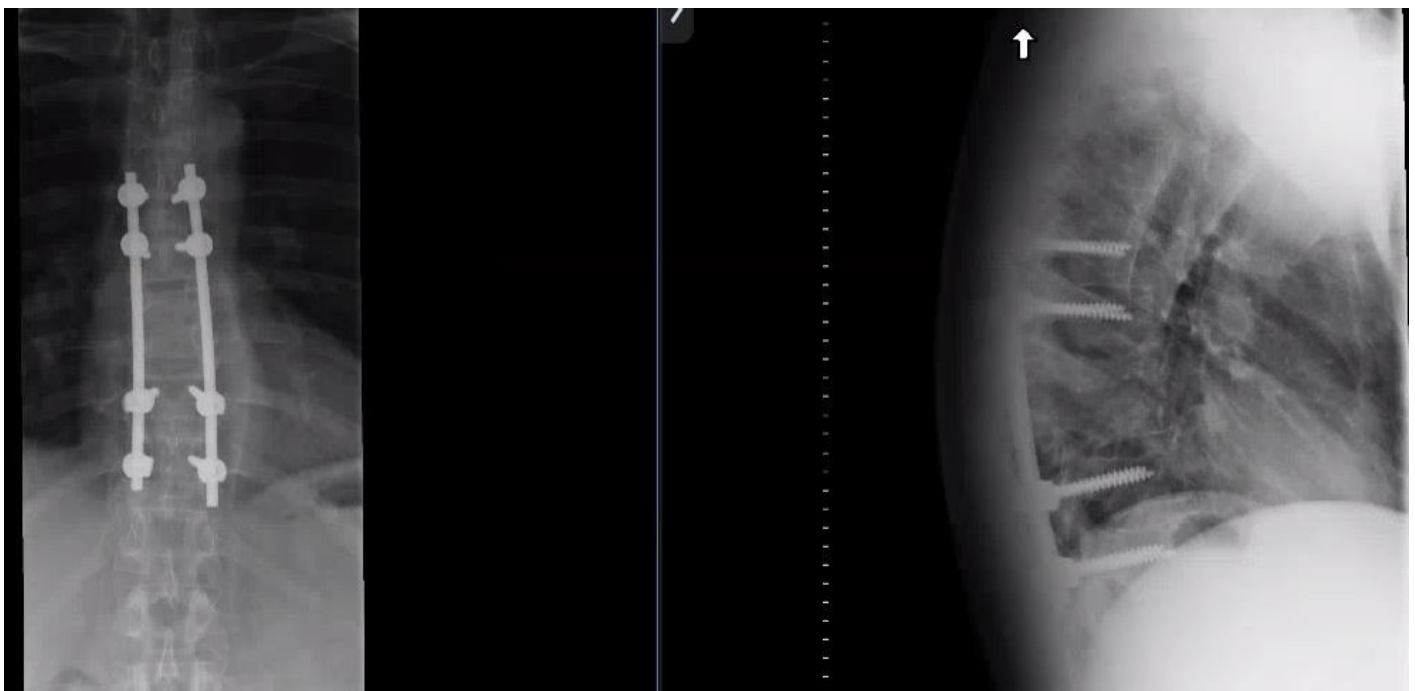


Figure 2.

*Posterior spinal instrumentation and fusion extend from T6 to T11, utilizing bilateral rods and transpedicular screw fixation. Laminectomies were performed at T7, T8, and T9. The lateral view additionally demonstrates obliteration of the T8–T9 intervertebral disc space and compression along the inferior endplate of T8.*

was moderate spinal canal stenosis and severe bilateral neural foraminal narrowing. The radiologist's impression suggested an inflammatory or infective etiology, such as spondylodiscitis, rather than a neoplastic process. A neurosurgical consult was suggested. Neurosurgical consultation was initiated, and blood cultures subsequently confirmed *Staphylococcus aureus*.

### Management

The patient underwent surgical decompression, washout, and instrumented fusion at the T6–T11 level. Postoperatively, he was managed with intravenous and oral antibiotics under the care of an infectious disease specialist. At an eight-week follow-up, the patient reported full resolution of his thoracic pain, with only mild sternal discomfort, likely attributable to the surgical fusion procedure. His surgical site had healed well, antibiotics were discontinued, and follow-up was scheduled for six months. At five-year follow-up the patient reported full functional abilities, complete resolution of pain, and no relapse of infection.

### Discussion

This case demonstrates the importance of maintaining a high index of suspicion for spinal infection in patients with persistent back pain and red flag features, even when traditional risk factors are absent. Spondylodiscitis is often misdiagnosed or diagnosed late, as its early symptoms can mimic mechanical back pain. In this case, the patient's age, absence of immunocompromise, and lack of recent systemic infection made the diagnosis particularly unexpected. Plain radiographs were unremarkable, and diagnosis was only established after MRI was expedited due to ongoing deterioration.

While rare, acupuncture-related infections have been documented in the literature. A 2023 systematic review found that serious adverse events from acupuncture, including spondylodiscitis and epidural abscesses, are more likely when procedures are performed without proper sterilization, repeated use of needles, or contact with clothing at the needlepoint.<sup>2</sup> The risks are compounded when acupuncture is delivered outside clinical environments, particularly during pandemics or health system disruptions. Infections may arise from direct inoculation through contaminated needles or skin flora introduced to deeper structures during needling. Although the overall risk of complications is low, infections such as vertebral

osteomyelitis must be considered in patients presenting with back pain following recent needling interventions.<sup>7</sup>

This case also illustrates the value of interdisciplinary collaboration and timely imaging. The proactive coordination between the advanced practice provider, primary care physician, and radiology department resulted in early MRI acquisition and specialist referral. Ultimately, the patient benefited from timely diagnosis, surgical intervention, and antimicrobial therapy, resulting in a favorable outcome.

### Summary

This case report highlights an uncommon but important cause of thoracic spine pain—spondylodiscitis—in an otherwise healthy middle-aged male. The presumed source of infection was acupuncture administered outside a clinical setting, drawing attention to the need for stringent infection control practices and patient education about the risks associated with therapeutic interventions. Clinicians should consider spinal infection in any patient presenting with unrelenting pain, red flag symptoms, and a history of spinal procedures or needling. Prompt recognition, imaging, and coordinated care are key to optimizing outcomes in such cases.

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