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CLINICAL REPORT

Investigating the idea that spinal manipulative therapy can affect the patient beyond muscle and joint pain:

A systematic narrative review.

Carrie-Ann McDowall

Abstract: Chiropractors are primary care providers for spinal and musculoskeletal conditions. Current literature recognises the evidence for benefits of common musculoskeletal complaints including back and neck pain, a minority of patient visits are non-musculoskeletal in nature. The hypothesis that spinal manipulative therapy does have an effect on the patient beyond muscle and joint pain is a claim that has been scrutinised inside and outside the profession possibly due to the absence of high level evidence to support those claims. Electronic databases were searched using Mesh terms and selection criteria was met. The search yielded 23 papers, the literature was evaluated using selective critical appraisal tools. Of those, ten were randomised controlled trials, nine were systematic reviews, one was a cohort study and three were surveys. Four papers were evaluated as no evidence, 14 were evaluated as inconclusive, four papers had conclusive evidence and there was a moderate to low range of bias across all papers. The claim that SMT can affect the patient beyond muscle and joint pain cannot be substantiated due to the methodological bias and inconclusive evidence of the current literature. Improvements for future evidence quality may increase with better objective outcome measures, specified topics of research, double-blinding in randomised controlled trials and more controlled cohort studies to improve reproducibility.

Indexing Terms: Spinal manipulative therapy, non-musculoskeletal, evidence, chiropractic.

Clinical Question

The clinical question addressed by this short report is, '*What is the level of evidence existing amongst the current literature which supports the popular opinion and claims of the benefits for spinal manipulative therapy, for non-musculoskeletal (NMSK) conditions*'?

... The claim that SMT can affect the patient beyond muscle and joint pain cannot be substantiated due to the methodological bias and inconclusive evidence of the current literature.'

Introduction

Spinal manipulative therapy (SMT) as performed by chiropractors shows moderate to high levels of evidence of benefit of common musculoskeletal complaints. (1) 4.6 Billion dollars was spent on back pain during 2000 to 2001 as published in the Australian National Health Survey, additionally 5 Billion was spent on diseases of the nervous system. (2) The hypothesis that SMT does have an effect on the patient beyond muscle and joint pain is a claim that has been scrutinised inside and outside the profession. (3) This systematic narrative review of the current literature aims to establish the quality of evidence available to support these claims.

The common opinion of what level of evidence exists for SMT is divided, as seen in recent publicity regarding the safety and efficacy of SMT particularly in children under 12 years. In 2019 *Safer Care Victoria* conducted a systematic review. (22) During the review, parents self-reported multiple reasons for taking their children to the chiropractor, amongst these reasons 56.7% were musculoskeletal based, 44.4% were for gastrointestinal ailments, 8.8% were for special needs ailments and 8.7% were for respiratory ailments.

While the review showcased a public demand for chiropractic intervention of NMSK conditions in children, it revealed a gap in the literature that identified limited and low level evidence to support the efficacy of SMT of children with NMSK conditions. This systematic narrative review will analyse the quality and quantity of the published literature due to divided opinion of the public, the profession, and report my view of why claims for SMT of NMSK conditions are made.

Methodology

Electronic searches of databases were performed including Medline. The Cochrane Library was used to perform a grey literature search of systematic reviews.

Three critical appraisal tools were utilised, the modified JADAD 5-point scale (4) (Table 4) for the RCTs, the 2009 PRISMA Checklist (1) (Table 1), and the STROBE checklist (5) (Figure 2) to assess the surveys.

Search strategy

Inclusion criteria

Open access full text, systematic reviews, RCTs, clinical trials, cohort studies, pilot studies, surveys MSK or NON MSK conditions.

Intervention was set to be manipulation, SMT, OMT, instrument assisted or mobilisation of joints. Comparison intervention was any other therapy or control intervention i.e. soft touch or manual therapy.

Outcomes were for NMSK improvement or positive effect or evidence of NMSK effect other than joint or muscle relief.

The key search Mesh terms included for non-musculoskeletal, pneumonia, asthma, allergies, immune system, inflammation, nervous system, respiratory system, headaches, migraines, chiropractic, spinal manipulative therapy, SMT, upper cervical, sleep, evidence, manual therapy, joint pain, muscle pain, wellness, adverse effects, paediatric, lymphatic, hormones, randomised controlled trials, clinical trials.

Exclusion criteria

Excluded search terms were physiotherapy, acupuncture and massage. Exclusion criteria included languages other than English, duplicates, dates before 1980, irrelevant to clinical questions, abstracts only, and papers that were not retrievable without subscription.

Search results

Database search results yielded 2,092 records, and a grey literature search yielded 65 records with 862 duplicates excluded during phase one, leaving 1,294 screened for eligibility. Phase two screening concluded with 1,271 papers being excluded with criteria, leaving the final 23 full research papers, consisting of ten RCTs, three surveys, one cohort study and nine systematic reviews to be critically appraised. These final research papers have been recorded into a 2009 Prisma flow diagram (Figure 1) adapted from www.prisma-statement.org and given as Table 2.

Figure 1: PRISMA flow 2009 Diagram Adapted from www.prisma-statement.org

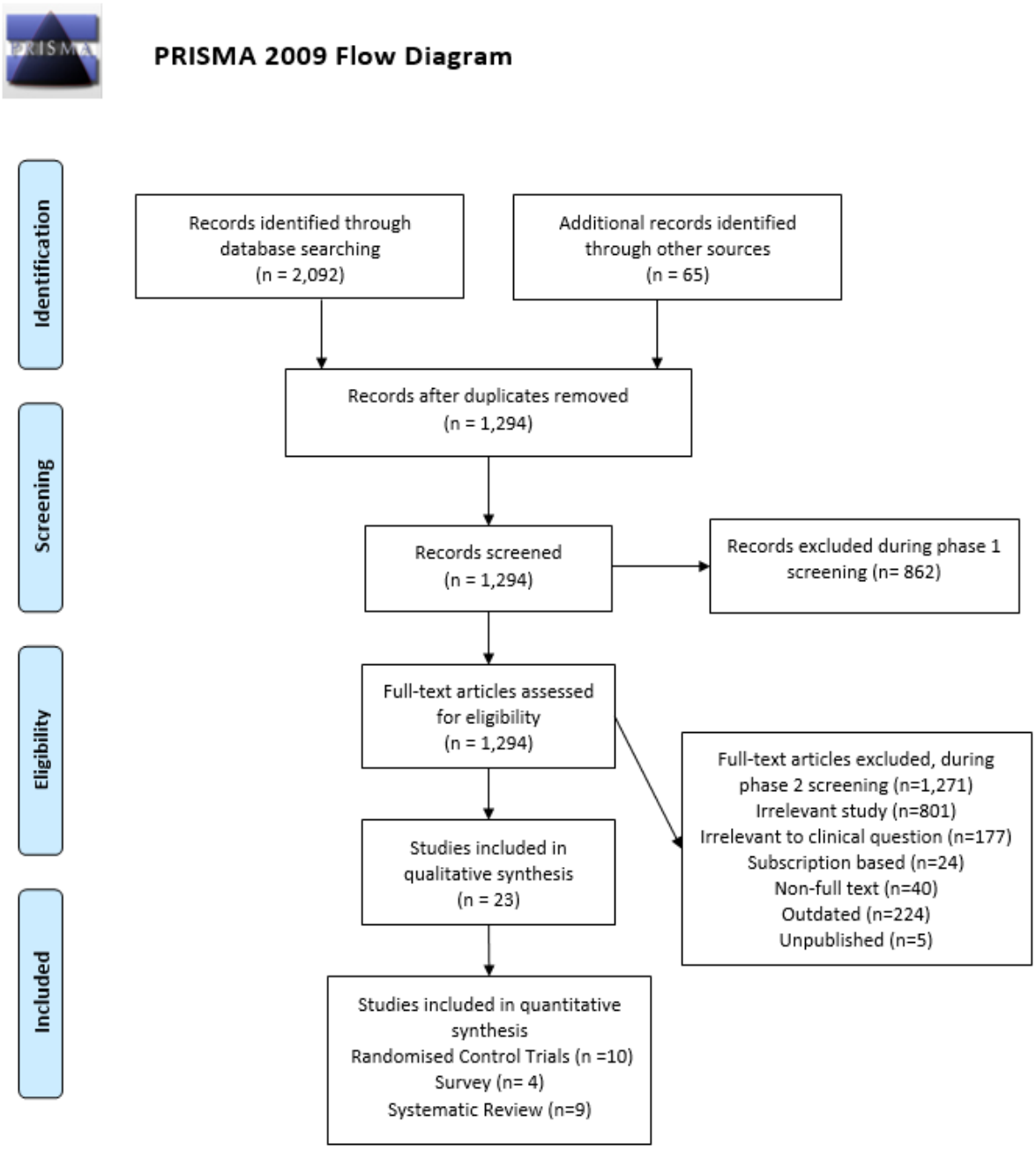

Table 1: PRISMA flow 2009 Diagram Adapted from www.prisma-statement.org

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	

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Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit: www.prisma-statement.org.

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Results

23 Papers have been summarised into Table 2. NMSK conditions identified in the review were: AD/HD, autonomic nervous system, cervicogenic headache, COPD, migraine, pneumonia, emotional stress, inflammation, immune system, cardiovascular (heart rate variability), HIV/AIDS. (The systematic reviews account for 109 NMSK in total some of which may be duplicated across the nine reviews).

Table 2: 23 Papers assessed within the PRISMA framework

Results Table										
Author	Type of paper	CAT score	Intervention other than SMT	Control or Placebo Intervention	Clinical Outcome Measures	P values of RCTs were reported	N value. Papers or Participants	NMSK Conditions	Conclusion of Evidence	Risk of Bias
Bablis et al. 2009	Survey	Moderate	NET	None	None	NA	761 participants	13 different conditions (see table 2 in full text located in reference list)	Conclusive	High
Bronfort et al. 2010	Systematic review	Moderate-High	Massage, MT	NA	NA	NA	101 papers	9 different conditions (see figure 2 in full text located in the reference list)	Mixed - Inconclusive	LOW
Clar et al. 2014	Systematic review	High	Massage, MT	NA	NA	NA	178 papers	25 different conditions (see table 2 in full text located in reference list)	Inconclusive Low-Moderate	LOW
Goncalves et al. 2018	Systematic review	HIgh	NA	NA	NA	NA	13 papers	Primary prevention of diseases other than MSK	No evidence	LOW
Hawk et al. 2007	Systematic review	Moderate-High	NA	NA	NA	NA	179 papers	50 different conditions (see table 5 in full text located in reference list)	Varied: Moderate to Low, inconclusive	LOW
Karpouzis et al. 2010	Systematic review	Moderate-High	All chiropractic interventions	NA	Behaviour score charts	NA	58 papers	AD/HD	Empty Review-Low	Moderate
Leboeuf-Yde, C et al. 2005	Survey	Moderate-High	SMT of any technique	None	NA	Yes	5607 participants	12 different conditions (see table 1 in full text located in reference list)	Moderate Inconclusive	Moderate
Picchiottino et al. 2019	Systematic review	High	Joint mobilisation	Sham JMT	HRV, Respiratory rate	NA	29 papers	Autonomic Nervous system	Inconclusive Low	LOW
Rubinstein et al. 2019	Systematic review	High	NA	Sham SMT	Pain Intensity and back pain specific functional status	NA	47 RCTs and 9211 Participants	none	Conclusive	LOW
Safer Care Victoria, 2019	Systematic review	High	NA	NA	NA	NA	23 papers	Colic, Sleep, Enuresis, Headache, wellbeing, Breastfeeding, asthma, otitis media,ADHD, Cerebral palsy,	Inconclusive	LOW
Wearing et al. 2016	Systematic review	High	Instrument assisted, JMT, MT	Exercise, MT,	Walking test, various Respiratory tests	NA	6 papers	COPD	Moderate Inconclusive	LOW
Bialosky, J.E et al. 2009	RCT	3	NA	Exercise bike, stretches	Numeric rating scale, and 5 psychological Questionnaires.	Yes	36 Participants	Temporal summation	No evidence	LOW
Bishop, M. D. et al. 2011	RCT	3	NA	Cervical Exercise	Numeric rating scale, and 5 psychological Questionnaires.	Yes	90 Participants	Temporal summation	Inconclusive	LOW
Chaibi, A. et al. 2017	RCT	3	Cervical SMT	Sham SMT	Chiropractic tests, Numeric rating scale	Yes	70 Participants	Migraine	Inconclusive	LOW
Chaibi, A. et al. 20	RCT	3	SMT	Control and Sham Manipulation	Days with CGH and days without CGH	Yes	19 Participants	Cervicogenic Headache	Inconclusive	Moderate
Clark B,C. et al 2018	RCT	3	SMT	Mobilisation, Sham Laser	EMG, T2 MRI,	NA	42 Participants	None	None- Incomplete	NA
Hass et al. 2018	RCT	3	SMT	Sham massage	Days with CGH and days without CGH	Yes	64 Participants	Cervicogenic Headache	Conclusive	Moderate
Jeffrey L, 1994	Cohort Study	Moderate-High	Upper Cervical SMT	Sham instrument	Grostic method and Xrays, Blood samples, Physical exam	Yes	10 Participants	HIV AIDS	Moderate Inconclusive	Moderate
Noll, D. R et al. 2016	RCT	3	OMT	Light touch	Medical analysis of pneumonia	Yes	387 Participants	Pneumonia	Moderate Inconclusive	Moderate
Roy,R, A et al. 2010	RCT	3	SMT	Control group	Inflammatory markers	Yes	21 Participants	Inflammation	Inconclusive	Moderate
Saggio, G et al. 2011	RCT	3	OMT	Control group	Saliva IgA levels	Yes	25 Participants	Stress/ immunoglobulin	Conclusive	Moderate
Wenban A,B. 2003	Survey	Moderate	SMT	NA	NA	NA	180 participants	Methodology of quality of evidence	Moderate Conclusive	High
Younes, M et al. 2017	RCT	5	SMT	Sham SMT	ECG, NPS,	Yes	22 Participants	Heart rate variability, Baroreflex	Moderate Inconclusive	LOW

Explanation of abbreviations* SMT- spinal manipulative therapy,MT- manual therapy, OMT- Osteopathic Manipulative Treatment, CGH- Cervicogenic Headache, NPS- numeric pain scale
EMG- electromagnetic, MRI,T2- Magnetic resonance image, JMT-joint mobilisation Technique

Nine systematic reviews were critically appraised using the PRISMA statement (Table 3) which showed results of high level quality.

Table 3 PRISMA flow 2009 Diagram Adapted from www.prisma-statement.org

PRISMA 2009 Checklist Table 1																										
Author / year	1	2	3	4	5	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
red= no green =yes																										
Bronfort et al. 2010																										
Clar, et al. 2014																										
Goncalves et al. 2018																										
Hawk et al. 2007																										
Karpouzis, et al. 2010																										
Picchiottino et al. 2019																										
Rubinstein et al. 2019																										
Safer Care Victoria, 2019																										
Wearing et al. 2016																										

Adapted from: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). For more information, visit: www.prisma-statement.org.

Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097.doi:10.1371/journal.pmed1000097

Ten randomised controlled trials were critically appraised using the Jadad five-point scale tool (Table 4) which showed results of moderate to high level quality.

Table 4: Jadad scale

Jadad Five-Point Scale for RCTs Table 2								
Author / year	Study was described as randor	Study was described as double-bl	Description of withdrawals and dro was provide	Methods to generate the sequen randomisation were described and appropriat	Methods to generate the sequen randomisation were described and inappropiat	Methods of double blinding w described and were appropi	Methods of double blinding w described and were inappropi	score H/L high or
YES=1 NO=0					yes=-1		yes=-1	
Bialosky, J.E et al. 2009	1	0	1	1	0	0	0	3 High
Bishop, M. D. et al. 2011	1	0	1	1	0	0	0	3 high
Chaibi, A. et al. 2017	1	0	1	1	0	0	0	3 high
Chaibi, A. e	1	0	1	1	0	0	0	3 high
Clark B,C. et al. 2018	1	0	1	1	0	0	0	3 high
Hass et al. 2018	1	0	1	1	0	0	0	3 high
Noll, D. R e al. 2016	1	0	1	1	0	0	0	3 high
Roy,R, A et al. 2010	1	0	1	1	0	0	0	3 high
Saggio, G e al. 2011	1	0	1	1	0	0	0	3 high
Younes, M et al. 2017	1	1	1	1	0	1	0	5 high

Scoring: 0–2 = low quality ; 3–5 = high quality . Adapted from Jadad AR, Moore RA, Carroll D, et al. Assessing the quality of reports of randomized clinical trials: is blinding necessary? https://onlinelibrary.wiley.com/doi/pdf/10.1002/9780470988343.app1Control Clin Trials 1996;17:1–12

The STROBE checklist tool (Figure 2) was used to critically appraise the three surveys and one cohort study (Table 5) and showed results of moderate to low level quality.

Figure 2: STROBE checklist

STROBE Statement—Checklist of items that should be included in reports of ***cohort studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) If applicable, explain how loss to follow-up was addressed
		(*e*) Describe any sensitivity analyses
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
		(c) Summarise follow-up time (eg, average and total amount)
Outcome data	15*	Report numbers of outcome events or summary measures over time
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period

Table 5: Four papers against STROBE criteria

STROBE Checklist Table 3				
Author /question number	**Bablis, et al. 2009**	**Jeffrey L, et al. 1994**	**Leboeuf-Yde, C et al. 2005**	**Wenban A,B. 2003**
1				
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17				
18				
19				
20				
21				
22				
Score:	Green= Yes, Red= No, Yellow= Unsure			
Information on the STROBE Initiative is available at http://www.strobe-statement.org.				

Discussion

Potential for bias

The critical appraisal tools (CAT) measured levels of bias and methodologies for each paper. Three CATs were used to allow for a variety of studies to best account for bias. The bias amongst the papers measured moderate to low considering almost half were systematic reviews and the others were randomised controlled trials. All papers (3, 6, 7, 8, 9, 10, 11, 12, 13) reported methodological limitations and reflected bias within the respective study. Most bias was reported as a limitation of double-blinding, a small sample size, and the effect of the sham or control intervention on results, that demonstrated a placebo effect.

Insights of three systematic reviews

The first review, published by Hawk et al. (14) in 2007 citing 197 papers, included 50 NMSK conditions, which provided evidence to support chiropractic care (the entire encounter). These conditions included asthma, chronic vertigo, infantile colic, children with otitis media and pneumonia in the elderly showed promising evidence for potential benefits from SMT. Hawk et al. demonstrated the consideration for a whole systems research (WSR) methodology, with a call to investigators increasing their attention to observational studies. Hawk et al. concluded that an average of 10.3% of patient visits to chiropractors were for NMSK conditions.

The second review was a UK based study, originally published by Bronfort et al. (15) in 2010, then updated, extended and re-published in 2014 by Clar et al. (16) Included in Bronfort were nine RCTs for NMSK conditions resulting in moderate evidence. The Clar study found 178 new or additional studies demonstrating evidence for NMSK conditions that were previously unconsidered. However, most papers cited in the reviews were inconclusive and were highlighted for requiring further research. This shows there is an emerging trend towards NMSK research.

What demand is there for NMSK treatment by chiropractors?

A published 2005 multinational survey of 5,607 participants conducted by Leboeuf-Yde et al. (17) reported that 10% found chiropractic adjustments made a definite improvement in NMSK conditions. The most notable were digestive, respiratory and urinary improvements, 56% of participants noticed some degree of improvement. The limiting methodologies of this study demonstrated increased bias, resulting in low level quality evidence (Table 4).

There are over 100 different techniques adopted by chiropractors, (12) Neuro Emotional Technique (NET) focuses on the stress and emotional level. Bablis et al. noted many patients who visit a chiropractor providing NET may more likely to be visiting for a NMSK reason. Bablis et al. (13) concluded that 36% of patients had self-reported NMSK complaints, most commonly presented were depression 10.9%, stress and anxiety 12.8%, and immune and recurrent infections 13.9%. Bablis et al. reported these statistics are not usually this high across standard chiropractic clinics.

Limitations of SMT evidence

The limitation of studies for SMT research regarding randomised controlled trials is the double-blinding component. For example, the inability to blind a parent for a trial involving infants in some cases could be considered unethical. The restriction on blinding practitioners applying the intervention is difficult, thus increases risk of bias. Low reproducibility is also a common flaw in the methodology due to the difficult nature in standardising an intervention amongst numerous practitioners. (15) Therefore, as RCTs prove challenging for SMT research, recognition should be given to cohort studies, observational studies and retrospective clinical studies, which in turn provide reliable data. (14) These types of studies reflect what can happen in a real clinical setting and may yield important outcomes.

A systematic review by Picchiottino et al. (18) looked at the changes affecting the ANS immediately after joint mobilisation. In 29 studies Picchiottino observed the '*usual pitfalls of bias*' in the methodology. This statement is indicative of a commonality of bias amongst SMT research. Most studies assessed, called for more research and greater participant size to allow for better credibility. For example, a pilot study conducted by Jeffrey L Selano et al. (10) showed a statistically significant increase of 48% in CD4 cells, compared to the control group in the ten participants who were infected with HIV/AIDS they had received upper cervical SMT. Selano et al. called for a larger study of 200 participants to improve generalisability.

Limitations of this review

This systematic narrative review was limited by design, and the number of papers assessed for quality of evidence are biased to the authors' opinions. This narrative review did not include all available studies, due to restricted access to full texts without a subscription to the journal or database.

What does the evidence tell us about SMT?

Two RCTs included in the review assess temporal summation of thermal patterns on the skin. The study conducted by Bishop (19) and Bialosky (20) was to demonstrate the link of SMT directly to hypoalgesia. While the study had impressive CAT scores, they did not find an answer to

their hypothesis, instead it led to a different question, the ability of the nervous system to change and adapt, '*neuroplasticity*.' They hypothesised exercise as a treatment for neurologically compromised individuals through engaging pathways of the nervous system at the dorsal root horn. This study demonstrated that the SMT intervention has potential to affect the body beyond muscle and joint pain.

High levels of quality evidence- why it's important

There is a need for strong evidence in SMT to maintain professional credibility, unsubstantiated claims can be damaging to the profession hence the call for high quality studies. The high quality studies are normally well funded and independently organised, they are carefully conducted, randomised and controlled. Goncalves et al. (21) states that poor quality studies waste resources and inconvenience participants.

Wenban found evidence for 68% of chiropractic treatments that were based on good methodologic quality in a retrospective survey conducted in 2003. (3) Wenban states the highest type of research evidence is extrapolated from a carefully controlled clinical trial.

My Table 6 (their 'Table 4') describes the levels of evidence required to make a public claim for a therapeutic outcome, this table illustrates level I evidence should be substantiated. However, a large number of SMT studies are level III through IV. The nine RCTs which are level II, included in this review found moderate levels of bias due to the methodology of double-blinding. Hawk et al. (14) concludes that whole system research is ideal for SMT studies as the methodology is more achievable, thus reducing bias and improving generalisability.

Adverse events reported

The ten RCTs and nine systematic reviews conclude that not enough papers report on adverse events in SMT. The papers that did report adverse events have a lower risk of bias. Most SMT adverse events that are reported are mild and transient. (9) It is important to mention here that SMT is reported as low risk of harm and is regarded as safe. (22) Possible considerations for the public to seek SMT for NMSK conditions is the safety record compared to iatrogenic statistics. '*In Australia medical error results in as many as 18,000 unnecessary deaths, and more than 50,000 patients become disabled each year.*' (23, 22)

Conclusion

The 23 selected studies reported inconclusive evidence and more appropriate level I research is needed to accurately claim the non-musculoskeletal conditions that are commonly observed to have a positive association to spinal manipulative therapy. Irrespective of the quality of evidence found, there were a large quantity of studies published for spinal manipulative therapy and the effects beyond muscle and joint pain. Studies demonstrated moderate to high level quality, majority of papers reported moderate levels of bias, it is important to mention an average of ten percent of patients received care for non-musculoskeletal conditions from Chiropractors and spinal manipulative therapy is associated with low risk of harm.

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Table 6 NHMRC Evidence levels

Table 4	National Health and Medical Research Council (NHMRC) levels of evidence
Level	Screening Intervention
I	A systematic review of level II studies
II	A Randomized control trial
III-1	A pseudorandomized controlled trial (i.e. alternate allocation or some other method)
III-2	A comparative study with concurrent controls: • Non-randomized, experimental trial • Cohort study • Case-control study
III-3	A comparative study with concurrent controls: Non-randomized, experimental trial, Cohort study, Case-control study
IV	Case series
Adapted from:	https://www.mja.com.au/sites/default/files/NHMRC.levels.of.evidence.2008-09.pdf

References

1. Rubinstein SM, de Zoete A, van Middelkoop M, Assendelft WJJ, de Boer MR, van Tulder MW. Benefits and harms of spinal manipulative therapy for the treatment of chronic low back pain: systematic review and meta-analysis of randomised controlled trials. BMJ (Clinical research ed). 2019 {cited May 30th 2020};364:l689. available from https://www.bmj.com/content/bmj/364/bmj.l689.full.pdf

2. Australlian Bureau of Statistics. Arthritis and musculoskeletal conditions in Australia, : Canberra.; 2005 [Government Database].{cited on 30th May 2020} PDF available from: https://www.abs.gov.au/Ausstats/abs@.nsf/0e5fa1cc95cd093c4a2568110007852b/ef042af5b7e324f0ca256f150082fca3!OpenDocument.

3. Wenban AB. Is chiropractic evidence based? A pilot study. Journal of Manipulative & Physiological Therapeutics. 2003 {cited on 30th May 2020} ;26(1):47.available from https://doi.org/10.1067/mmt.2003.2

4. Jadad AR, Moore RA, Carroll D, Jenkinson C, Reynolds DJM, Gavaghan DJ, et al. Assessing the quality of reports of randomized clinical trials: is blinding necessary? Controlled clinical trials. 1996 {cited on 30th May 2020};17(1):1-12.availablefromhttps://www.sciencedirect.com/science/article/abs/pii/0197245695001344?via%3Dihub

5. STROBE statement for Cohort Studies [Critical Appraisal Tool]. Available from: http://www.strobe-statement.org/.

6. Noll DR, Degenhardt BF, Johnson JC. Multicenter osteopathic pneumonia study in the elderly: subgroup analysis on hospital length of stay, ventilator-dependent respiratory failure rate, and in-hospital mortality rate. J Am Osteopath Assoc. 2016{cited on 30th May 2020};116(9):574-87.available from https://jaoa.org/article.aspx?articleid=2546793

7. Roy RA, Boucher JP, Comtois AS. Inflammatory response following a short-term course of chiropractic treatment in subjects with and without chronic low back pain. J Chiropr Med. 2010 {cited on 30th May 2020};9(3):107-14.available from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3188345/

8. Saggio G, Docimo S, Pilc J, Norton J, Gilliar W. Impact of osteopathic manipulative treatment on secretory immunoglobulin a levels in a stressed population. Journal of the American Osteopathic Association. 2011{cited on 30th May 2020};111(3):143.available from https://jaoa.org/article.aspx?articleid=2094159

9. Chaibi A, Benth JS, Tuchin PJ, Russell MB. Adverse events in a chiropractic spinal manipulative therapy single-blinded, placebo, randomized controlled trial for migraineurs. Musculoskeletal science & practice. 2017 {cited on 30th May 2020} ;29:66-71.available from https://www.sciencedirect.com/science/article/pii/S2468781217300541?via%3Dihub

10. Jeffrey L. Selano BCH, Bruce Pfleger, Karen Freeley Collins, John, Grostic D. The Effects of Specific Upper Cervical Adjustments on the CD4 Counts of HIV Positive Patients. Chiropractic Research Journal 1994 {cited on 30th May 2020} ;3(1):32-9.available from https://www.upcspine.com/dloads/rs80.pdf

11. Haas M, Bronfort G, Evans R, Schulz C, Vavrek D, Takaki L, et al. Dose-response and efficacy of spinal manipulation for care of cervicogenic headache: a dual-center randomized controlled trial. The spine journal : official journal of the North American Spine Society. 2018{cited on 30th May 2020} ;18(10):1741-54.available from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6107442/pdf/nihms946000.pdf

12. Karpouzis F, Bonello R, Pollard H. Chiropractic care for paediatric and adolescent Attention-Deficit/Hyperactivity Disorder: A systematic review. Chiropractic & osteopathy. 2010 {cited on 30th May 2020} ;18(1):13.available from https://doi.org/10.1186/1746-1340-18-13

13. Bablis P, Pollard H, Bonello R. A retrospective analysis of self-reported symptoms from 761 consecutive new patients presenting to a Neuro Emotional Technique chiropractic clinic. Complementary therapies in clinical practice. 2009{cited on 30th may 2020};15(3):166-71.available from https://www.sciencedirect.com/science/article/abs/pii/S1744388109000115?via%3Dihub

14. Hawk C, Khorsan R, Lisi AJ, Ferrance RJ, Evans MW. Chiropractic care for nonmusculoskeletal conditions: a systematic review with implications for whole systems research. Journal of alternative and complementary medicine (New York, NY). 2007{cited 30th May} ;13(5):491-512.available from https://www.liebertpub.com/doi/abs/10.1089/acm.2007.7088

15. Bronfort G, Haas M, Evans R, Leininger B, Triano J. Effectiveness of manual therapies: the UK evidence report. Chiropractic & osteopathy. 2010 {cited on 30th May 2020};18:3.available from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2841070/pdf/1746-1340-18-3.pdf

16. Clar C, Tsertsvadze A, Court R, Hundt GL, Clarke A, Sutcliffe P. Clinical effectiveness of manual therapy for the management of musculoskeletal and non-musculoskeletal conditions: systematic review and update of UK evidence report. Chiropractic & manual therapies. 2014 {cited on 30th May 2020} ;22(1):12.available from https://doi.org/10.1186/2045-709X-22-12

17. Leboeuf-Yde C, Pedersen EN, Bryner P, Cosman D, Hayek R, Meeker WC, et al. Self-reported nonmusculoskeletal responses to chiropractic intervention: a multination survey. J Manipulative Physiol Ther. 2005 {cited on 30th May 2020} ;28(5):294-302; discussion 65-6.available from https://www.sciencedirect.com/science/article/abs/pii/S0161475405001107

18. Picchiottino M, Leboeuf-Yde C, Gagey O, Hallman DM. The acute effects of joint manipulative techniques on markers of autonomic nervous system activity: a systematic review and meta-analysis of randomized sham-controlled trials. Chiropractic & manual therapies. 2019 {cited on 30th May 2020} ;27(1):17.available from https://chiromt.biomedcentral.com/articles/10.1186/s12998-019-0235-1

19. Bishop MD, Beneciuk JM, George SZ. Immediate reduction in temporal sensory summation after thoracic spinal manipulation. The spine journal : official journal of the North American Spine Society. 2011{cited on 30th May 2020} ;11(5):440-6.available from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3092807/pdf/nihms-280276.pdf

20. Bialosky JE, Bishop MD, Robinson ME, Zeppieri G, Jr., George SZ. Spinal manipulative therapy has an immediate effect on thermal pain sensitivity in people with low back pain: a randomized controlled trial. Physical therapy. 2009 {cited on 30th May 2020} ;89(12):1292-303. available from https://academic.oup.com/ptj/article/89/12/1292/2737580

21. Goncalves G, Scanff C, Leboeuf-Yde C. Effect of chiropractic treatment on primary or early secondary prevention: a systematic review with a pedagogic approach. Chiropractic & manual therapies. 2018 {cited on 30thMay 2022} ;26.available from https://chiromt.biomedcentral.com/track/pdf/10.1186/s12998-018-0179-x

22. Safer Care Victoria. Chiropractic spinal manipulation of children under 12: Independent review. Melbourne, Victoria: Victorian Government, Oct. 2019 {cited on 30th May 2020}. PDF available from https://www.bettersafercare.vic.gov.au/reports-and-publications/chiropractic-spinal-manipulation-of-children-under-12

23. Weingart SN, Wilson RM, Gibberd RW, Harrison B. Epidemiology of medical error. BMJ (Clinical research ed). 2000 {cited 30thMay 2020} ;320(7237):774-7.available from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1117772/

24. Beyerstein BL. Distinguishing science from pseudoscience. Retrieved on. 1996 {cited on 30 th May 2020} PDF available from. http://www.sld.cu/galerias/pdf/sitios/revsalud/beyerstein_cience_vs_pseudoscience.pdf

25. Chaibi A, Knackstedt H, Tuchin PJ, Russell MB. Chiropractic spinal manipulative therapy for cervicogenic headache: a single-blinded, placebo, randomized controlled trial. BMC research notes. 2017{cited on 30th May 2020} ;10(1):310.available from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5525198/pdf/13104_2017_Article_2651.pdf

26. Clark BC, Russ DW, Nakazawa M, France CR, Walkowski S, Law TD, et al. A randomized control trial to determine the effectiveness and physiological effects of spinal manipulation and spinal mobilization compared to each other and a sham condition in patients with chronic low back pain: Study protocol for The RELIEF Study. Contemp Clin Trials. 2018 {cited on 30th May 2020} ;70:41-52 available from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5994203/.

27. Younes M, Nowakowski K, Didier-Laurent B, Gombert M, Cottin F. Effect of spinal manipulative treatment on cardiovascular autonomic control in patients with acute low back pain. Chiropractic & manual therapies. 2017{cited on 30th May 2020} ;25:33.available from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5713473/pdf/12998_2017_Article_167.pdf

28. Wearing J, Beaumont S, Forbes D, Brown B, Engel R. The Use of Spinal Manipulative Therapy in the Management of Chronic Obstructive Pulmonary Disease: A Systematic Review. Journal of alternative and complementary medicine (New York, NY). 2016{cited on 30th May 2020} ;22(2):108-14 available from. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4761829/pdf/acm.2015.0199.pdf

29. Hart J. Analysis and Adjustment of Vertebral Subluxation as a Separate and Distinct Identity for the Chiropractic Profession: A Commentary. Journal of Chiropractic Humanities. 2016{ cited on 30th May 2020} ;23(1):46-52.available from http://www.sciencedirect.com/science/article/pii/S1556349916300055

30. Junod W. FDA and clinical drug trials: a short history2020 2020//.{cited on 30th May 2020} PDF available from https://www.fda.gov/media/110437/download

31. Kukurin GW. Chronic pediatric asthma and chiropractic spinal manipulation: a prospective clinical series and randomized clinical pilot study. J Manipulative Physiol Ther. 2002{cited on 30th May 2020} ;25(8):540-1available from https://www.jmptonline.org/article/S0161-4754(02)90004-7/pdf.

32. Lilienfeld SO, Ammirati R, David M. Distinguishing science from pseudoscience in school psychology: science and scientific thinking as safeguards against human error. J Sch Psychol. 2012{cited on 30th may 2020} ;50.available from https://doi.org/10.1016/j.jsp.2011.09.006

33. Moher D, Jones A, Lepage L, Group C. Use of the CONSORT statement and quality of reports of randomized trials: a comparative before-and-after evaluation. Jama. 2001{cited on 30th May 2020} ;285(15):1992-5.available from https://jamanetwork.com/journals/jama/fullarticle/193739

34. Stone-McCoy P TC. Resolution of asthma and other functional disorders following chiropractic care to reduce vertebral subluxations in a nine year old male: A case report. J Pediatric Matern & Fam Health - Chiropr 2018(April 2018){cited on 30th May 2020} :26-33.available fromhttps://www.vertebralsubluxationresearch.com/2018/04/09/resolution-of-asthma-and-other-functional-disorders-following-chiropractic-care-to-reduce-vertebral-subluxations-in-a-nine-year-old-male-a-case-report/

35. Weeks WB, Goertz CM, Meeker WC, Marchiori DM. Public Perceptions of Doctors of Chiropractic: Results of a National Survey and Examination of Variation According to Respondents' Likelihood to Use Chiropractic, Experience With Chiropractic, and Chiropractic Supply in Local Health Care Markets. Journal of Manipulative & Physiological Therapeutics. 2015 {cited 30th May 2020};38(8):533-44.available from https://doi.org/10.1016/j.jmpt.2015.08.001

36. Yu X, Wang X, Zhang J, Wang Y. Changes in pressure pain thresholds and Basal electromyographic activity after instrument-assisted spinal manipulative therapy in asymptomatic participants: a randomized, controlled trial. J Manipulative Physiol Ther. 2012 {cited on 30th May 2020} ;35(6):437-45.available from https://www.jmptonline.org/article/S0161-4754(12)00122-4/fulltext