

# Manual therapy for asthma (Review)

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[Intervention Review]

## Manual therapy for asthma

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### ABSTRACT

#### Background

A variety of manual therapies with similar postulated biologic mechanisms of action are commonly used to treat patients with asthma. Manual therapy practitioners are also varied, including physiotherapists, respiratory therapists, chiropractic and osteopathic physicians. A systematic review across disciplines is warranted.

#### Objectives

To evaluate the evidence for the effects of manual therapies for treatment of patients with bronchial asthma.

#### Search strategy

We searched for trials in computerized general (EMBASE, CINAHL and MEDLINE) and specialized databases (Cochrane Complementary Medicine Field, Cochrane Rehabilitation Field, Index to Chiropractic Literature (ICL), and Manual, Alternative and Natural Therapy (MANTIS)). In addition, we assessed bibliographies from included studies, and contacted authors of known studies for additional information about published and unpublished trials. Date of most recent search: August 2004.

#### Selection criteria

Trials were included if they: (1) were randomised; (2) included asthmatic children or adults; (3) examined one or more types of manual therapy; and (4) included clinical outcomes with observation periods of at least two weeks.

#### Data collection and analysis

All three reviewers independently extracted data and assessed trial quality using a standard form.

#### Main results

From 473 unique citations, 68 full text articles were retrieved and evaluated, which resulted in nine citations to three RCTs (156 patients) suitable for inclusion. Trials could not be pooled statistically because studies that addressed similar interventions used disparate patient groups or outcomes. The methodological quality of one of two trials examining chiropractic manipulation was good and neither trial found significant differences between chiropractic spinal manipulation and a sham manoeuvre on any of the outcomes measured. One small trial compared massage therapy with a relaxation control group and found significant differences in many of the lung function measures obtained. However, this trial had poor reporting characteristics and the data have yet to be confirmed.

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## Authors' conclusions

There is insufficient evidence to support the use of manual therapies for patients with asthma. There is a need to conduct adequately-sized RCTs that examine the effects of manual therapies on clinically relevant outcomes. Future trials should maintain observer blinding for outcome assessments, and report on the costs of care and adverse events. Currently, there is insufficient evidence to support or refute the use of manual therapy for patients with asthma.

## PLAIN LANGUAGE SUMMARY

### Manual therapy for asthma

Various manual forms of therapy are used to try and relieve asthma. Chiropractic and osteopathic techniques aim to increase movement in the rib cage and the spine to try and improve the working of the lungs and circulation. Other manual techniques include chest tapping, shaking, vibration, and postures to help shift and cough up phlegm. Massage is also used. Various therapists use these techniques, including chiropractors, physiotherapists, osteopaths and respiratory therapists. The review found there is not enough evidence from trials to show whether any of these therapies can improve asthma symptoms, and more research is needed.

## BACKGROUND

Medication reduces asthma symptoms in most patients. However, effective low-risk, non-pharmacological strategies could constitute a significant advance in asthma management.

Despite controversies in the literature regarding the use of manual therapy for conditions other than spinal and extremity pain, manipulation and mobilisation are manual therapies commonly used to treat patients with asthma and asthma-like symptoms. Osteopathic and chiropractic manipulative techniques have been advocated for almost 100 years, and are directed at increasing the motion of the thoracic cage, mobilising the ribs and thoracic spine, improving lung function and quality of life, and enhancing arterial oxygen content and lymphatic return for patients with a variety of obstructive airways diseases, including asthma (Allen 1993; Balon 1998; Bronfort 1994; Burns 1912; Forbes 1902; Hviid 1978; Lines 1990; Miller 1975; Wilson 1946). Chest percussion, shaking, vibration and postural drainage are postulated to mobilise peripheral bronchial secretions to more central airways for expectoration by coughing (Eid 1991). Postulated biologic mechanisms of action support review of the evidence from manual therapies across disciplines.

Manual therapy for asthmatic patients encompasses a variety of manoeuvres delivered by a variety of practitioners, including physiotherapists, respiratory therapists, and chiropractic and osteopathic physicians. The similarities and differences between practitioners and manoeuvres are not always clear. Adding to the confusion for patients, practitioners, and purchasers of health care is that general population surveys often describe visits to chiropractors as the use of alternative, unconventional, or complementary

medicine (Eisenberg 1993; MacLennan 1996); whereas, manual therapy delivered by physiotherapists and respiratory therapists generally occurs in hospital settings that are part of the dominant health care system.

Several qualitative reviews of the literature support the use of manual therapies for asthmatic patients. Chest physiotherapy in various forms seems to offer some benefit in asthma (Eid 1991; Orlandi 1989). Anecdotal evidence from the chiropractic literature has been summarized and supports the use of manual therapy for patients with bronchial asthma (Dennis 1992; Renaud 1990; Ziegler 1992). A 1994 Delphi study delineated chest physiotherapy and patient outcomes as a high research priority (Cullen 1994). A systematic review concerning physical therapy for chronic bronchitis and chronic obstructive pulmonary disease (COPD) is available in the Cochrane Library (Jones 1997). However there is no systematic review of manual therapy for the treatment of asthma. Because existing reviews are discipline-specific, and because several clinical trials of manual therapies for asthmatic patients have been conducted, a systematic review of the evidence is warranted.

## OBJECTIVES

The purpose of this review was to investigate the evidence from randomised and quasi-randomised controlled trials for the efficacy of manual therapy in the treatment of patients with bronchial asthma. Manual therapy was compared with control treatments in terms of: physiologic outcomes, morbidity and mortality, and side-effects of therapy.

## METHODS

### Criteria for considering studies for this review

#### Types of studies

Randomised or quasi-randomised (methods of allocating participants to a treatment which are not strictly random, e.g., by alternation, date of birth, or medical record numbers) trials with observation periods of at least two weeks were included.

#### Types of participants

Asthmatic children (over two years of age) and adults of all degrees of severity, whether living in institutions, communal settings or in the community. We included data from studies of mixed populations if separate data were available for asthmatic patients or when authors provided these data. We excluded studies reporting results on patients with COPD.

#### Types of interventions

We included all studies that examined the use of one or more types of manual therapy, including manipulation, mobilisation, massage, chest percussion, shaking and vibration. Although physiotherapy protocols often include postural drainage in combination with chest percussion, vibration and shaking, we excluded studies that reported postural drainage alone (i.e. not in combination or comparison with manual therapies). Because we are interested in manual therapies of the spine and chest wall, we excluded studies of reflexology and similar techniques. Comparison groups included sham manual therapy or placebo controls. We recorded pharmacological co-interventions and contacted authors for this information if not provided in the published report.

#### Types of outcome measures

We recorded data on all reported outcomes. The outcomes we expected to be available in reports included lung function (such as vital capacity, forced expiratory volume in one second (FEV1), FEV1/FVC ratio, hospital admissions, hospitalization days, emergency room visits, medication use, quality of life, and subjective symptoms. Trials that only examined immediate effects of care (pre-post intervention or less than two week observation period) were excluded from the review.

### Search methods for identification of studies

#### Electronic searches

We searched the Cochrane Airways Group trial register using the terms:

manip\* OR manual therap\* OR massage OR physical therapy OR physiotherapy OR percussion OR chest vibration OR chest shaking

In addition, we undertook electronic searches of the Index to Chiropractic Literature (ICL); the Manual, Alternative and Natural Therapy (MANTIS) database; registries of the Cochrane Complementary Medicine Field and the Cochrane Physical Therapy and Rehabilitation Field from inception through 2001.

#### Searching other resources

We also conducted manual searches of the Chiropractic Research Archives Collection (CRAC) and the grey literature in chiropractic, osteopathy, and physiotherapy from inception through 2001. Future updates will include electronic and manual searches of specialist databases to present. We reviewed reference lists of all primary studies and review articles to identify trials not captured by electronic and manual searches. We reviewed citations without language restriction and contacted the first author of each study to verify data and query on the existence of other published or unpublished trials. Finally, we made personal contact with colleagues, collaborators and other trialists working in the field of manual therapies to identify potentially relevant studies.

### Data collection and analysis

#### Selection of studies

At least two reviewers independently assessed search results, eligibility and selected studies for inclusion in the review. Initial disagreement occurred for three papers; after discussion all three trials were excluded. Reviewers independently screened titles, abstracts, and descriptors identified from the electronic and manual searches to identify potential trials and previous reviews of manual therapies for asthma. After the potential trials and reviews were retrieved, three reviewers independently applied the inclusion/exclusion criteria to unblinded full reports for selection of trials and reviews. We resolved disagreements about study inclusion by consensus (two trials, both excluded from review).

#### Data extraction and management

All three reviewers independently performed data abstraction of descriptive characteristics and study results. If data were not reported in an extractable form, we contacted the authors for additional information. If the authors could not be contacted or if the information was no longer available, this was reported. We resolved disagreements about the type of manual therapy reported by consensus. We entered lung function data (with the exception

of residual volume, functional residual capacity and total lung capacity) as negative values to conform to the Cochrane convention whereby effects that favour the treatment under review move to the left.

### Assessment of risk of bias in included studies

All three reviewers independently assessed the methodological quality of eligible RCTs utilizing three scoring methods: the Jadad scale (Jadad 1996); an “Internal Validity Scale” developed by one of the authors (KL); and the Cochrane approach. The three scoring methods place particular emphasis on each trial’s reporting characteristics, with explicit statements related to allocation concealment, baseline comparability, blinding of patients and evaluators, and the handling of withdrawals. We resolved disagreements by consensus. Results of the quality scoring are displayed in the table of included studies.

The Jadad scale has three items: one point is allocated for randomisation, blinding, and description of withdrawals and drop-outs; an extra point can be added for methods of randomisation and blinding that are well described and adequate. Studies which use a clearly inadequate method of randomisation or blinding (such as alternating patients) lose the point allocated. The maximum score is five points and studies scoring below three points are usually regarded as being of low methodological quality. The display in the table of included studies is as follows (examples): 2-2-1 (full score for each item); 1-0-0 (randomisation only stated; no further details obtained).

The Internal Validity (IV) Scale has been used in other reviews on complementary medicine (Linde 1996, Linde 1997, Linde 1998a, Linde 1998b, Linde 1998c). This quality scale has six items with possible scores of 0, 0.5 or 1 point for each item. Items assessed with this scale include treatment allocation, randomisation concealment, baseline comparability, blinding of patients, blinding of evaluators, and handling of withdrawals. Results are displayed by item in the “Table of included studies” (e.g., 1-1-1-0.5-1-1 represents a full score with exception of blinding of patients which was stated but treatment and placebo might have been distinguishable).

The methodological quality of trials was also assessed with particular emphasis on the allocation concealment, which was ranked using the Cochrane approach:

Grade A: Adequate concealment

Grade B: Uncertain

Grade C: Clearly inadequate concealment

Grade D: Not used

Operational definitions utilized for the scoring methods of all three instruments are available from the authors.

Simple agreement and weighted kappa statistics were used to measure agreement between evaluators using the three scoring methods. We established consensus on quality scores by discussion. No trial was excluded on the basis of quality score.

### Data synthesis

Data were combined using odds ratios (OR) and 95% confidence intervals (95% CI) for dichotomous data or weighted mean differences (WMD) and 95% CI for continuous data. The Generic Inverse Variance method was used for data from cross-over studies. For future updates to this review, when a sufficient number of studies are available, we will group studies according to age of participants (children/adults), type of manual therapy, and type of control group intervention.

Where trials examined both early and late pulmonary function variables, we used those measured later for this review because we considered the late effects more clinically relevant. Because there is considerable disagreement on the approach to meta-analysis of crossover trials, we elected to only use the first arm of the data in our analysis.

## RESULTS

### Description of studies

See: [Characteristics of included studies](#); [Characteristics of excluded studies](#).

### Results of the search

Electronic and manual searches through August 2004 identified 585 potential trials and reviews, which included 112 duplicate records. Based on abstracts of the remaining 473 records, 68 full text articles were retrieved and evaluated for inclusion. Fifty-six of these did not meet the inclusion criteria (including 14 traditional narrative reviews), one trial met the selection criteria but did not report control group data (Bronfort 2001), six citations were published abstracts to included trials, and two met the selection criteria for the original review, but were excluded with this update. The original review included one trial of reflexology (Petersen 1992) and one trial with an observation period less than two weeks (Asher 1990); these trials did not meet the revised selection criteria. This review is based on a total of three RCTs.

### Included studies

The three randomised trials enrolled 156 participants from Canada, Denmark and the US. Two trials (Balon 1998; Field 1998) investigated manual therapies in children with a mean age of 10.5 years (range 6 to 16 years) and one trial (Nielsen 1995) included adults with a mean age of 28.6 years (range 18 to 44). One trial (Nielsen 1995) utilized a cross-over design and the remaining trials used parallel groups. These studies included a very heterogeneous group of participants recruited from three settings:

children with chronic asthma from chiropractic practices (Balon 1998); adults with chronic moderate asthma attending a hospital out-patient allergy department (Nielsen 1995) and children attending a paediatric pulmonary clinic (Field 1998). One of the included studies (Nielsen 1995) reported data on adverse events. For details see “Table of Included Studies”.

### MANIPULATION VERSUS SHAM MANOEUVRE

Two trials (Balon 1998; Nielsen 1995) evaluated spinal manipulative therapy versus a sham manipulative manoeuvre. In the Nielsen trial, the duration and frequency of treatments in both groups was similar: 10 to 15 minutes for each session, eight sessions over the course of four weeks. The active treatment included specific spinal manipulation directed to spinal segmental biomechanical dysfunction identified by paraspinal muscle palpation and forced passive motion palpation of joint mobility. Decreased vertebral motion or abnormal joint play, based on motion palpation manoeuvres was the most important criteria utilized. Subjects in the active treatment group received drop-technique in the seated, prone, supine, or side-lying postures, with a specific contact over the vertebral osseous process, muscle or ligament and most often utilizing a high-velocity, low-amplitude, short lever thrust. Most of the time, an audible release was noted. No adjunctive physiotherapy or massage was utilized. The sham manoeuvre in the Nielsen 1995 trial, consisted of application of gentle manual pressure over the spinal contact with one hand, while the other hand thrust on the drop section with the purpose of releasing the table mechanism. No direct manipulative thrust was applied to the subject's spine and the tension of the drop section was just great enough not to be released by the weight of the subject.

Participants in both groups of the trial by Balon 1998 had similar treatment schedules. Patients were treated three times weekly for four weeks, twice weekly for four weeks, then weekly for eight weeks. Active chiropractic treatment consisted of manipulation with subjects prone, side-lying and supine, with “gentle soft-tissue therapy” to the overlying tissues. Specific manipulative manoeuvres were at the discretion of the chiropractor, and all chiropractors used the diversified technique, employing a high velocity, low-amplitude thrust, often accompanied by an audible release. For the sham manoeuvre, subjects were positioned prone and “soft-tissue massage and gentle palpation” were applied to the spine, paraspinal muscles, and shoulders. A distraction manoeuvre was performed by turning the subject's head from one side to the other, while alternately palpating the feet and ankles. Subjects were positioned on one side, and a non-directional push was applied to the gluteal region, and this procedure was repeated on the other side. A similar push was applied bilaterally to the scapulae with the subject prone, and in the supine position, the head was rotated from side-to-side, with a push applied to the external occipital protuberance. All of the sham manoeuvres were applied with a low-amplitude, low-velocity thrust to non therapeutic contacts,

with adequate joint slack so that no joint cavitation occurred. No additional therapeutic interventions were permitted in either intervention group.

### MASSAGE THERAPY VERSUS RELAXATION THERAPY COMPARISON GROUP

One trial (Field 1998) investigated massage therapy versus a control relaxation group. Subjects in the massage therapy group received a 20-minute massage by their parents before bedtime every night for 30 days, which included stroking and kneading motions in three regions: face/head/neck/shoulders; arms/hands; and legs/feet/back. Parents were given a live demonstration by a massage therapist, written instructions, and a videotaped demonstration. Subjects in the comparison group received a progressive muscle relaxation therapy procedure consisting of the parent instructing the child to tense and relax major muscle groups. Parental instruction and the duration and frequency of treatments were similar to the massage intervention.

We found a reference to one ongoing trial in Australia (Hayek) and will include results when available.

### Risk of bias in included studies

The quality of the two trials of chiropractic spinal manipulative therapy were moderate (Nielsen 1995) to good (Balon 1998); the remaining trial (Field 1998) was of poor methodological quality. Using the Cochrane system for categorizing the allocation concealment method, we found only one trial provided evidence of allocation concealment (Balon 1998); the other trials were designated as ‘unclear’. The mean quality scores were 2.7 (out of 5) for the Jadad scale and 3.7(out of 6) for the Internal Validity scale; however, one trial (Balon 1998) scored 4/5 for the Jadad scale and 6/6 for the IV scale (quality scores by item are listed in the Table of Included Studies). Only one trial (Nielsen 1995) reported on adverse events.

### Effects of interventions

#### MANIPULATION VERSUS SHAM MANOEUVRE

Because the two trials evaluated disparate patient groups, these trials could not be combined. In children with mild to moderate chronic asthma (Balon 1998) there were small increases in peak expiratory flow (PEF) in the morning and evening in both treatment groups, however these increases were not clinically meaningful (7 to 12 L/min) and there were no significant differences between the groups in the degree of change from baseline. Quality of life improved in both groups and the symptoms of asthma and use of



beta-agonists decreased, with no significant differences between the groups. In adults with chronic asthma (Nielsen 1995), there were no significant differences between the groups in self-rated asthma, lung function, or beta-agonist spray use.

### MASSAGE THERAPY VERSUS CONTROL

In the trial by Field 1998, main outcome measures were not defined a priori and reporting characteristics of the results were unclear about the size of intervention groups, based upon age characteristics. We sought further details from the author and, to date, have not received confirmation about the reporting characteristics that are unclear. According to the report, younger children who received massage therapy showed an immediate (30 min. post-intervention) decrease in behavioral anxiety and cortisol levels, and their attitude toward asthma and their peak air flow and other pulmonary functions improved over the course of the study. In the older children who received massage therapy, their anxiety levels decreased immediately after massage, their attitude toward asthma improved over the study and one measure of pulmonary function, forced expiratory flow 25% to 75% (FEF 25 to 75), improved. We were unable to obtain sample size characteristics and outcomes data from the authors.

## DISCUSSION

This systematic review examined the use of manual therapy for patients with bronchial asthma. For this update no new trials were selected and two trials were removed from the previous version of the review. We revised the selection criteria for this update to exclude trials if the intervention did not primarily address the spine and chest wall; this eliminated one trial (Petersen 1992). We also excluded trials that only examined immediate effects of care, defined as observation periods less than two weeks; this also eliminated one trial (Asher 1990) from the original review.

Despite an exhaustive search of available literature sources, only a small number of trials were identified. The methodological quality of one trial was good, one moderate, and the overall quality of the remaining trial was poor. Pooling of results was not possible due to differences in the populations studied, interventions used, and outcome measures reported.

Data from two trials examining chiropractic manipulative therapy compared to sham manoeuvres did not report significant differences between groups for lung function and quality of life measures. One trial reports beneficial effects of massage therapy when compared to a relaxation procedure for lung function measures in young (6 to 8 years) children, however this trial has poor reporting characteristics, a small sample size, and data have yet to be confirmed with authors.

Proponents of manual therapy, principally chiropractic and osteopathic physicians, postulate that the characteristic high-velocity, short-lever, low-amplitude thrust delivered to vertebral levels associated with the sensory and motor neural supply reduce patient's symptoms of asthma. A plethora of traditional narrative review articles and case studies have been published and postulate that (chiropractic and osteopathic) manipulative techniques aim to increase the motion of the thoracic cage, mobilize the ribs and thoracic portion of the spine, and enhance arterial supply and lymphatic return for patients with a variety of obstructive airways diseases, including asthma. In addition, chiropractic and osteopathic practitioners purport that treating somatic dysfunction may effect a variety of abnormal neural reflexes that contribute to unstable disease. Reviews of chest physiotherapy indicate that chest percussion, postural drainage and vibration procedures mobilize the tenacious airway secretions frequently present in asthmatic patients. The postulated superior benefit of manual therapies is not supported by our results.

## AUTHORS' CONCLUSIONS

### Implications for practice

There is no evidence from two trials, one in adults and one in children, to support the use of spinal manipulative therapy for patients with asthma. Although results of these trials demonstrated improvements in outcomes for all patients who received hands-on manual therapy, these improvements were not clinically important, and no statistical differences were found between treatment groups. The beneficial effects of massage therapy reported in one trial have yet to be confirmed. Given the small number of trials, definitive conclusions cannot be made regarding the efficacy of manual therapy for patients with asthma. However, there is insufficient evidence to warrant widespread use of manual therapies for asthmatic patients.

### Implications for research

Given the widespread use of manual therapies for asthmatic patients and only single trials reported for distinct patient groups and interventions, there is a need for further evaluation of manual therapies. Careful conduct and reporting of trials, including the nature (or absence) of adverse events, as well as the attendant costs of care will provide better evidence of the value (or lack thereof) of manual therapies. To date, only one trial has examined spinal manipulative therapy in asthmatic children; one trial in asthmatic adults; and one trial of massage therapy in children. None of the trials reported on the costs of care and only one trial reported on adverse events.

Although the nature of manual therapy manoeuvres makes it difficult to blind subjects to the intervention, future trials should maintain observer blinding for all outcome assessments. In addi-

tion, future trials that incorporate patients naive to the type of manipulative manoeuvres should assess the degree of patient blinding that occurred at the end of the trial.

Because sham-controlled trials may underestimate the actual benefit of manual therapy, investigators of future trials should consider incorporating a deferred treatment or no treatment control group. Manual therapies and sham manoeuvres may have considerable non-specific effects. The non-specific effect may not depend on the manual manoeuvre chosen. For example, research investigating the effects of touch, attention and caring, versus a deferred or no treatment control group would examine these effects.

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## REFERENCES

### References to studies included in this review

#### Balon 1998 *{published data only}*

- Anonymous. Canadian Memorial Chiropractic College. *Today's Chiropractic* 1995; Vol. 24, issue 2:112.
- \* Balon J, Aker PD, Crowther ER, Danielson C, Cox PG, O'Shaughnessy D, et al. A comparison of active and simulated chiropractic manipulation as adjunctive treatment for childhood asthma. *New England Journal of Medicine* 1998;**339**:1013–20.
- Balon JW, Aker PD, Crowther ER, Cox G, Danielson C, O'Shaughnessy AD, et al. A randomized controlled trial of chiropractic spinal manipulation on asthma in children. Proceedings of the 1997 World Chiropractic Congress; 1997 Jun 6-8; Tokyo (Japan). Toronto, Ontario (CANADA): World Federation of Chiropractic, 1997:156.
- Balon JW, Aker PD, Crowther ER, Cox G, Danielson C, O'Shaughnessy AD, et al. Does chiropractic manipulation improve childhood asthma? A randomized controlled trial. *European Respiratory Journal*. 1997; Vol. 10 Suppl: 472S–473S.
- Ernst E. A pilot study of chiropractic spinal manipulation yields good and bad news. *Focus on Alternative and Complementary Therapies* 2002;**7**(2):149–50.

#### Field 1998 *{published data only}*

- Field T, Henteleff T, Hernandez-Reif M, Martinez E, Mavunda K, Kuhn C, et al. Children with asthma have improved pulmonary functions after massage therapy. *Journal of Pediatrics* 1998;**132**:854–8.

#### Nielsen 1995 *{published and unpublished data}*

- Bronfort G. Chiropractic, asthma and the placebo effect. The final results of a randomized clinical trial. *Journal of Manipulative and Physiological Therapeutics* 1991;**14**(5): 338.
- Bronfort G, Nielsen N, Bendix T, Madsen F, Weeke B. Chiropractic treatment of asthma - a controlled clinical trial. Proceedings of the 1989 International Conference on Spinal Manipulation; 1989 Mar 31-Apr 1; Washington

DC, Arlington (VA): Foundation for Chiropractic Research, 1989:146–9.

\* Nielsen NH, Bronfort G, Bendix T, Madsen F, Weeke B. Chronic asthma and chiropractic spinal manipulation: a randomized clinical trial. *Clinical and Experimental Allergy* 1995;**25**:80–8.

### References to studies excluded from this review

#### Anon 1997 *{published data only}*

Anonymous. Current best practice for nebuliser treatment. British Thoracic Society Nebulizer Project Group. [Review] [0 refs]. *Thorax* 1997;**52**(Suppl):S1–23.

#### Anon 1999 *{published data only}*

Anonymous. Laying on of hands as a healing art?. *Hospital Practice* 1999;**34**(1):99–100.

#### Asher 1989 *{published data only}*

Asher MI, Douglas C, Airy M, Andrews D, Trenholme A. The effects of chest physical therapy on lung function in children recovering from acute severe asthma. *Australian and New Zealand Journal of Medicine* 1989;**19**:648.

#### Asher 1990 *{published data only}*

Asher MI, Douglas C, Airy M, Andrews D, Trenholme A. Effects of chest physical therapy on lung function in children recovering from acute severe asthma. *Pediatric Pulmonology* 1990;**9**:146–51.

#### Baranov 1984 *{published data only}*

Baranov IuP, Surovov IuA, Semin SN, Gaponiuk PIa, Klimentko LM. [Hemodynamic effects of reflexotherapy in treating patients with infectious-allergic bronchial asthma]. [Russian]. *Ter Arkh* 1984;**56**(3):44–7.

#### Berlowitz 1995 *{published data only}*

Berlowitz D, Denehy L, Johns DP, Bish RM, Walters EH. The Buteyko asthma breathing technique [letter]. *The Medical Journal of Australia* 1995;**162**(1):53.

#### Bobokhodzhaev 1984 *{published data only}*

Bobokhodzhaev Ila, Rudoi DG, Bobokhodzhaev OI, Kovaleva IF, Vlasova IF. [Effectiveness of the early inclusion

- of physical methods in the combined therapy of bronchial asthma]. [Russian]. *Vopr Kurortol Fizioter Lech Fiz Kult* 1984;1:58–9.
- Bockenbauer 2002** *{published data only}*  
Bockenbauer SE, Julliard KN, Lo KS, Huang E, Sheth AM. Quantifiable effects of osteopathic manipulative techniques on patients with chronic asthma. *The Journal of the American Osteopathic Association* 2002;102(7):371–5. [MEDLINE: PUBMED 12138951]
- Bronfort 1994** *{published data only}*  
Bronfort G. Is there a role for chiropractic management of infantile colic and chronic childhood asthma?. Proceedings of the 1994 International Conference on Spinal Manipulation; 1994 Jun 10-11; Palm Springs (CA). Arlington (VA): Foundation for Chiropractic Education and Research, 1994:131–3.
- Bronfort 1996** *{published data only}*  
Bronfort G. Asthma and chiropractic. *European Journal of Chiropractic* 1996;44(1):1–7.
- Bronfort 2001** *{published data only}*  
Bronfort G, Evans RL, Kubic P, Filkin P. Chronic pediatric asthma and chiropractic spinal manipulation: A prospective clinical series and randomized clinical pilot study. *Journal of Manipulative and Physiological Therapeutics* 2001;24(6):369–77.
- Brygge 2001** *{published data only}*  
Brygge T, Heinig JH, Collins P, Ronborg S, Gehrchen PM, Hilden J, Heegaard S, Poulsen LK. Reflexology and bronchial asthma. *Respiratory Medicine* 2001;95:173–9. [MEDLINE: PUBMED 11266233]
- Cambach 1997** *{published data only}*  
Cambach W, Chadwick-Straver RV, Wagenaar RC, van Keimpema AR, Kemper HC. The effects of a community-based pulmonary rehabilitation programme on exercise tolerance and quality of life: a randomized controlled trial. *European Respiratory Journal* 1997;10(1):104–13.
- Cessna 1989** *{published data only}*  
Cessna R. The asthmatic patient. *American Chiropractor* 1989;48–50.
- Christensson 1977** *{published data only}*  
Christensson P, Cimbritz H, Arborelius M Jr, Jungquist G. Effect of salbutamol with IPPB and physiotherapy for three days. *Scandinavian Journal of Respiratory Diseases* 1977; Suppl 101:109–12.
- Dean 1988** *{published data only}*  
Dean M, Bell E, Kershaw CR, Guyer BM, Hide DW. A short exercise and living course for asthmatics. *British Journal of Diseases of the Chest* 1988;82(2):155–61.
- Dennis 1992** *{published data only}*  
Dennis D, Golden D. Manipulative therapy an alternative treatment for asthma: A literature review. *Chiropractic: The Journal of Chiropractic Research, Study and Clinical Investigation* 1992;8(2):40–1.
- Edenbrandt 1990** *{published data only}*  
Edenbrandt L, Olseni L, Svenonius E, Jonson B. Effect of physiotherapy in asthmatic children—a one-year follow-up after physical training once a week. *Acta Paediatrica Scandinavica* 1990;79(10):973–5.
- Eid 1991** *{published data only}*  
Eid N, Buchheit J, Neuling M, Phelps H. Chest physiotherapy in review. *Respiratory Care* 1991;36(4):270–82.
- Ernst 1999a** *{published data only}*  
Ernst E. Complementary/alternative medicine for asthma: We do not know what we need to know. *Chest* 1999;115(1):1–3.
- Ernst 1999b** *{published data only}*  
Ernst E. Massage therapy is promising for childhood asthma. *Focus Alternat Complement Ther* 1999;4(1):30–1.
- Ernst 2000** *{published data only}*  
Ernst E. Does spinal manipulation have specific treatment effects?. *Family Practice* 2000;17(6):554–6.
- Free 1993** *{published data only}*  
Free R. Asthma: A chiropractic alternative. *Digest of Chiropractic Economics* 1993;36(1):42.
- Fung 1986** *{published data only}*  
Fung KP, Chow OK, So SY. Attenuation of exercise-induced asthma by acupuncture. *Lancet* 1986;2(8521):1419–22.
- Gamble 1995** *{published data only}*  
Gamble A. Alternative medical approaches to the treatment of asthma. *Alternative and Complementary Therapies* 1995;1(2):61–6.
- Garde 1994** *{published data only}*  
Garde R. Asthma and chiropractic. *Chiropractic Pediatrics* 1994;1(3):9–16.
- Garmon 1992a** *{published data only}*  
Garmon R, Zemenick R. Acute severe asthma: Part 1. Pathophysiology and clinical assessment. *The Journal of the American Osteopathic Association* 1992;92(2):219–25.
- Garmon 1992b** *{published data only}*  
Garmon R, Zemenick R. Acute severe asthma: Part 2. Current therapy. *The Journal of the American Osteopathic Association* 1992;92(3):343–52.
- Graham 2000** *{published data only}*  
Graham DM, Blaiss MS. Complementary/alternative medicine in the treatment of asthma. *Annals of Allergy, Asthma, & Immunology* 2000;85:438–49.
- Gruber 1997** *{published data only}*  
Gruber W, Eber E, Zach M. Alternative medicine and bronchial asthma - A review from a paediatric perspective. *Monatsschrift für Kinderheilkunde* 1997;145(8):786–96.
- Hardy 1996** *{published data only}*  
Hardy KA, Anderson BD. Noninvasive clearance of airway secretions. *Respiratory Care Clinics of North America* 1996;2(2):323–43.
- Hossri 1976** *{published data only}*  
Hossri CM. The treatment of asthma in children through acupuncture massage. *Journal of the American Society of Psychosomatic Dentistry and Medicine* 1976;23(1):3–16. [CN-00448880]

**Jobst 1995** {published data only}

Jobst K. A critical analysis of acupuncture in pulmonary disease: Efficacy and safety of the acupuncture needle. *Journal of Alternative and Complementary Medicine* 1995;**1**(1):57–85.

**Kukurin 2002** {published data only}

Kukurin GW. Chronic pediatric asthma and chiropractic spinal manipulation: A prospective clinical series and randomized clinical pilot study (Letter). *Journal of Manipulative and Physiological Therapeutics* 2002;**25**(8):540–41. [CN-00403606]

**Lewith 1996** {published data only}

Lewith G. Asthma: A complementary medical perspective. *Complementary Therapies in Medicine* 1996;**4**(2):106–11.

**Lines 1993** {published data only}

Lines D. A holistic approach to the treatment of bronchial asthma in a chiropractic practice. *Chiropractic Journal of Australia* 1993;**23**(1):4–8.

**Mitchell 1989** {published data only}

Mitchell P, Wells J. Acupuncture for chronic asthma: A controlled trial with six months follow-up. *American Journal of Acupuncture* 1989;**17**:5–13.

**Noche 1990** {published data only}

Noche ML Jr. Prophylaxis in childhood asthma. [Review]. *Acta Paediatrica Japonica* 1990;**32**(2):176–82.

**Petersen 1992** {published data only}

Petersen LN, Faurouchou P, Olsen OT, Svendsen UG. Footzone therapy and bronchial asthma - a clinically controlled investigation. *Ugeskr Laeger* 1992;**154**:2065–8.

**Postiaux 1997** {published data only}

Postiaux G, Ladha K, Gillard C, Charlier J, Lens E. Chest physiotherapy for young infants (<24 months) guided by lung sounds. *Revue Francaise D'Allergologie Ed D'Immunologie Clinique* 1997;**37**(2):206–22.

**Pryor 1979** {published data only}

Pryor J, Webber B. An evaluation of the forced expiration technique as an adjunct to postural drainage. *Physiotherapy* 1979;**65**(10):304–7.

**Redchits 1986** {published data only}

Redchits IV, Treumova SI. [Effectiveness of the differential treatment of bronchial asthma patients on the southern coast of the Crimea]. [Russian]. *Vopr Kurortol Fizioter Lech Fiz Kult* 1986;**Jul-Aug**(4):54–6.

**Renaud 1990** {published data only}

Renaud C, Pinchette D. Chiropractic management of bronchial asthma: A literature review. *Journal of Chiropractic* 1990;**27**(12):25–6.

**Ribeiro 2003** {published data only}

Ribeiro PGR, Prisco CCV, Ribeiro M, Stelmach R, Cukier A, Martins MA, Carvalho CRE, Nunes MPT. Effects of physiotherapy program on clinical asthma control. *American Thoracic Society 99th International Conference Proceedings* 2003, (A102 Poster D20):A211.

**Richards 1999** {published data only}

Richards DG, Mein EA, Nelson CD. Chiropractic manipulation for childhood asthma. *New England Journal of Medicine* 1999;**340**(5):391–2.

**Sadil 1997** {published data only}

Sadil V, Sadil S, Dolejsi I, Eckmayr J. Acupoint and meridian massage in asthma - pathy or bunkum?. Focus Alternative Complementary Therapies (Presented at the 4th Annual Symposium on Complementary Health Care). 1997; Vol. 2, issue 4:195.

**Samransamruajkit 1999** {published data only}

Samransamruajkit R, Chin TW, Yuengsrigul A, Newton T, Nussbaum E. Possible beneficial effect of chest physical therapy in hospitalized asthmatic children. *Pediatric Asthma, Allergy & Immunology* 2003;**16**(4):295–303.

**Scherman 1975** {published data only}

Scherman M, Eriksson NE, Grimby G. Physiotherapeutic treatment in cases of bronchial asthma. *Sjukgymnasten* 1975:18–21.

**Siluanova 1991** {published data only}

Siluanova VA, Makarova IN, Voronova EL, Liukevich IA. [The effect of medical gymnastics on the external respiratory function of patients with infectious-allergic bronchial asthma under ambulatory treatment]. [Russian]. *Vopr Kurortol Fizioter Lech Fiz Kult* 1991;**5**:19–23.

**Sinitsina 1991** {published data only}

Sinitsina TM, Schemelinina TI, Didur MD, Evsiukova EV, Emel'ianov AV, Nazarova VA. [The results of the dynamic observation of bronchial hyperreactivity in risk-group subjects and in bronchial asthma patients. Some corrective procedures]. [Russian]. *Ter Arkh* 1991;**63**(8):21–5.

**Tandon 1991** {published data only}

Tandon M, Soh P, Wood A. Acupuncture for bronchial asthma? A double-blind crossover study. *Medical Journal of Australia* 1991;**154**:409–12.

**Tarasova 1987** {published data only}

Tarasova AS, Shustova TV. [Comparative effectiveness of treating children and adolescents with bronchial asthma at a central highlands health resort]. [Russian]. *Vopr Kurortol Fizioter Lech Fiz Kult* 1987;**2**:20–2.

**Tikhomirova 1993** {published data only}

Tikhomirova KS, Alieva IZ, Chalaia EN. [Speleotherapy in the combined health resort treatment of children with bronchial asthma]. [Russian]. *Vopr Kurortol Fizioter Lech Fiz Kult* 1993;**4**:10–2.

**Weingarton 1985** {published data only}

Weingarten MA, Goldberg J, Teperberg Y, Harrison N, Oded A. A pilot study of the multidisciplinary management of childhood asthma in a family practice. *Journal of Asthma* 1985;**22**(5):261–5.

**Ziegler 1992** {published data only}

Ziegler R, Carpenter D. The chiropractic approach to the treatment of asthma: A literature review. *Journal of Chiropractic* 1992;**29**(6):71–3.

**Ziment 1998 {published data only}**

Ziment I. Western 'alternative' medicine: What you need to know. *Journal of Respiratory Diseases* 1998;**19**(9):747–56.

**Ziment 1999 {published data only}**

Ziment I. What else are your patients using to treat their asthma?. *Journal of Respiratory Diseases* 1999;**20**(1):58–64.

**Ziment 2000 {published data only}**

Ziment I, Tashkin DP. Alternative medicine for allergy and asthma. *Journal of Allergy & Clinical Immunology* 2000; **106**:603–14.

**References to ongoing studies****Hayek {published data only (unpublished sought but not used)}**

Hayek R. A multi-site trial: Chiropractic and asthma with physiological markers. *Journal of the American Chiropractic Association*. 2001; Vol. 38, issue 2:46–7.

**Additional references****Allen 1993**

Allen TW, D'Alonzo GE. Investigating the role of osteopathic manipulation in the treatment of asthma. *The Journal of the American Osteopathic Association* 1993;**93**: 654–6, 659.

**Burns 1912**

Burns L. Clinic reports from the Pacific College of Osteopathy. 1912:1054–6.

**Cullen 1994**

Cullen D. Delineating clinical-effectiveness research priorities for the respiratory care profession. *AARC Times* 1994;**18**:16–20.

**Eisenberg 1993**

Eisenberg DM, Kessler RC, Foster C, Norlock FE, Calkins DR, Delbanco TL. Unconventional medicine in the United States. Prevalence, costs, and patterns of use. *New England Journal of Medicine* 1993;**328**:246–52.

**Forbes 1902**

Forbes HW. Bronchial asthma. 1902:106–9.

**Hviid 1978**

Hviid C. A comparison of the effect of chiropractic treatment on respiratory function in patients with respiratory distress symptoms and patients without. *Bulletin of the European Chiropractors' Union* 1978;**26**:17–34.

**Jadad 1996**

Jadad AR, Moore RA, Carroll D, Jenkinson C, Reynolds JM, Gavaghan DJ, McQuay HJ. Assessing the quality of reports of randomized clinical trials: Is blinding necessary?. *Controlled Clinical Trials* 1996;**17**:1–12.

**Jones 1997**

Jones AP, Rowe BH. Bronchopulmonary hygiene physical therapy in chronic obstructive pulmonary disease and bronchiectasis (Cochrane Review). *The Cochrane Library* 1999, Issue 1.

**Linde 1996**

Linde K, Ramirez G, Mulrow CD, Pauls A, Weidenhammer W, Melchart D. St John's wort for depression - an overview and meta-analysis of randomised clinical trials. *British Medical Journal* 1996;**313**:253–8.

**Linde 1997**

Linde K, Clausius N, Ramirez G, Melchart D, Hedges LV, Eitel F, et al. Are the clinical effects of homeopathy placebo effects? A meta-analysis of randomized placebo-controlled trials. *Lancet* 1997;**350**:834–43.

**Linde 1998a**

Linde K, Jobst K. Homoeopathy for asthma (Cochrane Review). *The Cochrane Library* 1999, Issue 1.

**Linde 1998b**

Linde K, Jobst K, Panton J. Acupuncture for the treatment of asthma bronchiale (Cochrane Review). *The Cochrane Library* 1998, Issue 4.

**Linde 1998c**

Linde K, Mulrow CD. St John's wort for depression (Cochrane Review). *The Cochrane Library* 1998, Issue 4.

**Lines 1990**

Lines DH, McMillan AJ, Spehr GJ. Effects of soft tissue technique and Chapman's neurolymphatic reflex stimulation on respiratory function. *Journal of the Australian Chiropractors' Association* 1990;**20**:17–22.

**MacLennan 1996**

MacLennan AH, Wilson DH, Taylor AW. Prevalence and cost of alternative medicine in Australia. *Lancet* 1996;**347**: 569–73.

**Miller 1975**

Miller WD. Treatment of visceral disorders by manipulative therapy. In: Goldstein M editor(s). *The research status of spinal manipulative therapy*. Bethesda: NINCDS Monograph, 1975:295–301.

**Orlandi 1989**

Orlandi O, Perino B, Testi R. Old and new in chest physiotherapy. *European Respiratory Journal* 1989;**2 Suppl** 7:595–8.

**Wilson 1946**

Wilson PT. The osteopathic treatment of asthma. *Journal of the American Osteopathic Association* 1946;**45**(11):491–2.

\* Indicates the major publication for the study

## CHARACTERISTICS OF STUDIES

### Characteristics of included studies [ordered by study ID]

#### Balon 1998

Methods	Design: RCT Alloc: sealed numerical randomisation code Blinding: outcome assessors blinded; patient blinding assessed Loss to F/U: 11 of 91 (12%) Jadad scale: 2-1-1 IV scale: 1-1-1-1-1-1
Participants	Country: Canada Setting: 11 chiropractic practices Provider(s): 11 chiropractors, all with > 5 yrs clinical experience Subjects: 91 enrolled; 80 analysed (46% female) Age mean (sd): Active group = 11.4 (2.5); Sham group = 12.1 (2.7) Age range: 7 to 16 years Inclusion criteria: 7 to 17 years, asthma for more than a year, bronchodilator needed at least 3x/wk, same medication for at least 6 wk, evidence of vertebral subluxation Exclusion criteria: other lung diseases, contraindications for spinal manipulation, previous chiropractic care, unstable asthma
Interventions	Active group: Diversified technique (high velocity, low amplitude manipulation) to patients in prone, side-lying and supine positions; spinal levels determined by DC; 3x/wk for 4 wk, 2x/wk for 4 wk, 1x/wk for 8 wk Sham group: With patients lying prone: soft tissue massage and gentle palpation to spine, paraspinal muscles and shoulders; distraction maneuver turning patient's head side to side while alternately palpating ankles and feet. With patients supine: head rotated slightly to each side and an impulse applied to the external occipital protuberance. Low amplitude, low velocity impulses applied to all nontherapeutic contacts with adequate joint slack so that no joint opening or cavitation occurred. Duration and frequency same as Active group. Cointervention: PRN beta-agonists; previous medications continued during study
Outcomes	Pulm function tests: morning and evening PEF; number of days with morning PEF < 85%; FEV1; Log PC20. All measured at baseline, two and four months Admit/relapse: not reported QoL: Pediatric Asthma Quality of Life Questionnaire which measures activity, symptoms, emotions, and overall QoL Other: use of beta-agonists, use of oral corticosteroids, overall satisfaction with treatment Adverse events: not reported
Notes	We are attempting to contact authors for data on beta-agonist spray use

#### *Risk of bias*

Item	Authors' judgement	Description
Allocation concealment?	Yes	Sealed numerical randomisation code

**Field 1998**

Methods	Design: RCT Alloc: "children were randomly assigned sequentially"; concealment not described Blinding: assessors of videotaped child behavior were blinded to treatments Loss to F/U: not stated Jadad scale: 1-0-0 IV scale: 1-0-0,5-0-0-0	
Participants	Country: USA Setting: recruitment and outcomes at paediatric pulmonary clinic; treatments given in the home Provider(s): parents of asthmatic children were given live demonstration by massage therapist, written instructions, and a videotaped demonstration to take with them Subjects: n = 32 (38% female) Age mean (sd): 9.15 (sd not reported) Age range: 6 to 14 years Inclusion criteria: report did not specify a priori Exclusion criteria: not specified	
Interventions	Massage therapy group: 20 min massage before bedtime every night for 30 days; included stroking and kneading to three regions (face/head/neck/shoulders; arms/hands; legs/feet/back) Relaxation therapy group: Parent instructing child to tense and relax major muscle groups; duration and frequency same as Massage group Cointervention: not specified	
Outcomes	Pulm function tests: FVC, FEV1, and FEF25 to 75 at days 1 and 30; PEFr each night Admit/relapse: not reported QoL: State Anxiety Scale parents and children Other: saliva cortisol levels and videotaped behavior of child (affect, anxiety, activity, vocalizing) for 30 min before and after first and last treatments Adverse events: not reported	
Notes	We are attempting to contact authors for clarification of sample size information and variability data	
<b><i>Risk of bias</i></b>		
<b>Item</b>	<b>Authors' judgement</b>	<b>Description</b>
Allocation concealment?	Unclear	Concealment not described

**Nielsen 1995**

Methods	Design: single-site cross-over RCT, 2 wk baseline, 4 wk treatment one, 2 wk washout, 4 wk treatment two Alloc: minimization, concealment not described Blinding: reported that patients and outcome assessors blinded; success of blinding not reported Loss to F/U: 2 of 33 (6%); group not specified Jadad scale: 2-1-0 IV scale: 1-0-0.5-0.5-1-0.5	
Participants	Country: Denmark Setting: hospital out-patient allergy department Provider(s): two "experienced" chiropractors Subjects: 33 enrolled; 31 analysed; 58% female Race/ethnicity: not specified Age mean (sd): 28.6 (7.2) Age range: 18 to 44 years Inclusion criteria: chronic moderate asthma (similar to NIH definition, FEV1 > 80% predicted within last 6 months) Exclusion criteria: concurrent clinically significant medical diseases, manipulative therapy within last 5 yr, contraindications to spinal manipulation	
Interventions	"Active" manipulation group: drop table and high velocity low amplitude thrust (most commonly short lever) to dysfunctional segment(s); 2x/wk for 4 wk; 10-15 min each "Sham" manipulation group: one hand gentle manual pressure over spinal contact(s), while other hand thrust on the drop section with the purpose of releasing it; no direct manipulative thrust applied to patient's spine; duration and frequency same as Active group Cointervention: maintenance treatment with beta2-agonists (prn); 21 patients received inhaled corticosteroids, 6 theophylline, 4 oral beta2-agonists	
Outcomes	Pulm function tests: FEV1 and FVC once weekly; PEF twice daily (three repetitions each, largest value recorded); n-BR and all outcomes at baseline, between the treatment phases, and at the end of the study Admit/relapse: not reported QoL: no formal measure Other: 100mm VAS patient rated asthma severity; 100mm VAS patient rated treatment effectiveness; diary for beta2-agonist use and symptom scores for coughing, wheezing, sputum production, sleep disturbance, physical activity Adverse events: stated that no side-effects were reported by patients as a result of the manipulation	
Notes		
<b><i>Risk of bias</i></b>		
<b>Item</b>	<b>Authors' judgement</b>	<b>Description</b>
Allocation concealment?	Unclear	Concealment not described

Alloc: allocation; FEF25 to 75: forced expiratory flow 25% to 75%; FEV1: forced expiratory volume in one second; F/U: follow-up; FVC: forced vital capacity; hr: hours; IV: internal validity; min: minutes; mm: millimeter; n: sample size; n-BR: non-specific



bronchial hyper-reactivity; PEFr: peak expiratory flow rate; PT: physiotherapy; QoL: quality of life; RCT: randomized controlled trial; RV: residual volume; TLC: total lung capacity; VAS: visual analogue scale; wk: weeks

### Characteristics of excluded studies [ordered by study ID]

Study	Reason for exclusion
Anon 1997	Not RCT/CCT and not manual therapy
Anon 1999	Commentary; not asthma
Asher 1989	Article not obtained; incorrect citation?
Asher 1990	Observation period < 2 weeks
Baranov 1984	Not manual therapy; acupuncture trial
Berlowitz 1995	Not RCT; not manual therapy
Bobokhodzhaev 1984	Not RCT
Bockenbauer 2002	Only immediate effects assessed
Bronfort 1994	Not RCT. Expanded abstract published as conference proceeding makes reference to ongoing studies. Author contacted and verified that no new trial data are available. Data presented at conference related to Nielsen 1995 trial
Bronfort 1996	Traditional narrative review. Article provides data for Nielsen 1995 trial, but these data are not different from the full report. Article makes reference to two ongoing trials. One of the trials has subsequently been published and included in this review (Balon 1998). Author contacted to verify information about additional ongoing trial; author stated that ongoing work is a case series, not a randomised trial
Bronfort 2001	Report of randomized pilot study meets selection criteria; however, no control group data were reported. Contacted author on 03/03/2002: Bronfort stated that the trial sham group was only for the purpose of establishing feasibility, that no between group differences were intended for evaluation, and that the two groups, by chance, were vastly different in terms of baseline severity and other important characteristics
Brygge 2001	Reflexology, emphasis the feet
Cambach 1997	Mixed population of asthma and COPD. Unable to evaluate manual therapy component of rehabilitation program. No response from author
Cessna 1989	Traditional narrative review
Christensson 1977	Not clearly stated as randomised. Unable to assess manual therapy component of physiotherapy procedures. No response from authors
Dean 1988	Not RCT; allocation based on disease severity; not manual therapy

(Continued)

Dennis 1992	Traditional narrative review; no outcome measures reported
Edenbrandt 1990	Cannot separate effects of manual therapy
Eid 1991	Traditional narrative review
Ernst 1999a	Editorial
Ernst 1999b	Commentary
Ernst 2000	Traditional narrative review
Free 1993	Not RCT
Fung 1986	Not manual therapy
Gamble 1995	Traditional narrative review
Garde 1994	Traditional narrative review and case reports
Garmon 1992a	Traditional narrative review; not manual therapy
Garmon 1992b	Traditional narrative review; not manual therapy
Graham 2000	Traditional narrative review; not manual therapy
Gruber 1997	Traditional narrative review
Hardy 1996	Traditional narrative review
Hossri 1976	Not RCT
Jobst 1995	Not manual therapy; review of acupuncture
Kukurin 2002	Letter to editor
Lewith 1996	Traditional narrative review; not manual therapy; no outcome measures reported
Lines 1993	Case reports; no outcome measures
Mitchell 1989	Not manual therapy; acupuncture trial
Noche 1990	Traditional narrative review; not manual therapy
Petersen 1992	Reflexology, emphasis on foot zone therapy
Postiaux 1997	Not RCT; only three of 12 children had asthma; not manual therapy

(Continued)

Pryor 1979	Method of allocation not specified; unlikely randomised. No response from authors
Redchits 1986	Not manual therapy
Renaud 1990	Traditional narrative review; no outcome measures reported
Ribeiro 2003	Not manual therapy
Richards 1999	Editorial
Sadil 1997	Not manual therapy
Samransamruajkit	Not manual therapy
Scherman 1975	Article not obtained; incorrect citation?
Siluanova 1991	Unlikely that allocation was randomised; no clear comparison of manual therapy with another therapy
Sinitsina 1991	Not manual therapy
Tandon 1991	Not manual therapy; acupuncture trial
Tarasova 1987	Unlikely that allocation was randomised; no clear comparison of manual therapy with another therapy
Tikhomirova 1993	Not RCT; not manual therapy
Weingarton 1985	Cannot separate manual therapy effects
Ziegler 1992	Traditional narrative review; no outcome measures reported
Ziment 1998	Traditional narrative review
Ziment 1999	Traditional narrative review
Ziment 2000	Traditional narrative review

## DATA AND ANALYSES

### Comparison 1. Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Morning PEFR expressed as a percentage of baseline	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
1.1 at two months	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
1.2 at four months	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
2 Evening PEFR expressed as a percentage of baseline	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
2.1 at two months	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
2.2 at four months	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
3 Days with morning PEFR less than 85% of the baseline value	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
4 FEV1 (litres)	2		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
4.1 at one month (change from baseline)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
4.2 at two months	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
4.3 at four months	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
5 Non-specific bronchial hyper-reactivity (log PC20)	2		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
5.1 at one month (change from baseline)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
5.2 at four months	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
6 FVC at one month (change from baseline)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
7 Use of short term ('rescue') bronchodilator medication use	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
7.1 at one month (change from baseline)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
8 Self-rated asthma severity (VAS, change from baseline)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
9 Global quality of life (Pediatric AQLQ)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
9.1 at two months (change from baseline)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
9.2 at four months (change from baseline)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable

## Comparison 2. Manipulation versus sham manoeuvre - Crossover studies

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Morning PEFR (change from baseline)	1		L/min (Fixed, 95% CI)	Totals not selected
2 Evening PEFR (change from baseline)	1		L/min (Fixed, 95% CI)	Totals not selected
3 FEV1 (change from baseline)	1		Litres (Fixed, 95% CI)	Totals not selected
4 FVC (change from baseline)	1		Litres (Fixed, 95% CI)	Totals not selected
5 Non-specific bronchial hyper-reactivity (PC20, change from baseline)	1		Doses (Fixed, 95% CI)	Totals not selected
6 Use of rescue medication (change from baseline)	1		Puffs/day (Fixed, 95% CI)	Totals not selected
7 Self-rated asthma severity (VAS, change from baseline)	1		Symptoms (Fixed, 95% CI)	Totals not selected
8 Wheeze (change from baseline)	1		Symptoms (Fixed, 95% CI)	Totals not selected
9 Decreased activity (change from baseline)	1		Symptoms (Fixed, 95% CI)	Totals not selected
10 Cough (change from baseline)	1		Symptoms (Fixed, 95% CI)	Totals not selected
11 Mucus (change from baseline)	1		Symptoms (Fixed, 95% CI)	Totals not selected

### Analysis 1.1. Comparison 1 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies, Outcome 1 Morning PEFR expressed as a percentage of baseline.

Review: Manual therapy for asthma

Comparison: 1 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies

Outcome: 1 Morning PEFR expressed as a percentage of baseline

Study or subgroup	Manipulation		Sham		Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
	N	Mean(SD)	N	Mean(SD)		
1 at two months Balon 1998	35	103.4 (12.7)	40	101.3 (13.1)		2.10 [ -3.75, 7.95 ]
2 at four months Balon 1998	38	103.6 (13.7)	42	104.3 (13.3)		-0.70 [ -6.63, 5.23 ]

-10 -5 0 5 10  
Favours Control Favours Treatment

**Analysis 1.2. Comparison 1 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies, Outcome 2 Evening PEFR expressed as a percentage of baseline.**

Review: Manual therapy for asthma

Comparison: 1 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies

Outcome: 2 Evening PEFR expressed as a percentage of baseline

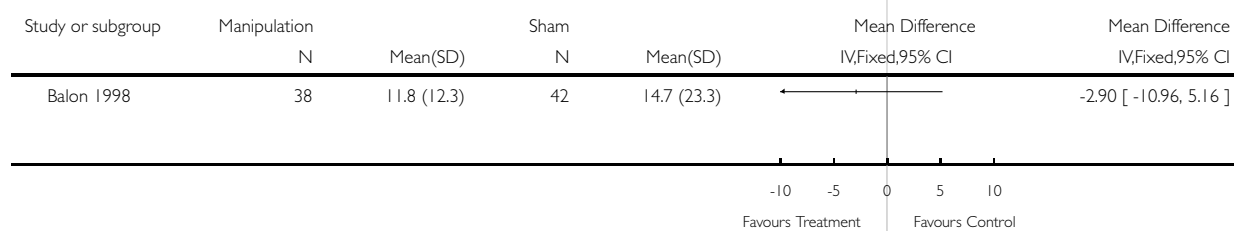


**Analysis 1.3. Comparison 1 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies, Outcome 3 Days with morning PEFR less than 85% of the baseline value.**

Review: Manual therapy for asthma

Comparison: 1 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies

Outcome: 3 Days with morning PEFR less than 85% of the baseline value

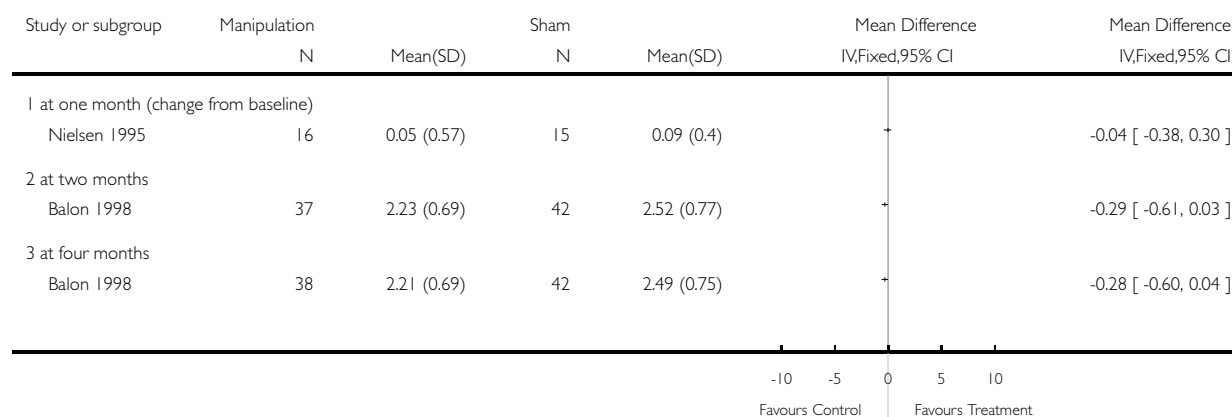


**Analysis 1.4. Comparison 1 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies, Outcome 4 FEV1 (litres).**

Review: Manual therapy for asthma

Comparison: 1 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies

Outcome: 4 FEV1 (litres)

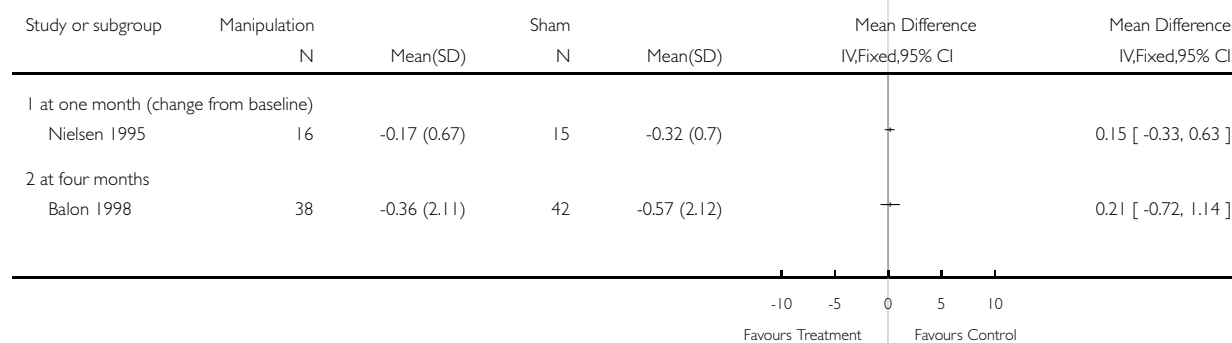


**Analysis 1.5. Comparison 1 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies, Outcome 5 Non-specific bronchial hyper-reactivity (log PC20).**

Review: Manual therapy for asthma

Comparison: 1 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies

Outcome: 5 Non-specific bronchial hyper-reactivity (log PC20)

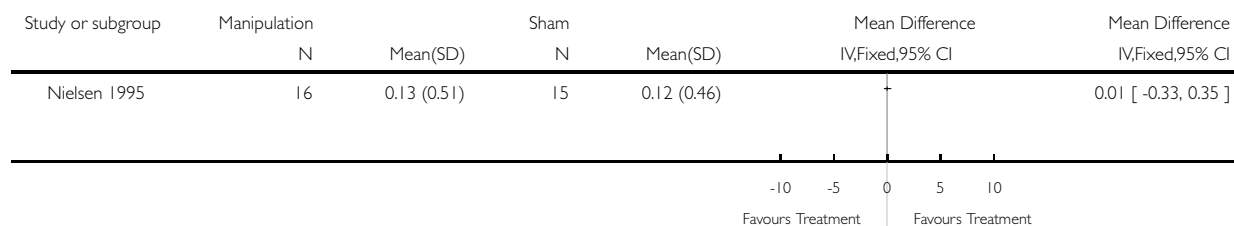


**Analysis 1.6. Comparison 1 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies, Outcome 6 FVC at one month (change from baseline).**

Review: Manual therapy for asthma

Comparison: 1 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies

Outcome: 6 FVC at one month (change from baseline)

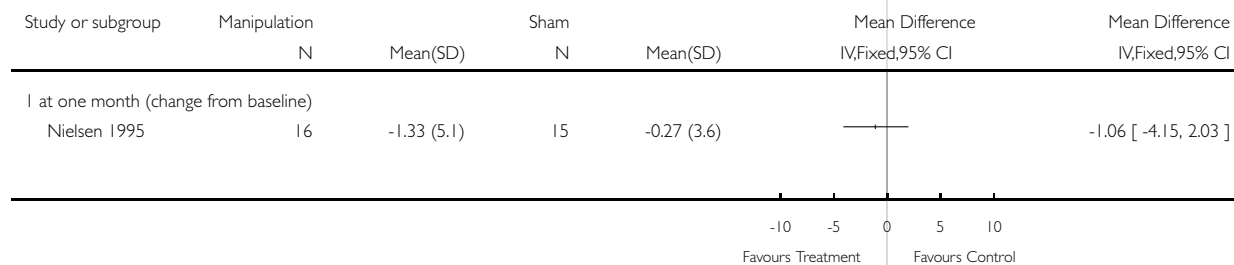


**Analysis 1.7. Comparison 1 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies, Outcome 7 Use of short term ('rescue') bronchodilator medication use.**

Review: Manual therapy for asthma

Comparison: 1 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies

Outcome: 7 Use of short term ('rescue') bronchodilator medication use



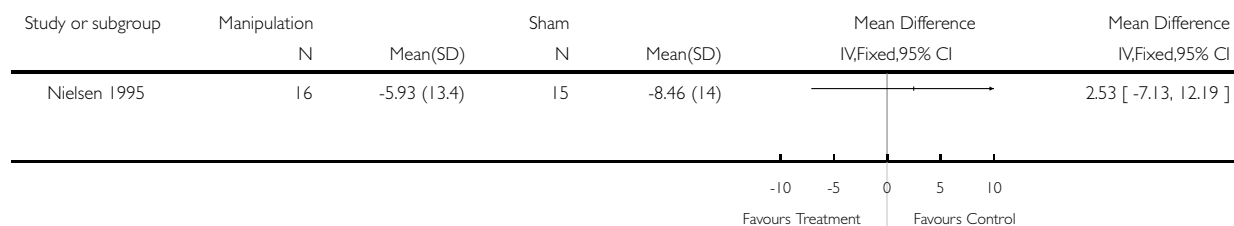


**Analysis 1.8. Comparison 1 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies, Outcome 8 Self-rated asthma severity (VAS, change from baseline).**

Review: Manual therapy for asthma

Comparison: 1 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies

Outcome: 8 Self-rated asthma severity (VAS, change from baseline)

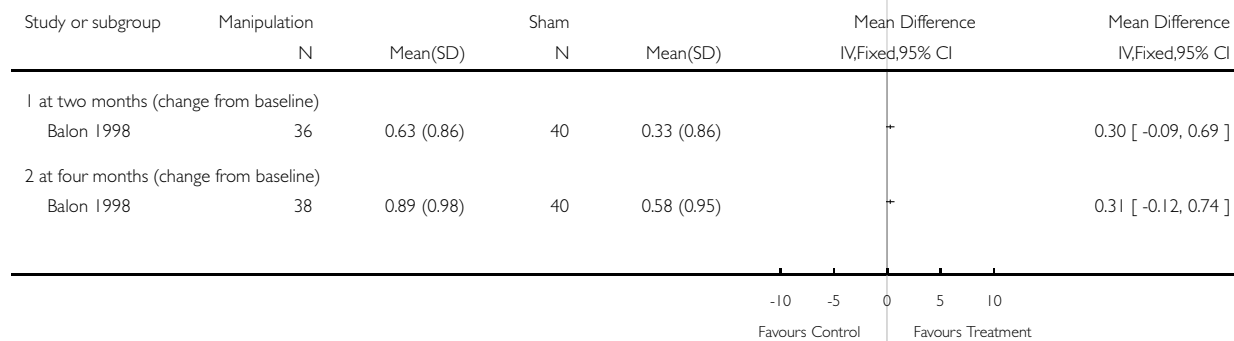


**Analysis 1.9. Comparison 1 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies, Outcome 9 Global quality of life (Pediatric AQLQ).**

Review: Manual therapy for asthma

Comparison: 1 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies

Outcome: 9 Global quality of life (Pediatric AQLQ)

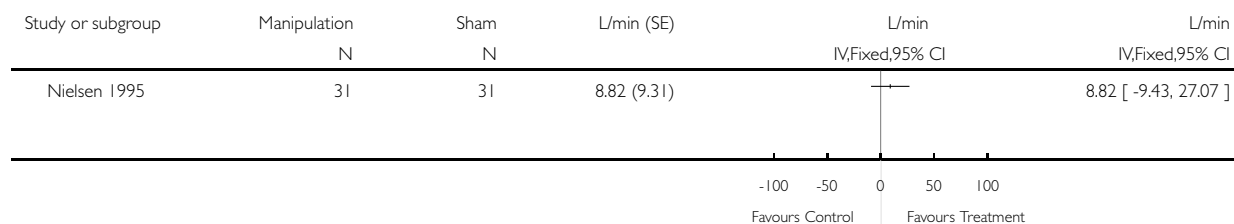


**Analysis 2.1. Comparison 2 Manipulation versus sham manoeuvre - Crossover studies, Outcome 1 Morning PEFR (change from baseline).**

Review: Manual therapy for asthma

Comparison: 2 Manipulation versus sham manoeuvre - Crossover studies

Outcome: 1 Morning PEFR (change from baseline)

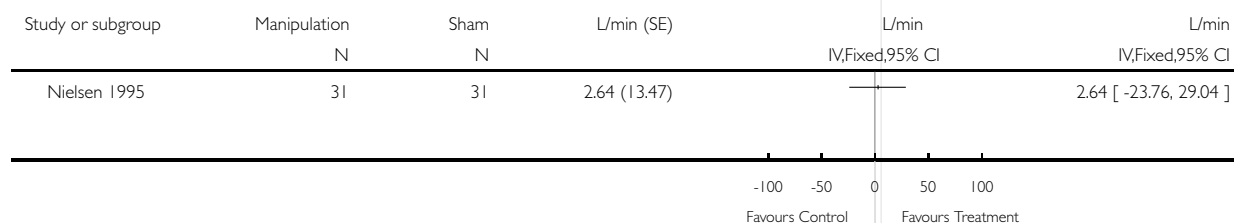


**Analysis 2.2. Comparison 2 Manipulation versus sham manoeuvre - Crossover studies, Outcome 2 Evening PEFR (change from baseline).**

Review: Manual therapy for asthma

Comparison: 2 Manipulation versus sham manoeuvre - Crossover studies

Outcome: 2 Evening PEFR (change from baseline)

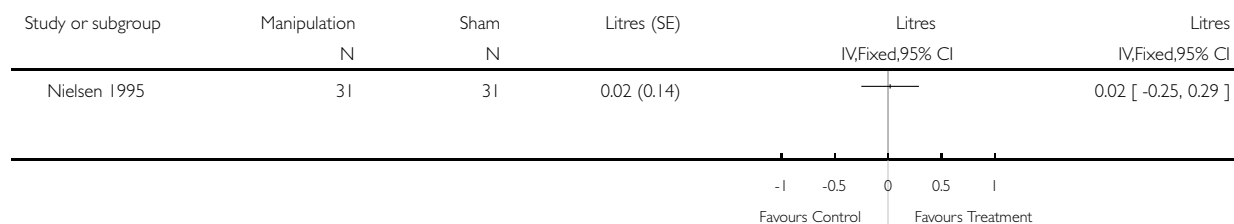


**Analysis 2.3. Comparison 2 Manipulation versus sham manoeuvre - Crossover studies, Outcome 3 FEV1 (change from baseline).**

Review: Manual therapy for asthma

Comparison: 2 Manipulation versus sham manoeuvre - Crossover studies

Outcome: 3 FEV1 (change from baseline)

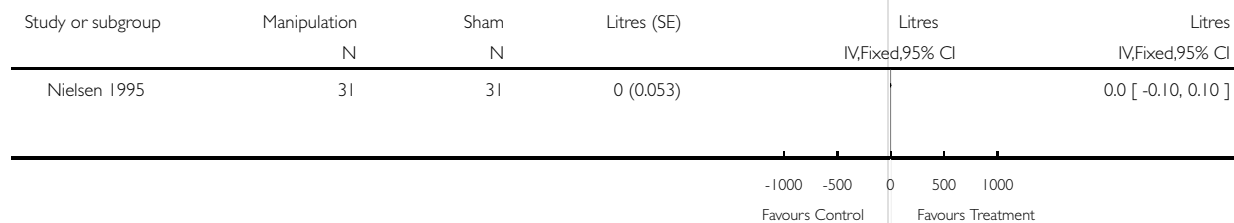


**Analysis 2.4. Comparison 2 Manipulation versus sham manoeuvre - Crossover studies, Outcome 4 FVC (change from baseline).**

Review: Manual therapy for asthma

Comparison: 2 Manipulation versus sham manoeuvre - Crossover studies

Outcome: 4 FVC (change from baseline)

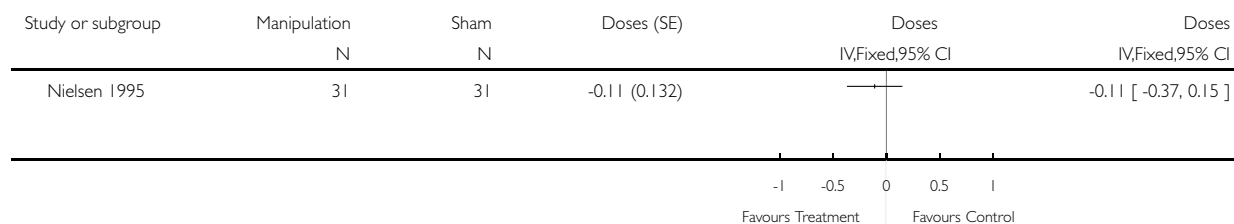


**Analysis 2.5. Comparison 2 Manipulation versus sham manoeuvre - Crossover studies, Outcome 5 Non-specific bronchial hyper-reactivity (PC20, change from baseline).**

Review: Manual therapy for asthma

Comparison: 2 Manipulation versus sham manoeuvre - Crossover studies

Outcome: 5 Non-specific bronchial hyper-reactivity (PC20, change from baseline)

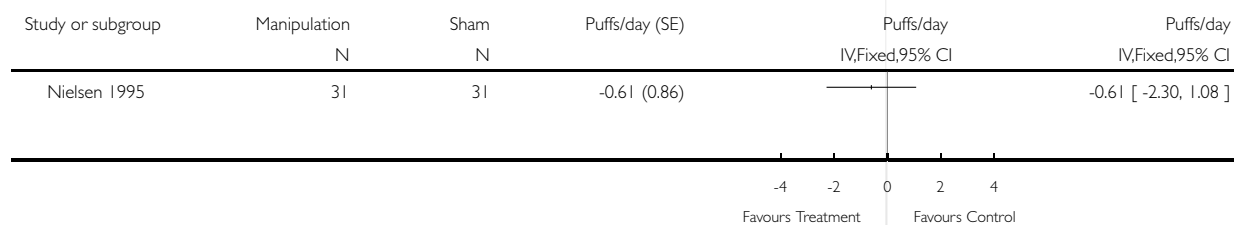


**Analysis 2.6. Comparison 2 Manipulation versus sham manoeuvre - Crossover studies, Outcome 6 Use of rescue medication (change from baseline).**

Review: Manual therapy for asthma

Comparison: 2 Manipulation versus sham manoeuvre - Crossover studies

Outcome: 6 Use of rescue medication (change from baseline)

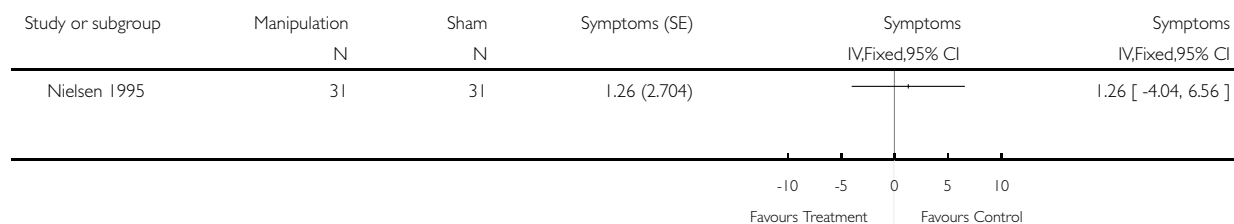


**Analysis 2.7. Comparison 2 Manipulation versus sham manoeuvre - Crossover studies, Outcome 7 Self-rated asthma severity (VAS, change from baseline).**

Review: Manual therapy for asthma

Comparison: 2 Manipulation versus sham manoeuvre - Crossover studies

Outcome: 7 Self-rated asthma severity (VAS, change from baseline)

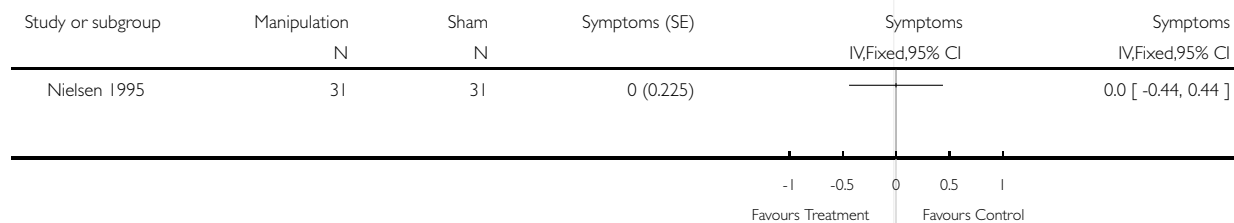


**Analysis 2.8. Comparison 2 Manipulation versus sham manoeuvre - Crossover studies, Outcome 8 Wheeze (change from baseline).**

Review: Manual therapy for asthma

Comparison: 2 Manipulation versus sham manoeuvre - Crossover studies

Outcome: 8 Wheeze (change from baseline)

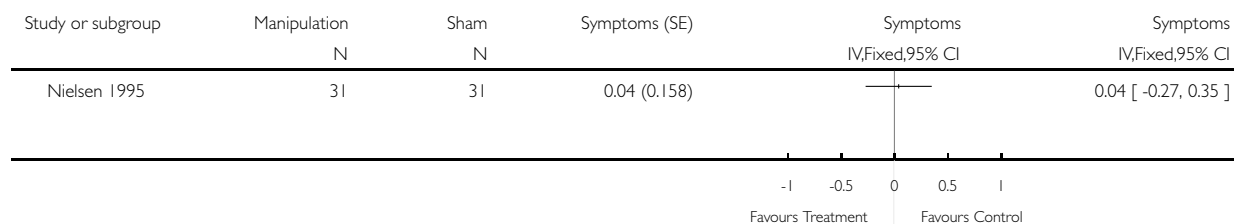


**Analysis 2.9. Comparison 2 Manipulation versus sham manoeuvre - Crossover studies, Outcome 9 Decreased activity (change from baseline).**

Review: Manual therapy for asthma

Comparison: 2 Manipulation versus sham manoeuvre - Crossover studies

Outcome: 9 Decreased activity (change from baseline)

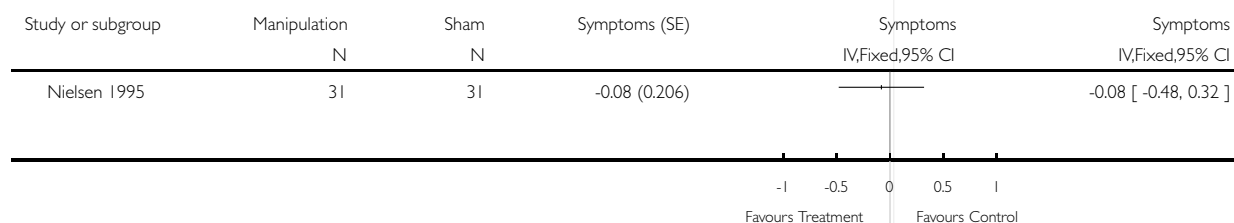


**Analysis 2.10. Comparison 2 Manipulation versus sham manoeuvre - Crossover studies, Outcome 10 Cough (change from baseline).**

Review: Manual therapy for asthma

Comparison: 2 Manipulation versus sham manoeuvre - Crossover studies

Outcome: 10 Cough (change from baseline)

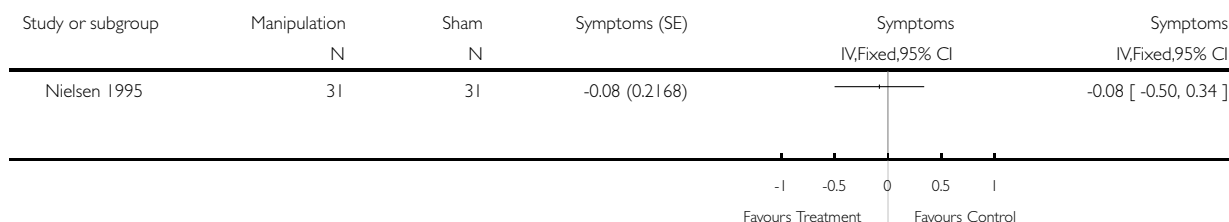


## Analysis 2.11. Comparison 2 Manipulation versus sham manoeuvre - Crossover studies, Outcome 11 Mucus (change from baseline).

Review: Manual therapy for asthma

Comparison: 2 Manipulation versus sham manoeuvre - Crossover studies

Outcome: 11 Mucus (change from baseline)



## FEEDBACK

### Manual Therapy for Asthma: A Chiropractic Perspective, 2 January 2011

#### Summary

Like many chiropractors, we rely on systematic reviews to assist us in making clinical decisions. According to Hondras and colleagues “Currently, there is insufficient evidence to support or refute the use of manual therapy for patients with asthma” (this review). This is dissonant with our clinical experience and wish to address it here. The three clinical trials of chiropractic SMT and asthma randomized patients to active SMT or sham SMT. Upon closer examination, we are not convinced on the veracity of the sham therapies employed. We can find no requisite study validating any of the sham SMTs employed and the literature offered in support of their veracity is questionable. In the study by Balon et al., considered the study of highest methodological quality, the simulated treatment consisting of massage followed by a variety of HVLA thrusts to the patient without cavitation (1). From a chiropractic perspective, the maneuver can hardly be considered inert. In the other two trials, a drop table technique was employed for the sham SMT. We use similar maneuvers for analgic patients with successful outcomes (2). The trials involving chiropractic SMT and asthmatic patients are not randomized controlled clinical trials per se but rather randomized comparison trials. Additionally, there are findings that the primary objective outcome measure in these studies (i.e. spirometry) has questionable diagnostic accuracy for asthma (2, 3). These aspects of the clinical trials on chiropractic SMT and asthma have never been considered by previous systematic reviews. We respectfully submit that they should be considered by the Cochrane reviewers in the future and as it stands, asthmatic patients benefit from chiropractic care based on randomized comparison trials.

#### References

1. Balon Balon J, Aker PD, Crowther ER, Danielson C, Cox PG, O? Shaughnessy D. A comparison of active and simulated chiropractic manipulation as adjunctive treatment for childhood asthma. *New Engl J Med* 1998; 339:1013-1020.
2. Alcantara J, Alcantara JD, Alcantara J. Chiropractic treatment for asthma? You bet! *J Asthma* 2010;47(5):597-598
3. Schneider A, Gindner L, Tilemann L, Schermer T, Dinant GJ, Meyer FJ, Szecsenyi J. Diagnostic accuracy of spirometry in primary care. *BMC Pulm Med.* 2009;9:31

#### Reply

Thank you for your feedback about our systematic review. As is often the case, results of systematic reviews may differ from clinical practice experience. Although our review is long overdue for an update, our criteria for considering studies for this review would 'exclude' this feedback letter and we would be unable to incorporate your clinical practice experience. Our methods assessed all trials that met the criteria for inclusion in the same ways and the Types of studies, Types of participants, Types of interventions, and Types

of outcome measures are transparent. We did not set out to support or dispute the sham therapy maneuvers or placebo controls; rather we reported what the trialists' published and assessed the rigor with which the trials were reported as conducted. Your reference to "the other two trials, a drop table technique was employed for the sham SMT" is unclear to us. The Nielsen trial did employ a drop table, while the Field trial did not. It is also unclear how citations 2 and 3 provide or refute evidence for the "diagnostic accuracy for asthma." We applaud future efforts for the careful conduct and reporting of trials, as well as consideration for qualitative methods that might be appropriate to evaluate the non-specific effects of manual therapy manoeuvres.

Maria Hondras and Arthur Jones

### Contributors

Joel Alcantara, Joey D. Alcantara and Junjoe Alcantara.

Submitter agrees with default conflict of interest statement: I certify that I have no affiliations with or involvement in any organization or entity with a financial interest in the subject matter of my feedback.

### WHAT'S NEW

Last assessed as up-to-date: 6 January 2005.

Date	Event	Description
7 February 2011	Feedback has been incorporated	Feedback has been received and appended to the review along with a rebuttal from the authors

### HISTORY

Protocol first published: Issue 1, 1998

Review first published: Issue 1, 2000

Date	Event	Description
6 August 2008	Amended	Converted to new review format.
7 January 2005	New citation required and conclusions have changed	Substantive amendment



## CONTRIBUTIONS OF AUTHORS

MAH wrote the protocol, created the methodology and data extraction forms, reviewed all citations for relevance, selected studies, extracted, entered and analysed data, corresponded with authors to verify methodology and data extraction, verified all references, wrote the report and corresponded with review editors and editorial base. She is responsible for the overall management of the review and subsequent updates.

KL developed the 'Internal Validity Scale' utilized in this review, helped write the protocol, extract and analyse data, and review the final report.

APJ helped write the protocol, review citations for relevance, select studies, extract and analyse data, and review the final report.

## DECLARATIONS OF INTEREST

The use of reviewers with diverse professional backgrounds (allopathy, chiropractic, epidemiology, respiratory care, social sciences) should serve to limit any profession specific conflicts of interest during the review process. None of the reviewers participated in the trials included in this review.

## SOURCES OF SUPPORT

### Internal sources

- The University of Texas Health Science Center at San Antonio, USA.
- NHS Research and Development, UK.
- Palmer Center for Chiropractic Research, USA.

### External sources

- Carl and Veronica Carstens-Foundation, Essen, Germany.
- NIAMS Grant No 5 U24 AR43346-02, USA.
- NIAMS Grant No 1 U24 AR45166-02, USA.

## INDEX TERMS

### Medical Subject Headings (MeSH)

\*Manipulation, Chiropractic; \*Manipulation, Osteopathic; \*Massage; \*Respiratory Therapy; Asthma [rehabilitation; \*therapy]; Randomized Controlled Trials as Topic

### MeSH check words

Adult; Child; Child, Preschool; Humans; Infant