Determining Adverse Events in Patients with Neck Pain Receiving Orthopaedic Manual Physiotherapy: A Pilot and Feasibility Study

Lisa C. Carlesso, PT, PhD;* Joy C. Macdermid, PT, PhD;†‡ P. Lina Santaguida, PT, PhD;* Lehana Thabane, PhD*

ABSTRACT

Purpose: To pilot and determine the feasibility of estimating adverse events in patients with neck pain treated with cervical manipulation/mobilization by Canadian orthopaedic manual physiotherapists (OMPTs) using an online data-collection system to provide estimates for a future larger multi-centre international study. **Methods:** In a prospective multi-site two-group cohort study, participants received usual care and either (a) combined manipulation and mobilization or (b) mobilization only. Study feasibility objectives and criteria for success were set a priori. Data were analyzed using descriptive statistics. **Results:** A total of 20 patients were recruited from 6 of 16 participating centres, 17 to the mobilization group and 3 to the combined group. Barriers to data collection included low recruitment, difficulties in using the online data-collection system, and clinicians' and patients' being too busy to participate. Missing data for the primary outcome averaged 28.5%. A total of 69 symptom occurrences were reported during the treatment phase, all benign and transient. Most began within 0–12 hours after treatment (66/69, 95.6%) and lasted for 0–2 days (56/69, 81.2%). Kappa estimates of agreement between therapists and patients on reporting of adverse symptoms across visits 1–5 was substantial ($\kappa = 0.68$; 95% CI, 0.52–0.84; $p < 0.01$). **Conclusions:** This pilot study demonstrates substantial challenges in conducting a large multi-centre trial. Brief, benign, and transient adverse events were common; no substantial adverse events were observed.

Key Words: adverse events; feasibility study; neck manipulation; pilot study.

RÉSUMÉ

Objectif : Déterminer, dans le cadre d'un projet pilote, s'il est possible d'estimer les événements indésirables chez les patients dont la douleur au cou est traitée par manipulation/mobilisation cervicale effectuée par des physiothérapeutes manuels orthopédiques (PTMO) du Canada en utilisant un système de collecte des données en ligne pour produire des estimations en vue d'une future étude internationale multicentrique de plus grande envergure. **Méthodes :** On a procédé à une étude de cohorte prospective à deux groupes multisites; les participants ont reçu les soins habituels et a) une manipulation et une mobilisation combinées ou b) une mobilisation seulement. Les objectifs relatifs à la faisabilité de l'étude et les critères de réussite ont été établis d'avance. On a utilisé des statistiques descriptives. **Résultats :** Vingt patients ont été recrutés de six centres participants sur 16, soit 17 dans le groupe qui a subi une mobilisation et trois dans celui qui a subi le traitement combiné. Les obstacles à la collecte des données ont inclus l'effectif peu nombreux recruté, la difficulté à utiliser le système de collecte de données en ligne et le fait que les cliniciens et les patients étaient trop occupés pour participer. Les données manquantes pour le résultat primaire se sont établies en moyenne à 28,5%. Au total, on a signalé 69 occurrences de symptômes au cours de la phase de traitement, tous bénins et provisoires. La plupart ont commencé dans les 0 à 12 heures suivant le traitement (66/69, 95,6%) et ont duré de 0 à 2 jours (56/69, 81,2%). Les estimations kappa de la convergence entre les thérapeutes et les patients en ce qui concerne la déclaration de symptômes indésirables entre les visites 1 et 5 étaient importantes ($\kappa = 0,68$; IC à 95%, 0,52 à 0,84; $p < 0,01$). **Conclusions :** Cette étude pilote démontre qu'un essai multicentrique d'envergure pose des défis importants. Les effets indésirables brefs, bénins et provisoires étaient courants et l'on n'a observé aucun événement indésirable important.

The occurrence of adverse events associated with spinal manipulation, particularly when applied to the neck, has historically received significant attention. Re-

cently the focus has shifted to improving differential diagnosis before treatment to identify people who may be at risk of sustaining catastrophic adverse events such

From the: *Department of Clinical Epidemiology and Biostatistics and †School of Rehabilitation Sciences, McMaster University, Hamilton; ‡Clinical Research Lab, Hand and Upper Limb Centre, St. Joseph's Health Centre, London, Ont.

Correspondence to: Lisa C. Carlesso, University Health Network, Toronto Western Research Institute, 399 Bathurst St.—MP11-328, Toronto, ON M5T 2S8; lccarlesso@gmail.com.

Contributors: All authors designed the study; collected, analyzed, and interpreted the data; drafted or critically revised the article; and approved the final draft.

Competing Interests: None declared.

Lisa C. Carlesso is supported by the Frederick Banting and Charles Best Canada Graduate Scholarships—Doctoral Award from the Canadian Institute of Health Research.

This study received funding from the Physiotherapy Foundation of Canada.

Physiotherapy Canada 2013; 65(3);255–265; doi:10.3138/ptc.2012-28

as stroke or death.¹⁻⁴ Clinicians now have a better understanding of how to recognize a patient presenting with neck or head pain/symptoms that may be precursors to non-ischemic symptoms of a stroke.² This information is beneficial to all clinicians who treat people with neck pain, regardless of whether cervical manipulation is used.

Reports of adverse events associated with cervical manipulation have affected all practitioners who use this treatment technique, even though most of the evidence relates to chiropractic manipulations.⁵⁻⁸ Other health practitioners, such as physiotherapists and osteopaths, also practise spinal manipulation, but the incidence of adverse events in these two professions has not been rigorously studied. It should not be assumed that rates associated with any one profession are transferable to another, given the variations in practice patterns (indications, screening, contra-indications), patient populations, and execution of techniques that exist among professions.

Attempts to estimate incidence of adverse events are further complicated by a lack of standard definitions and classification of symptoms.^{9,10} The published studies reporting estimates of adverse events cannot be compared to one another, since they typically report events using non-standardized definitions of mild, moderate, and serious events. Carnes and colleagues¹⁰ proposed a framework for categorizing and defining adverse events; Carlesso and colleagues¹¹ and Rajendran and colleagues¹² have since added to this evidence by providing the perspective of patients, a viewpoint not included in the initial framework. In combination, these studies provide a solid foundation from which to begin more standardized classification and definition of adverse events in manual therapies.

Another element with the potential to bias incidence rates is the difference in reporting between clinicians and patients. It is well documented in other areas of health care that reports of adverse events vary greatly depending on whether the clinician or the patient is reporting.¹³⁻¹⁵ To our knowledge, this difference has not been studied among manual therapy practitioners. There is evidence that cervical manipulation has a stronger association with adverse events than cervical mobilization, irrespective of clinician type;¹⁶ any study of adverse events, therefore, must be powered to assess both. We know that the optimal design for establishing precise estimates of adverse events is a prospective cohort design. Because of the inherent difficulty and potentially significant resources involved in conducting such a study, an international study would seem to be appropriate, so that results could provide stable estimates and generalizable data within a reasonable time frame. It is therefore essential to test the process and feasibility of an online data-collection system.

The purpose of this pilot and feasibility study was to determine estimates of adverse events in patients with

neck pain treated with cervical manipulation/mobilization by Canadian orthopaedic manual physiotherapists (OMPTs) in private practice settings, using an online data-collection system, in order to provide estimates for a larger multi-centre international study.

OBJECTIVES

The objectives of the pilot and feasibility study were the following:

1. To pilot study procedures that would be used for a future international cohort study, including (a) evaluating recruitment strategies and enrolment rates to identify barriers for clinicians and patients participating in the study and estimate accrual rates and consent rates; (b) piloting the use of a Web-based data-collection system and operations of the associated database management centre; and (c) piloting all study measures planned for a larger future study to identify potential interpretation issues, including patterns of missing data, and to identify potential problems with data distribution, including floor/ceiling effects in responses.
2. To determine the standard deviation of the primary outcome measure (patient-reported adverse events) and use this to inform sample sizes for a future international cohort study.
3. To determine preliminary estimates of the primary outcome—adverse events, mild, moderate, and major—that would improve the estimation of sample sizes and inform our understanding of the importance of proceeding with the full cohort study. The criteria for success of the pilot study were determined *a priori* as follows:¹⁷⁻²¹ one participant recruited per group per week; at least 70% of all eligible participants able to be recruited; at least 95% completion of data at all follow-up points; less than 5% of participants having access or usability issues with the online data-collection system.
4. To determine preliminary estimates of agreement of adverse event reporting between therapists and patients.

METHODS

Design and sample

Our study was designed to determine the feasibility and preliminary estimates of adverse events associated with cervical spine mobilization/manipulation administered by OMPTs in primary-care settings. A prospective two-arm cohort design was used to compare combined cervical spine manipulation and mobilization with mobilization only; these interventions are representative of Canadian manual therapists' use of these manual therapy techniques.²² The two groups received all aspects of usual care as determined by the physiotherapist, along with either (a) combined manipulation and mobilization

(combined group) or (b) mobilization only (mobilization group). Allocation was not randomized; instead, after determining eligibility, the treating therapist and patient chose the appropriate group through discussion, based on clinical presentation and patient preference. A patient could not be considered for the combined group if any contraindication for neck manipulation was present. In addition, those patients who did not want to receive neck manipulation were allocated to the mobilization group.

All new patients presenting with primary neck pain were screened for eligibility by the treating therapist and, if appropriate, offered the opportunity to participate. Neck pain was defined as pain in the area between the occiput and the lower level of the scapulae and superolaterally to the tip of the acromion. Patients were eligible for inclusion if they were between 18 and 70 years old, with a primary report of acute (≤ 2 wk), sub-acute (3–12 wk) or chronic (>12 wk) neck pain presenting for physiotherapy treatment at one of the participating clinics. Patients were excluded if they had contraindications to both cervical manipulation and mobilization interventions (e.g., signs and symptoms of cervical artery dysfunction, spinal cord compromise, vertebral fracture, spinal ligamentous instability, central nervous system disorders, non-musculoskeletal-based pain, or cervical or thoracic spine stenosis);^{23,24} if they had received any cervical manual therapy in the past 3 months; or if they were currently receiving hands-on treatment for their neck disorder from another health care provider. All participants were advised that they could withdraw from the study and have their data removed at any time. After obtaining consent, the therapist registered the patient in the Web-based data-collection system by indicating his or her eligibility.

Sites

All therapists who had completed or were registered in one of Canada's post-professional manual therapy certification programmes were targeted for recruitment to the study. Two programmes in Canada have met the educational standards of and are approved by the International Federation of Manipulative Physical Therapists (IFOMPT). Therapists across Canada who had completed or were registered in either of these programmes (>500) were contacted via e-mail with an information sheet providing study details and objectives; those interested in participating were asked to contact the primary investigator.

Participating therapists ($n = 22$) received a 45-minute training session in database use and management and study procedures, conducted by simultaneous telephone and online participation. Each therapist was given an operations manual for the database before the session, which then reviewed how to enrol a patient, the forms to be filled out for each visit, and any other questions

that the therapists had. Ethical approval was obtained from the Research Ethics Boards of McMaster University, the University of Guelph, and Western University.

Upon entering a clinic with a participating therapist, each patient underwent screening, including a typical history and physical examination. Patients deemed eligible for the study received a report of the therapist's assessment and an invitation to participate in the study, along with a letter of information and consent package; reassessment, treatment, and post-treatment assessment were conducted on future visits. Therapists recorded their findings on standardized forms, indicating treatment and adverse events.

Interventions

For the purposes of the study, we defined *manipulation* as a low-amplitude, high-velocity force applied at the end of range of a joint,²⁵ and *mobilization* as including low- to high-amplitude and low- to medium-velocity movements applied within the normal physiologic range of a joint. Individuals with any direct contraindications or medical "red flags" to cervical manipulation were not considered for enrolment in the combined group but were approached to provide data for mobilization effects. Indications for use of manipulation included joint fixation, joint adhesion, inextensible scar, treatment plateaued with mobilization, loss of movement in two biomechanically linked directions, absence of any contraindications to manipulation, and confirmation of ligamentous integrity and of the absence of cervical arterial dysfunction.^{24,26} All participants in the combined group received manipulation to the neck as part of their treatment.

Visits

Once enrolled, participants were treated during between one and five visits, spaced at the therapist's discretion. Treatment ended if the therapist decided to stop or change the manual treatment being delivered or after five visits. For example, if a participant was entered into the combined group and the therapist concluded after three visits that neck manipulation was no longer needed, the active treatment portion of the study was concluded, and the participant passed on to the follow-up phase. The treating therapists' control over the delivery of treatment, along with the group receiving combined manual therapy, allowed for a real-world representation of the daily practice of OMPTs.

Measurement of outcomes

Using a published framework and a completed study on patient interpretations of adverse events, we created a list of possible adverse events, categorized as mild, moderate, or major (see Box 1). This framework uses a list of possible symptoms, severity of functional impact, and duration of symptoms to categorize adverse events across the spectrum.

Box 1 Adverse Events Outcomes

Category		Severity	Duration of symptoms or functional impact	Examples
Mild	No impact on function		≤24 h	Headache, dizziness, bruising, increased stiffness, increased pain, nausea, radiating symptoms (pain, numbness, tingling)
Moderate	Function modified but intact, may require alteration in treatment		>24 h–1 wk	As above plus dislocation; loss of motion; breathing difficulties; visual disturbances; facial pain, numbness, or tingling; ringing in ears; confusion or disorientation; vomiting
Major	Function absent, requires medical intervention		>1 wk	As above plus transient ischemic attack, stroke, fracture, loss of bowel or bladder control, coma

Data collection and analyses

Because determining feasibility was our overall objective, we agreed that a small sample size of 28 participants per group would be sufficient to achieve this goal.^{17,18}

Patients were encouraged to enter data electronically. Upon enrolment, the data-management company assigned each patient a unique identifier to maintain anonymity; patients' e-mail addresses were provided to the data-management company to allow for follow-up reporting. Each patient was then sent a URL that he or she could use to log in and enter data via Web-based forms. Reminders were sent by e-mail. Participants unable or unwilling to complete the forms online were given paper copies, which they were asked to return on their next visit to the clinic. An administrative staff member not involved in patient care then faxed the forms to the data-management company.

OMPTs provided demographic information and reported treatment and adverse events by completing Web-based forms at the patient's next visit. Any adverse events that the patient reported before leaving the treatment were recorded for that visit, along with any reported upon the return visit. Descriptive statistics were used to characterize the participants and the therapists.

Baseline data collection for the patients consisted of scores on the Neck Disability Index (NDI), the Pain Catastrophizing Scale, the 11-item version of the Tampa Scale for Kinesiophobia, the Comorbidities questionnaire, and the Numeric Pain Rating Scale (NPRS); how much they trusted their therapist and how satisfied they were with their treatment, both rated on a 7-point Likert-type scale (1 = completely trust / extremely satisfied; 7 = do not trust at all / extremely dissatisfied); adverse events; and demographic data. The primary outcome, patient-reported adverse events, was measured by asking patients whether they had experienced any adverse events in relation to their most recent visit. A patient who answered "yes" was then prompted to report his or her symptoms, based on a list of 25 symptoms derived from the literature; the list also included the category

"other." Patients who reported experiencing a particular symptom were asked if this was the first time they had experienced it and to indicate both onset (0–12, 13–24, or >24 h) and duration (0–2 d, 3–7 d, or >1 wk). In addition, patients were asked to what degree the adverse reaction affected their functional ability (no impact/normal function, modifications or help required, or loss of function/incapacitated). Finally, they were asked whether their physiotherapist had advised them that they might experience some unintended symptoms after treatment. On subsequent visits, patients again answered questions about trust, satisfaction, adverse events, and warnings from their therapist.

Follow-up occurred at 21 days and 90 days after each patient's last treatment. Data collection at this time consisted of the NDI, satisfaction, adverse events, global rating of change on a 10-point Likert-type scale, and the NPRS.

Adverse events

We calculated overall frequencies and frequencies within each treatment group. No definition of adverse events was decided upon a priori or provided to patients or practitioners. We had anticipated, based on the framework we chose (see Box 1) and the rarity of major adverse events, that only mild to moderate adverse events might be reported. The framework, in essence, defines what events are considered adverse by layering on the factors of duration and severity. The existing evidence supports the idea that how patients define "adverse" varies depending on numerous contextual factors, which makes a priori definition difficult.^{11,12}

Clinician versus patient reporting of adverse events

We first calculated frequencies for all adverse events reported by both clinicians and patients, then calculated clinician–patient agreement using kappa values, which are ideal for assessing agreement on categorical data (yes/no). Weighted kappa, designed for assessing agreement between ordinal data, was used to examine the categories of mild, moderate, and major adverse events.

Study barriers

At the end of the study, we contacted participating therapists via e-mail and asked two open-ended questions: *What barriers did you experience that had an impact on (a) patient enrolment and (b) study procedures?* And, *What barriers did patients report as impacting on study enrolment?*

RESULTS

Therapists identified three barriers to patient enrolment: no access to a computer at work; too busy to do consent and extra paperwork; and lack of eligible patients. Barriers to participation identified by patients and reported by therapists were being too busy or the study's requiring too much time; not wanting details of treatment included in study; and experiencing a language barrier (in Quebec). The primary investigator observed that despite the online/telephone training and provision of an operations manual and study procedures, some therapists appeared not to understand that patients could choose to fill out the forms on paper. The fact that the treatment schedule was flexible (i.e., it was not restricted to five visits but allowed for change in the treatment technique or for the patient's being discharged) seems to have had little impact on enrolment.

Of the more than 500 OMPTs we approached, 24 completed training. Two of these immediately told us that they were too busy to participate in recruitment; 6 of the remaining 22 enrolled patients from September 2010 to April 2011. In total, 80 patients were asked to participate after initial screening, of whom 20 enrolled—17 in the mobilization group and 3 in the combined group (see summary in Figure 1). Three participants withdrew immediately after providing informed consent and receiving the initial forms to fill out, stating that they did not have time to participate.

The Web-based data-collection system was developed between June and August 2010 through a process that included multiple iterations of mapping the various time points for the outcome measures used, checking the proper transcription of the measures into the database, and testing their functionality at each treatment site. Before recruitment began, the functionality of the database was satisfactory. After recruitment began, however, issues were identified with the functionality of e-mail reminders, difficulties in accessing data forms (e.g., forms did not appear once the patient was enrolled), data reports formatted incorrectly and containing duplicate data, difficulty with therapists and patients logging in and resetting passwords, and measures posted to an incorrect next visit date. All issues were addressed and fixed as quickly as possible as they occurred. The database coordinator or primary investigator undertook corrective actions immediately if the issue was affecting current data collection; the treating therapist or patient was contacted via e-mail.

Compliance with scheduled visits was excellent (none were missed). However, there were missing data for baseline measures (8.0%), primary outcome measure (29%), and all other questionnaires (29%). Missing data began at visit 2, with one participant (6.0%), and peaked at visits 4 and 5 and 90-day follow-up with five participants (29%). Reasons for this high rate of missing outcomes were not collected from the therapists.

Given the study's low enrolment, we did not try to calculate relative risk ratios for the adverse events or to group them into mild, moderate, and major categories, as we felt that no meaningful interpretation could be achieved from such small numbers. Table 1 shows proportions and parameters of all adverse events reported in each group by visit. A total of 69 symptom occurrences were reported during the treatment phase. Adverse events reported across all visits and follow-up were headache, soreness, stiffness, tenderness, fatigue, weakness, decreased neck range of motion, tingling in the spine or upper extremities, radiating pain, increased pain, nausea or vomiting, and ringing in the ears. At 21 days, 1 participant in the combined group (33%) reported stiffness, soreness, decreased neck range of motion, ringing in the ears, and tingling in the spine or upper extremity. In the mobilization group, 4 participants reported adverse events: 1 (7.0%) reported headache, 1 (7.0%) reported nausea or vomiting, and 2 (14%) each reported tenderness and stiffness. At 90 days, 1 participant (33%) in the combined group reported headache and stiffness; in the mobilization group, 1 participant (7.0%) reported headache. Table 2 shows onset and duration of symptoms by group. For almost all reported adverse events in both groups, onset was within the first 12 hours after treatment (66/69, 95.6%); only 3 (4.0%) reported onset between 13 and 24 hours. In most cases (56/69, 81%), symptoms lasted from 0 to 2 days; 12/69 reported duration from 3 to 7 days; and 1 adverse event was reported as lasting >1 week (1.0%).

Agreement between therapists and participants on whether an adverse event occurred was substantial ($\kappa = 0.681$; 95% CI, 0.521–0.841; $p < 0.01$).

Participants' mean age was 45 (SD 10.2) years; 71% were female. Table 3 summarizes patient characteristics.

Treatment provided by participating therapists is summarized by visit in Table 4. Both groups used manual therapy to the neck and thoracic spine, complemented by exercise and other treatment modalities such as acupuncture, ice/heat, education, and electrotherapies.

Mean changes in NDI scores from baseline to 90-day follow up were 4.2 (SD 3.5) at 21 days and 1.6 (SD 2.1) 90 days. Mean global rating of change was 2.37 (SD 1.35) at 21 days and 3.37 (SD 1.06) at 90 days. Satisfaction with care (on a scale from –3 to +3) remained fairly consistent during the treatment phase and at 21-day follow-up, ranging from 1.75 to 2.40 (SD 0.49–2.05), and decreased slightly at 90-day follow up to 1.17 (SD 2.13).

Figure 1 Participant flow and follow-up.

DISCUSSION

Given the paucity of harms-related data pertaining specifically to orthopaedic manual physiotherapists, we conducted a pilot and feasibility study in Canada to assess the feasibility of a large multi-centre international study to determine the rate of adverse events associated with manual therapy interventions applied to people with neck dysfunction.

Objectives

Our study did not meet all of our initial objectives, as the proposed methodology was limited in the prospect of a future larger multi-centre study. Our recruitment objective was not met. Recruitment is always a concern

in clinical studies, and we anticipated difficulty with participation from qualified physiotherapists. Because clinical research has historically been performed primarily in teaching centres, it was important to establish the feasibility of carrying out this type of study within private orthopaedic physiotherapy clinics in Canada. Our findings suggest that recruitment is even more problematic in this context. A recent survey of Canadian physiotherapists' perceptions of barriers to and facilitators of engagement in clinical research found no significant differences in barriers between practitioners in private settings and those in public or other settings, but noted non-significant trends among private practice practitioners toward concerns about time constraints and lost income.²⁷

Table 1 Patient-Reported Adverse Events, Visits 1–5

Adverse event	No. of adverse events reported*									
	Visit 1		Visit 2		Visit 3		Visit 4		Visit 5	
	Combined	Mob	Combined	Mob	Combined	Mob	Combined	Mob	Combined	Mob
No. of patients reporting any adverse event	1	2	1	7	1	4	1	4	1	3
Headache	1	1	1	2	–	–	–	–	1	1
Tenderness	–	2	1	5	–	–	–	1	–	2
Stiffness	–	2	1	2	1	1	1	1	1	1
Soreness	1	2	1	5	2	2	–	2	1	–
Fatigue	–	1	1	1	–	–	–	1	–	–
Weakness	–	1	–	1	–	–	–	–	–	–
Dizziness	–	–	–	–	–	1	–	–	–	–
Breathing difficulties	–	–	–	–	–	1	–	–	–	–
Decreased neck motion	–	–	1	–	1	–	1	–	–	–
Nausea/vomiting	–	–	–	1	–	–	–	–	–	–
Ringing in the ears	–	–	1	–	1	–	1	–	–	–
Tingling	–	–	1	–	1	–	–	1	–	–
Radiating pain	–	–	–	1	–	2	–	–	–	1
Increased pain	–	–	–	–	–	–	–	1	–	–
Other: sore breast	–	–	–	–	1	–	–	–	–	–

*Unless otherwise specified.

Combined = manipulation and mobilization group; Mob = mobilization-only group.

Table 2 Onset and Duration of Symptoms Reported, Visits 1–5

Symptoms	Onset				Duration					
	0–12 h		13–24 h		0–2 d		3–7 d		>1 wk	
	Combined	Mob	Combined	Mob	Combined	Mob	Combined	Mob	Combined	Mob
Headache	3	4	–	–	3	4	–	–	–	–
Tenderness	1	9	–	1	–	9	1	1	–	–
Stiffness	4	7	–	–	–	7	4	–	–	–
Soreness	5	10	–	1	5	10	–	1	–	–
Fatigue	1	3	–	–	1	3	–	–	–	–
Weakness	–	2	–	–	–	1	–	1	–	–
Dizziness	–	1	–	–	–	1	–	–	–	–
Breathing difficulties	–	1	–	–	–	–	–	1	–	–
Decreased neck motion	3	–	–	–	–	–	3	–	–	–
Nausea/vomiting	–	1	–	–	–	1	–	–	–	–
Ringing in the ears	3	–	–	–	3	–	–	–	–	–
Tingling	2	1	–	–	2	1	–	–	–	–
Radiating pain	–	3	1	–	–	3	–	–	–	1
Increased pain	–	1	–	–	1	–	–	–	–	–
Other: sore breast	1	–	–	–	1	–	–	–	–	–
Total*	23/225	43/2940	1/225	2/2940	16/225	40/2940	8/225	4/2940	0	1/2940

*Denominator represents number of possible responses per group per category.

Combined = manipulation and mobilization group; Mob = mobilization-only group.

The challenges of recruiting participants are clear: more than 500 therapists were invited to participate in our study, but only 22 agreed to do so. Our ability to follow up on non-responders was limited by changing

membership and e-mail lists. Given this group's record of sparse participation in clinical research, we felt that an independent study of non-response would be a better approach to the problem than tracking non-response

Table 3 Patient Characteristics ($n = 17$)

Characteristic	No. of patients
Sex	
Female	12
Education	
High school	2
Post-secondary	11
Graduate degree	4
Duration of neck pain	
<2 wk	2
3–12 wk	4
>12 wk	11
History of trauma to neck	7
Work status	
Full time	13
Part time	3
Not working	1
Professionals consulted for neck pain	
Family physician	6
Chiropractor	5
Specialist	1
Osteopath	0
Physiotherapist	9
Massage therapist	3
Medication use	
Taking medications	9
Over the counter	6
Prescription for pain	2
Prescription not related to pain	7
No. of days in preceding year with neck pain	
<30	5
30–60	3
>60	9

in an already detailed analysis plan. What we did not expect, however, was the low rate of participation by therapists who completed the study training session, only 25% of whom actually enrolled patients. Despite their initial interest, most said they were too busy to actually try to enrol patients. This is an important issue, since considerable resources must be allocated to centres that commit to enrolling patients. Furthermore, when applying for study funding, it would be important to demonstrate a high level of commitment from the enrolling centres, as funders are unlikely to support a study if there are concerns about its feasibility. For all these reasons, it is important to find ways to ensure that centres that commit to a specific enrolment will be able to achieve their targets.

Patient response was also sub-optimal. The burden of participation on participants requires re-examination, as some declined to participate on the grounds that it would take too much time. Like many studies, ours required an initial commitment to complete baseline study measures and follow-up time points; perhaps less commonly, we also asked that participants complete measures after each visit. Cognizant of this demand, we designed the post-visit questionnaires to be brief and

easy to complete. Without interviewing patients qualitatively after study completion, we cannot be sure to what degree this affected recruitment. Furthermore, it is difficult to disentangle patient and therapist non-participation: if therapists do not provide adequate information about the burden of the study, or if they fail to remind patients to complete the forms, their lack of enthusiasm may affect patient participation.

Problems with the online database were mainly limited to the front end of the study, and were dealt with as efficiently as possible, but still caused some delays and frustration for both patients and therapists. The proportion of missing data was clearly high, and therefore problematic. As we did not directly ask patients about reasons for missing data, we can only speculate. Studies comparing online to paper-based survey methods found that data completion rates were better among online users and that the electronic methods were as good as paper;^{28,29} a Cochrane review of methods to improve response to electronic questionnaires suggests numerous strategies,³⁰ some of which we employed. Considerations for future studies include conducting pre-study focus groups to inquire about preferred collection methods and using a mixed-methods approach with a qualitative component following treatment to ask patients about reasons for missing data.

The low enrolment in the combined manipulation/mobilization group makes comparison between groups difficult, and we were unable to estimate future sample sizes. Nonetheless, our results are similar to those of other studies.^{31–33}

To our knowledge, this is the first time that agreement on reporting of adverse events has been published in our field. Agreement of adverse events reported between practitioner and patient was better in our study than in other areas of health care.¹⁴ Given the nature and frequency of patients' interactions with therapists compared to their interactions with physicians, this may not be surprising. Medical or surgical practice is often concerned about *complications* directly attributable to a treatment; adverse events are not necessarily a result of treatment, however, nor do they necessarily constitute a complication. For example, a small amount of pain may be a necessary result of mobilizing a joint, or it may be due to increased activity following treatment. The therapist and patient would likely agree that an increase in pain had occurred, particularly if the increase was measured in practice, but this would not constitute a complication. Lack of a clear distinction between adverse events and complications in the literature may contribute to variations in agreement between our study and others.

Criteria for success

Our study ran for 8 months, but did not meet the criterion of enrolling one patient per group per week. Only one in four patients asked to participate enrolled,

Table 4 Treatment Parameters

Treatment	No. of treatments per visit									
	Visit 1		Visit 2		Visit 3		Visit 4		Visit 5	
	Combined	Mob	Combined	Mob	Combined	Mob	Combined	Mob	Combined	Mob
Area treated										
Occiput–C2	2	9	1	9	0	8	1	7	1	7
C3–C7	3	12	3	12	3	13	2	12	2	10
Direction of force										
Traction	0	4	3	3	0	4	0	3	0	3
Flexion	2	10	1	9	1	9	1	10	1	10
Extension	1	6	1	6	2	8	1	8	1	8
Rotation	1	3	2	5	1	3	2	3	2	3
Distraction	0	2	1	1	1	3	0	3	2	1
Other treatments										
Passive stretching	2	7	0	7	0	7	1	6	1	6
Exercise prescription	2	11	2	12	2	9	2	9	2	8
Acupuncture	1	4	0	4	0	4	0	5	0	4
Myofascial release	0	0	1	0	0	1	0	1	1	0
Soft-tissue massage	0	0	0	1	0	2	0	3	0	2
Ice/heat	2	3	0	3	1	2	0	0	0	0
Electrotherapeutic modalities	1	1	2	3	1	2	1	1	1	1
Laser	0	1	0	1	0	1	0	1	0	1
Thoracic manipulation	2	2	2	4	2	4	1	1	1	5
Other	0				0		0		0	
Education		1		2		1				
Lumbar mobilization		1								
Mechanical traction		1								
Thoracic mobilization		2		5		3		3		2
Snag			1							
TMJ distraction						1		1		

Combined = manipulation and mobilization group; Mob = mobilization-only group; TMJ = temporomandibular joint.

well below the threshold of 70% established as part of our success criteria. Given the high rate of missing data, our results may indicate that it is advisable to offer incentives to therapists, and possibly also to patients; we did not offer any incentives to either. While it is difficult to know how incentives might have affected participation rates, the lack of them may have affected therapist participation more than patient enrolment. The challenge in offering an incentive is to obtain substantial grant funding to provide something that is valued but not substantial enough to bias participation; the value of an incentive is always questionable, particularly when it is offered to health professional and not to patients.

The incidence of issues with the online database was larger than the criterion of 5% of all participants experiencing problems, but issues were resolved as efficiently as possible. Unfortunately, the costs of the data-management system were high and the funds for the study limited, so it was difficult to justify continuing the study.

Generalizability

Because of the study's low enrolment and uneven group numbers, it is difficult to interpret beyond this pilot and feasibility study to confidently apply our findings to people receiving the focal treatments. There

were some differences between groups in the symptoms reported; the mobilization group actually reported more symptoms than the combined group, echoing the findings of a previous study that mobilization techniques created a larger number of adverse responses than manipulation.³³ It is clear that the adverse events reported were transient and would likely be considered mild to moderate in nature according to the existing evidence in this area.^{10,11} In the absence of a de facto framework for defining categories of adverse events in manual therapy, however, we cannot state this confidently.

Reflecting on our initial objectives suggests that there are many barriers to conducting the study on a larger scale. Several substantial changes would need to be implemented to address the issues we identified. One question that remains unanswered is the feasibility of clinical research in private orthopaedic physiotherapy clinics in Canada. While the climate may be changing, it seems likely that, in the absence of active incentives and knowledge-translation activities to affect attitudes toward research involvement, this change may proceed very slowly. Researchers wanting to conduct clinical research in this setting should be aware that they may face similar difficulties unless more proactive measures are in place to ensure adequate recruitment, completeness of data

collection, and therapist incentives, all of which will have a substantial impact on the budget required. Since health care for neck pain is primarily conducted in this context, however, it is essential that new approaches be considered.

Cost-effective methods to increase the technical feasibility of such studies are also needed. Web-based data-collection systems have promise, since such systems can be cost-effective, but our study suggests that real-time data collection may be needed. The decreasing cost of devices such as tablets may allow researchers to offer the convenience of a paper-based in-clinic version while retaining the advantages of electronic data collection. As the use of smartphones and tablets continues to increase, we suspect that barriers to online participation will decrease.

CONCLUSIONS

This pilot study was designed to assess feasibility of collecting data on adverse events among patients of manual physiotherapists in a private practice setting in Canada. None of the feasibility criteria were achieved. Lack of receptivity on the part of both practitioners and patients was a substantial barrier. Before embarking on a similar study focusing on prospective collection of adverse events, future researchers should conduct therapist and patient focus groups to identify barriers to participation. Areas to be examined include attitudinal barriers, the nature of incentives valued by therapists that would fit within acceptable scientific behaviour, paper forms of outcome measures for patients to fill out, and a qualitative component to address issues such as missing data. Resolving these and other issues may help inform the design of a new pilot study to maximize the potential for success.

KEY MESSAGES

What is already known on this topic

There is a large literature base associating mild to major adverse events with neck manipulation, and the occurrence of major adverse events has gained scientific and media attention. While these catastrophic events are largely reported in connection with chiropractic treatment, other health professionals also use this technique, and there is a lack of data on adverse events in connection with neck manipulation administered by physiotherapists. It is important to establish profession-specific data to provide adequate treatment profiles of benefit and harm. There are currently no rigorous estimates for the physiotherapy profession.

What this study adds

This pilot study established that a large-scale international multi-centre study to provide profession-specific estimates of adverse events associated with neck manipulation is a problematic undertaking, as the pilot met none of the predetermined criteria for success. The

investigators, participating clinicians, and patients identified several barriers to data collection, including issues that may be specific to the Canadian OMPT community as well as issues associated with using an online data-collection system. Because of poor recruitment, no accurate estimates of adverse events were obtained. Future studies should be aware of the possible challenges of conducting research in this environment and should consider offering both online and paper versions of outcome measures. Funding may be a challenge, given the resources needed and the professional commitment to conduct the study in a cost-effective manner.

REFERENCES

1. Kerry R, Taylor AJ. Cervical arterial dysfunction assessment and manual therapy. *Man Ther.* 2006;11(4):243–53. <http://dx.doi.org/10.1016/j.math.2006.09.006>. Medline:17074613
2. Kerry R, Taylor AJ. Cervical arterial dysfunction: knowledge and reasoning for manual physical therapists. *J Orthop Sports Phys Ther.* 2009;39(5):378–87. Medline:19411768
3. Rubinstein S, Côté P. Mild mechanical traumas are possible risk factors for cervical artery dissection. *Cerebrovasc Dis.* 2007;24(2–3):319. <http://dx.doi.org/10.1159/000106520>. Medline:17675838
4. Rubinstein SM, Leboeuf-Yde C, Knol DL, et al. Predictors of adverse events following chiropractic care for patients with neck pain. *J Manipulative Physiol Ther.* 2008;31(2):94–103. <http://dx.doi.org/10.1016/j.jmpt.2007.12.006>. Medline:18328935
5. Rubinstein SM, Leboeuf-Yde C, Knol DL, et al. The benefits outweigh the risks for patients undergoing chiropractic care for neck pain: a prospective, multicenter, cohort study. *J Manipulative Physiol Ther.* 2007;30(6):408–18. <http://dx.doi.org/10.1016/j.jmpt.2007.04.013>. Medline:17693331
6. Thiel HW, Bolton JE, Docherty S, et al. Safety of chiropractic manipulation of the cervical spine: a prospective national survey. *Spine.* 2007;32(21):2375–8, discussion 2379. <http://dx.doi.org/10.1097/BRS.0b013e3181557bb1>. Medline:17906581
7. Cassidy JD, Boyle E, Côté P, et al. Risk of vertebrobasilar stroke and chiropractic care: results of a population-based case-control and case-crossover study. *Spine.* 2008;33(4 Suppl):S176–83. <http://dx.doi.org/10.1097/BRS.0b013e3181644600>. Medline:18204390
8. Rothwell DM, Bondy SJ, Williams JJ, et al. Chiropractic manipulation and stroke: a population-based case-control study. *Stroke.* 2001;32(5):1054–60. <http://dx.doi.org/10.1161/01.STR.32.5.1054>. Medline:11340209
9. Carlesso LC, Macdermid JC, Santaguida LP. Standardization of adverse event terminology and reporting in orthopaedic physical therapy—applications to the cervical spine. *J Ortho Sports Phys.* 2010;40:455–63.
10. Carnes D, Mullinger B, Underwood M. Defining adverse events in manual therapies: a modified Delphi consensus study. *Man Ther.* 2010;15(1):2–6. <http://dx.doi.org/10.1016/j.math.2009.02.003>. Medline:19443262
11. Carlesso LC, Cairney J, Dolovich L, et al. Defining adverse events in manual therapy: an exploratory qualitative analysis of the patient perspective. *Man Ther.* 2011;16(5):440–6. <http://dx.doi.org/10.1016/j.math.2011.02.001>. Medline:21377403
12. Rajendran D, Bright P, Bettles S, et al. What puts the adverse in 'adverse events'? Patients' perceptions of post-treatment experiences in osteopathy—a qualitative study using focus groups. *Man Ther.* 2012;17(4):305–11. <http://dx.doi.org/10.1016/j.math.2012.02.011>. Medline:22425134
13. Weissman JS, Schneider EC, Weingart SN, et al. Comparing patient-reported hospital adverse events with medical record review: do patients know something that hospitals do not? *Ann Intern Med.* 2008;149(2):100–8. Medline:18626049

14. Basch E, Jia X, Heller G, et al. Adverse symptom event reporting by patients vs clinicians: relationships with clinical outcomes. *J Natl Cancer Inst.* 2009;101(23):1624–32. <http://dx.doi.org/10.1093/jnci/djp386>. Medline:19920223
15. McKay SD, MacDermid JC, Roth JH, et al. Assessment of complications of distal radius fractures and development of a complication checklist. *J Hand Surg Am.* 2001;26(5):916–22. <http://dx.doi.org/10.1053/jhsu.2001.26662>. Medline:11561246
16. Carlesso LC, Gross AR, Santaguida PL, et al. Adverse events associated with the use of cervical manipulation and mobilization for the treatment of neck pain in adults: a systematic review. *Man Ther.* 2010;15(5):434–44. <http://dx.doi.org/10.1016/j.math.2010.02.006>. Medline:20227325
17. Thabane L, Ma J, Chu R, et al. A tutorial on pilot studies: the what, why and how. *BMC Med Res Methodol.* 2010;10(1):1. <http://dx.doi.org/10.1186/1471-2288-10-1>. Medline:20053272
18. Moore CG, Carter RE, Nietert PJ, et al. Recommendations for planning pilot studies in clinical and translational research. *Clin Transl Sci.* 2011;4(5):332–7. <http://dx.doi.org/10.1111/j.1752-8062.2011.00347.x>. Medline:22029804
19. Lancaster GA, Dodd S, Williamson PR. Design and analysis of pilot studies: recommendations for good practice. *J Eval Clin Pract.* 2004;10(2):307–12. <http://dx.doi.org/10.1111/j.2002.384.doc.x>. Medline:15189396
20. Shanyinde M, Pickering RM, Weatherall M. Questions asked and answered in pilot and feasibility randomized controlled trials. *BMC Med Res Methodol.* 2011;11(1):117. <http://dx.doi.org/10.1186/1471-2288-11-117>. Medline:21846349
21. Arain M, Campbell MJ, Cooper CL, et al. What is a pilot or feasibility study? A review of current practice and editorial policy. *BMC Med Res Methodol.* 2010;10(1):67. <http://dx.doi.org/10.1186/1471-2288-10-67>. Medline:20637084
22. Carlesso LC, MacDermid JC, Santaguida PL, et al. Beliefs and practice patterns in spinal manipulation and spinal motion palpation reported by Canadian manipulative physiotherapists. *Physiother Can.* 2012; 65(2):167–75. <http://dx.doi.org/10.3138/ptc.2012-11>
23. Gibbons P, Tehan P. Spinal manipulation: Indications, risks and benefits. *J Bodyw Mov Ther.* 2001;5(2):110–9. <http://dx.doi.org/10.1054/jbmt.2000.0208>
24. Canadian Physiotherapy Association—Orthopaedic Division. Clinical technique manuals, Level 4/5. 2006.
25. Canadian Physiotherapy Association—Orthopaedic Division. Theory manuals I & II. Diploma of Advanced Manual and Manipulative Physiotherapy. 2005.
26. Hing WA, Reid DA, Monaghan M. Manipulation of the cervical spine. *Man Ther.* 2003;8(1):2–9. <http://dx.doi.org/10.1054/math.2002.0487>. Medline:12635631
27. Bostick GP, Walton DM, Schneider GM, et al. Barriers and facilitators to clinician engagement in physiotherapy research. Quebec (QC): JPDL International; 2012.
28. Kongsved SM, Basnov M, Holm-Christensen K, et al. Response rate and completeness of questionnaires: a randomized study of Internet versus paper-and-pencil versions. *J Med Internet Res.* 2007;9(3):e25. <http://dx.doi.org/10.2196/jmir.9.3.e25>. Medline:17942387
29. Ritter P, Lorig K, Laurent D, et al. Internet versus mailed questionnaires: a randomized comparison. *J Med Internet Res.* 2004;6(3):e29. <http://dx.doi.org/10.2196/jmir.6.3.e29>. Medline:15471755
30. Edwards PJ, Roberts I, Clarke MJ, et al. Methods to increase response to postal and electronic questionnaires. *Cochrane Database Syst Rev.* 2009;(3):MR000008. Medline:19588449
31. Cagnie B, Vinck E, Beernaert A, et al. How common are side effects of spinal manipulation and can these side effects be predicted? *Man Ther.* 2004;9(3):151–6. <http://dx.doi.org/10.1016/j.math.2004.03.001>. Medline:15245709
32. Leaver AM, Maher CG, Herbert RD, et al. A randomized controlled trial comparing manipulation with mobilization for recent onset neck pain. *Arch Phys Med Rehabil.* 2010;91(9):1313–8. <http://dx.doi.org/10.1016/j.apmr.2010.06.006>. Medline:20801246
33. Sweeney A, Doody C. Manual therapy for the cervical spine and reported adverse effects: a survey of Irish manipulative physiotherapists. *Man Ther.* 2010;15(1):32–6. <http://dx.doi.org/10.1016/j.math.2009.05.007>. Medline:19632881