# Manual therapy for asthma (Review)

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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from included studies, and contacted authors of known studies for additional information about published and unpublished trials.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.

**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

There is not enough evidence to draw a conclusion about the effects of manual therapy by physiotherapists and chiropractors for adults or children with 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.

## 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 intervention

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

See: Cochrane Airways Group methods used in reviews.

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. 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.

## METHODS OF THE REVIEW

STUDY SELECTION

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).

ASSESSMENT OF STUDY QUALITY

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 ABSTRACTION

All three reviewers independently performed data abstraction of descriptive characteristics and study results. If data were not reported in abstractable from, 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.

DATA ANALYSIS

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.

## DESCRIPTION OF STUDIES

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.

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 nondirectional 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 2001) and will include results when available.

## METHODOLOGICAL QUALITY

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.

## RESULTS

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 addition, 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.

## POTENTIAL CONFLICT 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.


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* *Indicates the major publication for the study*

## TABLES

### Characteristics of included studies

| Study | Balon 1998 |
|---|---|
| Methods | Design: RCT<br>Alloc: sealed numerical randomisation code<br>Blinding: outcome assessors blinded; patient blinding assessed<br>Loss to F/U: 11 of 91 (12%)<br>Jadad scale: 2-1-1<br>IV scale: 1-1-1-1-1-1 |
| Participants | Country: Canada<br>Setting: 11 chiropractic practices |

**Characteristics of included studies** (*Continued*)

| | |
|---|---|
| | Provider(s): 11 chiropractors, all with > 5 yrs clinical experience<br>Subjects: 91 enrolled; 80 analysed (46% female)<br>Age mean (sd): Active group = 11.4 (2.5); Sham group = 12.1 (2.7)<br>Age range: 7 to 16 years<br>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<br>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 determinded by DC; 3x/wk for 4 wk, 2x/wk for 4 wk, 1x/wk for 8 wk<br>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 alernately 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.<br>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<br>Admit/relapse: not reported<br>QoL: Pediatric Asthma Quality of Life Questionnaire which measures activity, symptoms, emotions, and overall QoL<br>Other: use of beta-agonists, use of oral corticosteroids, overall satisfaction with treatment<br>Adverse events: not reported |
| Notes | We are attempting to contact authors for data on beta-agonist spray use. |
| Allocation concealment | A – Adequate |

| **Study** | **Field 1998** |
|---|---|
| Methods | Design: RCT<br>Alloc: "children were randomly assigned sequentially"; concealment not described<br>Blinding: assessors of videotaped child behavior were blinded to treatments<br>Loss to F/U: not stated<br>Jadad scale: 1-0-0<br>IV scale: 1-0-0.5-0-0-0 |
| Participants | Country: USA<br>Setting: recruitment and outcomes at paediatric pulmonary clinic; treatments given in the home<br>Provider(s): parents of asthmatic children were given live demonstration by massage therapist, written instructions, and a videotaped demonstration to take with them<br>Subjects: n = 32 (38% female)<br>Age mean (sd): 9.15 (sd not reported)<br>Age range: 6 to 14 years<br>Inclusion criteria: report did not specify a priori<br>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)<br>Relaxation therapy group: Parent instructing child to tense and relax major muscle groups; duration and frequency same as Massage group<br>Cointervention: not specified |
| Outcomes | Pulm function tests: FVC, FEV1, and FEF25 to 75 at days 1 and 30; PEFR each night<br>Admit/relapse: not reported |

**Characteristics of included studies** (*Continued*)

| | |
|---|---|
| | QoL: State Anxiety Scale parents and children<br>Other: saliva cortisol levels and videotaped behavior of child (affect, anxiety, activity, vocalizing) for 30 min before and after first and last treatments<br>Adverse events: not reported |
| Notes | We are attempting to contact authors for clarification of sample size information and variability data. |
| Allocation concealment | B – Unclear |

| **Study** | **Nielsen 1995** |
|---|---|
| Methods | Design: single-site cross-over RCT, 2 wk baseline, 4 wk treatment one, 2 wk washout, 4 wk treatment two<br>Alloc: minimization, concealment not described<br>Blinding: reported that patients and outcome assessors blinded; success of blinding not reported<br>Loss to F/U: 2 of 33 (6%); group not specified<br>Jadad scale: 2-1-0<br>IV scale: 1-0-0.5-0.5-1-0.5 |
| Participants | Country: Denmark<br>Setting: hospital out-patient allergy department<br>Provider(s): two "experienced" chiropractors<br>Subjects: 33 enrolled; 31 analysed; 58% female<br>Race/ethnicity: not specified<br>Age mean (sd): 28.6 (7.2)<br>Age range: 18 to 44 years<br>Inclusion criteria: chronic moderate asthma (similar to NIH definition, FEV1 > 80% predicted within last 6 months)<br>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<br>"Sham" manipulation group: one hand gentle manual pressure over spinal contact(s), while other hand thrusted 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<br>Cointervention: maintenance treatment with beta2-agonists (prn); 21 patients received inhaled corticosteroids, 6 theophyline, 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<br>Admit/relapse: not reported<br>QoL: no formal measure<br>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<br>Adverse events: stated that no side-effects were reported by patients as a result of the manipulation |
| Notes | |
| Allocation concealment | B – Unclear |

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

| 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 |
| Bockenhauer 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 rehabiliation 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 |
| 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 |

**Characteristics of excluded studies** (*Continued*)

| | |
|---|---|
| Hossri 1976 | Not RCT |
| Jobst 1995 | Not manual therapy; review of acupunture |
| 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. |
| 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? |
| Siluianova 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; acupunture 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 |

## ANALYSES

### Comparison 01. Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies

| Outcome title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 01 Morning PEFR expressed as a percentage of baseline | | | Weighted Mean Difference (Fixed) 95% CI | Totals not selected |
| 02 Evening PEFR expressed as a percentage of baseline | | | Weighted Mean Difference (Fixed) 95% CI | Totals not selected |
| 03 Days with morning PEFR less than 85% of the baseline value | | | Weighted Mean Difference (Fixed) 95% CI | Totals not selected |
| 04 FEV1 (litres) | | | Weighted Mean Difference (Fixed) 95% CI | Totals not selected |
| 05 Non-specific bronchial hyper-reactivity (log PC20) | | | Weighted Mean Difference (Fixed) 95% CI | Totals not selected |
| 06 FVC at one month (change from baseline) | | | Weighted Mean Difference (Fixed) 95% CI | Totals not selected |

| | | |
|---|---|---|
| 07 Use of short term ('rescue') bronchodilator medication use | Weighted Mean Difference (Fixed) 95% CI | Totals not selected |
| 08 Self-rated asthma severity (VAS, change from baseline) | Weighted Mean Difference (Fixed) 95% CI | Totals not selected |
| 09 Global quality of life (Pediatric AQLQ) | Weighted Mean Difference (Fixed) 95% CI | Totals not selected |

**Comparison 02. Manipulation versus sham manoeuvre - Crossover studies**

| Outcome title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 01 Morning PEFR (change from baseline) | | | L/min (Fixed) 95% CI | Totals not selected |
| 02 Evening PEFR (change from baseline) | | | L/min (Fixed) 95% CI | Totals not selected |
| 03 FEV1 (change from baseline) | | | Litres (Fixed) 95% CI | Totals not selected |
| 04 FVC (change from baseline) | | | Litres (Fixed) 95% CI | Totals not selected |
| 05 Non-specific bronchial hyper-reactivity (PC20, change from baseline) | | | Doses (Fixed) 95% CI | Totals not selected |
| 06 Use of rescue medication (change from baseline) | | | Puffs/day (Fixed) 95% CI | Totals not selected |
| 07 Self-rated asthma severity (VAS, change from baseline) | | | Symptoms (Fixed) 95% CI | Totals not selected |
| 08 Wheeze (change from baseline) | | | Symptoms (Fixed) 95% CI | Totals not selected |
| 09 Decreased activity (change from baseline) | | | Symptoms (Fixed) 95% CI | Totals not selected |
| 10 Cough (change from baseline) | | | Symptoms (Fixed) 95% CI | Totals not selected |
| 11 Mucus (change from baseline) | | | Symptoms (Fixed) 95% CI | Totals not selected |

## INDEX TERMS

**Medical Subject Headings (MeSH)**

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

**MeSH check words**

Adult; Child; Child, Preschool; Humans; Infant

## COVER SHEET

**Title** Manual therapy for asthma

**Authors** Hondras MA, Linde K, Jones AP

**Contribution of author(s)** 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. |
| **Issue protocol first published** | 1998/1 |
| **Review first published** | 2000/1 |
| **Date of most recent amendment** | 28 January 2005 |
| **Date of most recent SUBSTANTIVE amendment** | 07 January 2005 |
| **What's New** | 01 December 2004<br>For the 2004 update, we revised the research question and created a more narrow focus for this review. Because we are interested in manual therapies of the spine and chest wall, we excluded studies of reflexology and similar techniques. In addition, we agreed to exclude studies that only examined immediate effects of care and excluded studies with less than two weeks of care and measurements.<br>Electronic and manual literature searches through July 2004 generated 92 references for this update. Of the 92 citations, 68 full-text articles were retrieved for potential study selection. Review of 68 full-text reports and bibliographies did not generate new citations for the revised selection criteria. Of the five RCTs in the original publication, three trials no longer met the revised selection criteria: two trials, not manual therapy (reflexology) and one trial only measured immediate effects.<br>Generic inverse variance (GIV) data have been entered for the Nielsen 1995 study. This method of analysing data was not previsouly available in RevMan, and has enabled us to use data from this crossover study that had previously not been used.<br>10 March 2003<br>Electronic and manual literature searches through February 2002 generated 103 references for this update. Of the 103 citations, eleven full-text articles were retrieved for potential study selection. Review of eleven full-text reports and bibliographies did not generate new citations. Of the eleven reports, one trial (Bronfort 2001) met the study selection criteria, but did not report control group data. I contacted the author on 03/03/2002 and he declined the opportunity to provide these data. There were no new trials selected for this review update.<br>The negative signs were removed from the beneficial outcomes and the Metaview labels were reversed. |
| **Date new studies sought but none found** | 04 August 2004 |
| **Date new studies found but not yet included/excluded** | 25 November 2004 |
| **Date new studies found and included/excluded** | 13 December 2004 |
| **Date authors' conclusions section amended** | Information not supplied by author |
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## GRAPHS AND OTHER TABLES

### Analysis 01.01. Comparison 01 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies, Outcome 01 Morning PEFR expressed as a percentage of baseline

Review: Manual therapy for asthma

Comparison: 01 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies

Outcome: 01 Morning PEFR expressed as a percentage of baseline

| Study | Manipulation N | Mean(SD) | Sham N | Mean(SD) | Weighted Mean Difference (Fixed) 95% CI | Weighted Mean Difference (Fixed) 95% CI |
|---|---|---|---|---|---|---|
| 01 at two months | | | | | | |
| Balon 1998 | 35 | 103.40 (12.70) | 40 | 101.30 (13.10) | | 2.10 [ -3.75, 7.95 ] |
| 02 at four months | | | | | | |
| Balon 1998 | 38 | 103.60 (13.70) | 42 | 104.30 (13.30) | | -0.70 [ -6.63, 5.23 ] |

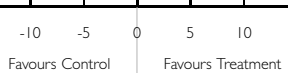

### Analysis 01.02. Comparison 01 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies, Outcome 02 Evening PEFR expressed as a percentage of baseline

Review: Manual therapy for asthma

Comparison: 01 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies

Outcome: 02 Evening PEFR expressed as a percentage of baseline

| Study | Manipulation N | Mean(SD) | Sham N | Mean(SD) | Weighted Mean Difference (Fixed) 95% CI | Weighted Mean Difference (Fixed) 95% CI |
|---|---|---|---|---|---|---|
| 01 at two months | | | | | | |
| Balon 1998 | 35 | 101.70 (11.70) | 40 | 102.00 (10.70) | | -0.30 [ -5.40, 4.80 ] |
| 02 at four months | | | | | | |
| Balon 1998 | 38 | 104.00 (13.70) | 42 | 104.50 (10.20) | | -0.50 [ -5.84, 4.84 ] |



### Analysis 01.03. Comparison 01 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies, Outcome 03 Days with morning PEFR less than 85% of the baseline value

Review: Manual therapy for asthma

Comparison: 01 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies

Outcome: 03 Days with morning PEFR less than 85% of the baseline value

| Study | Manipulation N | Mean(SD) | Sham N | Mean(SD) | Weighted Mean Difference (Fixed) 95% CI | Weighted Mean Difference (Fixed) 95% CI |
|---|---|---|---|---|---|---|
| Balon 1998 | 38 | 11.80 (12.30) | 42 | 14.70 (23.30) | | -2.90 [ -10.96, 5.16 ] |

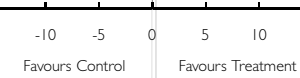

### Analysis 01.04. Comparison 01 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies, Outcome 04 FEV1 (litres)

Review: Manual therapy for asthma

Comparison: 01 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies

Outcome: 04 FEV1 (litres)

| Study | Manipulation N | Mean(SD) | Sham N | Mean(SD) | Weighted Mean Difference (Fixed) 95% CI | Weighted Mean Difference (Fixed) 95% CI |
|---|---|---|---|---|---|---|
| 01 at one month (change from baseline) | | | | | | |
| Nielsen 1995 | 16 | 0.05 (0.57) | 15 | 0.09 (0.40) | | -0.04 [ -0.38, 0.30 ] |
| 02 at two months | | | | | | |
| Balon 1998 | 37 | 2.23 (0.69) | 42 | 2.52 (0.77) | | -0.29 [ -0.61, 0.03 ] |
| 03 at four months | | | | | | |
| Balon 1998 | 38 | 2.21 (0.69) | 42 | 2.49 (0.75) | | -0.28 [ -0.60, 0.04 ] |



### Analysis 01.05. Comparison 01 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies, Outcome 05 Non-specific bronchial hyper-reactivity (log PC20)

Review: Manual therapy for asthma

Comparison: 01 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies

Outcome: 05 Non-specific bronchial hyper-reactivity (log PC20)

| Study | Manipulation N | Mean(SD) | Sham N | Mean(SD) | Weighted Mean Difference (Fixed) 95% CI | Weighted Mean Difference (Fixed) 95% CI |
|---|---|---|---|---|---|---|
| 01 at one month (change from baseline) | | | | | | |
| Nielsen 1995 | 16 | -0.17 (0.67) | 15 | -0.32 (0.70) | | 0.15 [ -0.33, 0.63 ] |
| 02 at four months | | | | | | |
| Balon 1998 | 38 | -0.36 (2.11) | 42 | -0.57 (2.12) | | 0.21 [ -0.72, 1.14 ] |

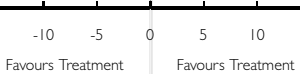

### Analysis 01.06. Comparison 01 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies, Outcome 06 FVC at one month (change from baseline)

Review: Manual therapy for asthma

Comparison: 01 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies

Outcome: 06 FVC at one month (change from baseline)

| Study | Manipulation N | Mean(SD) | Sham N | Mean(SD) | Weighted Mean Difference (Fixed) 95% CI | Weighted Mean Difference (Fixed) 95% CI |
|---|---|---|---|---|---|---|
| Nielsen 1995 | 16 | 0.13 (0.51) | 15 | 0.12 (0.46) | | 0.01 [ -0.33, 0.35 ] |




### Analysis 01.07. Comparison 01 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies, Outcome 07 Use of short term ('rescue') bronchodilator medication use

Review: Manual therapy for asthma

Comparison: 01 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies

Outcome: 07 Use of short term ('rescue') bronchodilator medication use

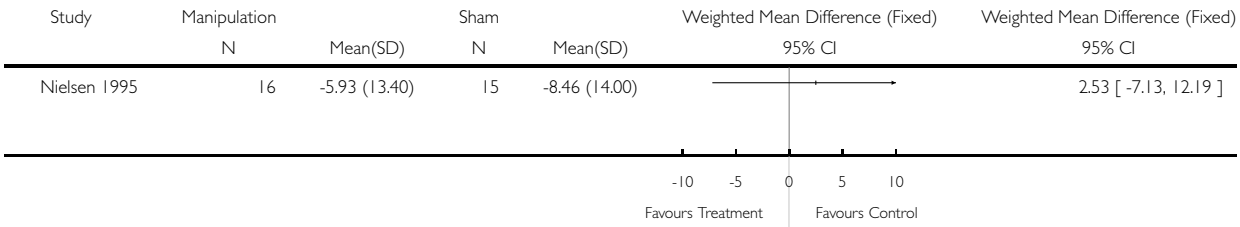
| Study | Manipulation N | Mean(SD) | Sham N | Mean(SD) | Weighted Mean Difference (Fixed) 95% CI | Weighted Mean Difference (Fixed) 95% CI |
|---|---|---|---|---|---|---|
| 01 at one month (change from baseline) | | | | | | |
| Nielsen 1995 | 16 | -1.33 (5.10) | 15 | -0.27 (3.60) | | -1.06 [ -4.15, 2.03 ] |

### Analysis 01.08. Comparison 01 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies, Outcome 08 Self-rated asthma severity (VAS, change from baseline)

Review: Manual therapy for asthma

Comparison: 01 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies

Outcome: 08 Self-rated asthma severity (VAS, change from baseline)

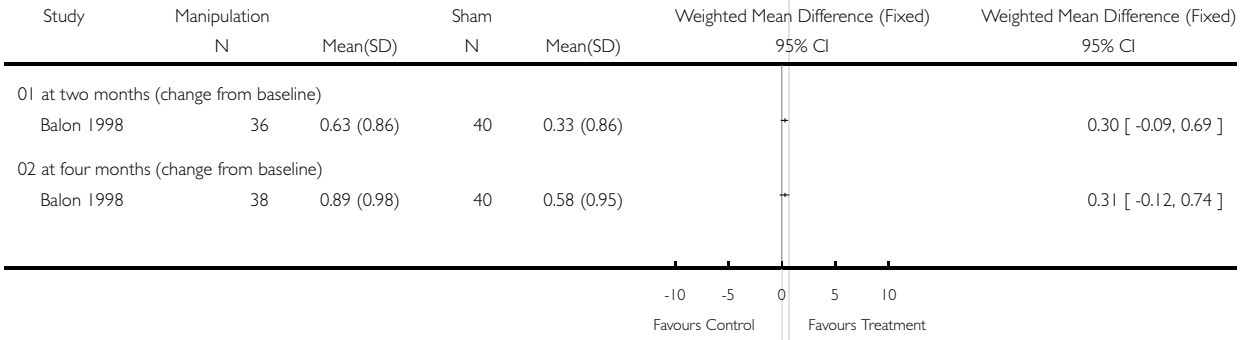



### Analysis 01.09. Comparison 01 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies, Outcome 09 Global quality of life (Pediatric AQLQ)

Review: Manual therapy for asthma

Comparison: 01 Manipulation versus sham manoeuvre - Parallel/1st arm crossover studies

Outcome: 09 Global quality of life (Pediatric AQLQ)

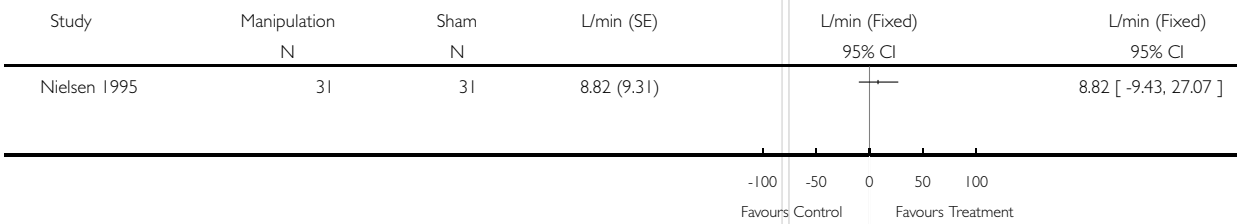



### Analysis 02.01. Comparison 02 Manipulation versus sham manoeuvre - Crossover studies, Outcome 01 Morning PEFR (change from baseline)

Review: Manual therapy for asthma

Comparison: 02 Manipulation versus sham manoeuvre - Crossover studies

Outcome: 01 Morning PEFR (change from baseline)



### Analysis 02.02. Comparison 02 Manipulation versus sham manoeuvre - Crossover studies, Outcome 02 Evening PEFR (change from baseline)

Review: Manual therapy for asthma

Comparison: 02 Manipulation versus sham manoeuvre - Crossover studies

Outcome: 02 Evening PEFR (change from baseline)

| Study | Manipulation N | Sham N | L/min (SE) | L/min (Fixed) 95% CI | L/min (Fixed) 95% CI |
|---|---|---|---|---|---|
| Nielsen 1995 | 31 | 31 | 2.64 (13.47) | | 2.64 [ -23.76, 29.04 ] |

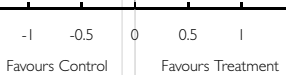

### Analysis 02.03. Comparison 02 Manipulation versus sham manoeuvre - Crossover studies, Outcome 03 FEV1 (change from baseline)

Review: Manual therapy for asthma

Comparison: 02 Manipulation versus sham manoeuvre - Crossover studies

Outcome: 03 FEV1 (change from baseline)

| Study | Manipulation N | Sham N | Litres (SE) | Litres (Fixed) 95% CI | Litres (Fixed) 95% CI |
|---|---|---|---|---|---|
| Nielsen 1995 | 31 | 31 | 0.02 (0.14) | | 0.02 [ -0.25, 0.29 ] |



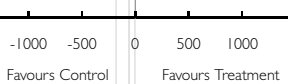

### Analysis 02.04. Comparison 02 Manipulation versus sham manoeuvre - Crossover studies, Outcome 04 FVC (change from baseline)

Review: Manual therapy for asthma

Comparison: 02 Manipulation versus sham manoeuvre - Crossover studies

Outcome: 04 FVC (change from baseline)

| Study | Manipulation N | Sham N | Litres (SE) | Litres (Fixed) 95% CI | Litres (Fixed) 95% CI |
|---|---|---|---|---|---|
| Nielsen 1995 | 31 | 31 | 0.0 (0.05) | | 0.0 [ -0.10, 0.10 ] |



### Analysis 02.05. Comparison 02 Manipulation versus sham manoeuvre - Crossover studies, Outcome 05 Non-specific bronchial hyper-reactivity (PC20, change from baseline)

Review: Manual therapy for asthma

Comparison: 02 Manipulation versus sham manoeuvre - Crossover studies

Outcome: 05 Non-specific bronchial hyper-reactivity (PC20, change from baseline)

| Study | Manipulation N | Sham N | Doses (SE) | Doses (Fixed) 95% CI | Doses (Fixed) 95% CI |
|---|---|---|---|---|---|
| Nielsen 1995 | 31 | 31 | -0.11 (0.13) | | -0.11 [ -0.37, 0.15 ] |

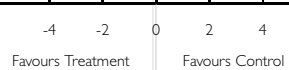

### Analysis 02.06. Comparison 02 Manipulation versus sham manoeuvre - Crossover studies, Outcome 06 Use of rescue medication (change from baseline)

Review: Manual therapy for asthma

Comparison: 02 Manipulation versus sham manoeuvre - Crossover studies

Outcome: 06 Use of rescue medication (change from baseline)

| Study | Manipulation N | Sham N | Puffs/day (SE) | Puffs/day (Fixed) 95% CI | Puffs/day (Fixed) 95% CI |
|---|---|---|---|---|---|
| Nielsen 1995 | 31 | 31 | -0.61 (0.86) | | -0.61 [ -2.30, 1.08 ] |



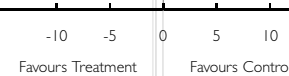

### Analysis 02.07. Comparison 02 Manipulation versus sham manoeuvre - Crossover studies, Outcome 07 Self-rated asthma severity (VAS, change from baseline)

Review: Manual therapy for asthma

Comparison: 02 Manipulation versus sham manoeuvre - Crossover studies

Outcome: 07 Self-rated asthma severity (VAS, change from baseline)

| Study | Manipulation N | Sham N | Symptoms (SE) | Symptoms (Fixed) 95% CI | Symptoms (Fixed) 95% CI |
|---|---|---|---|---|---|
| Nielsen 1995 | 31 | 31 | 1.26 (2.70) | | 1.26 [ -4.04, 6.56 ] |



### Analysis 02.08. Comparison 02 Manipulation versus sham manoeuvre - Crossover studies, Outcome 08 Wheeze (change from baseline)

Review: Manual therapy for asthma

Comparison: 02 Manipulation versus sham manoeuvre - Crossover studies

Outcome: 08 Wheeze (change from baseline)

| Study | Manipulation N | Sham N | Symptoms (SE) | Symptoms (Fixed) 95% CI | Symptoms (Fixed) 95% CI |
|---|---|---|---|---|---|
| Nielsen 1995 | 31 | 31 | 0.0 (0.23) | | 0.0 [ -0.44, 0.44 ] |


### Analysis 02.09. Comparison 02 Manipulation versus sham manoeuvre - Crossover studies, Outcome 09 Decreased activity (change from baseline)

Review: Manual therapy for asthma

Comparison: 02 Manipulation versus sham manoeuvre - Crossover studies

Outcome: 09 Decreased activity (change from baseline)

| Study | Manipulation N | Sham N | Symptoms (SE) | Symptoms (Fixed) 95% CI | Symptoms (Fixed) 95% CI |
|---|---|---|---|---|---|
| Nielsen 1995 | 31 | 31 | 0.04 (0.16) | | 0.04 [ -0.27, 0.35 ] |


### Analysis 02.10. Comparison 02 Manipulation versus sham manoeuvre - Crossover studies, Outcome 10 Cough (change from baseline)

Review: Manual therapy for asthma

Comparison: 02 Manipulation versus sham manoeuvre - Crossover studies

Outcome: 10 Cough (change from baseline)

| Study | Manipulation N | Sham N | Symptoms (SE) | Symptoms (Fixed) 95% CI | Symptoms (Fixed) 95% CI |
|---|---|---|---|---|---|
| Nielsen 1995 | 31 | 31 | -0.08 (0.21) | | -0.08 [ -0.48, 0.32 ] |

## Analysis 02.11. Comparison 02 Manipulation versus sham manoeuvre - Crossover studies, Outcome 11 Mucus (change from baseline)

Review: Manual therapy for asthma

Comparison: 02 Manipulation versus sham manoeuvre - Crossover studies

Outcome: 11 Mucus (change from baseline)

| Study | Manipulation N | Sham N | Symptoms (SE) | Symptoms (Fixed) 95% CI | Symptoms (Fixed) 95% CI |
|---|---|---|---|---|---|
| Nielsen 1995 | 31 | 31 | -0.08 (0.22) | | -0.08 [ -0.50, 0.34 ] |