

# A Review of the Evidence for the Effectiveness, Safety, and Cost of Acupuncture, Massage Therapy, and Spinal Manipulation for Back Pain

Daniel C. Cherkin, PhD; Karen J. Sherman, PhD; Richard A. Deyo, MD, MPH; and Paul G. Shekelle, MD, PhD

**Background:** Few treatments for back pain are supported by strong scientific evidence. Conventional treatments, although widely used, have had limited success. Dissatisfied patients have, therefore, turned to complementary and alternative medical therapies and providers for care for back pain.

**Purpose:** To provide a rigorous and balanced summary of the best available evidence about the effectiveness, safety, and costs of the most popular complementary and alternative medical therapies used to treat back pain.

**Data Sources:** MEDLINE, EMBASE, and the Cochrane Controlled Trials Register.

**Study Selection:** Systematic reviews of randomized, controlled trials (RCTs) that were published since 1995 and that evaluated acupuncture, massage therapy, or spinal manipulation for nonspecific back pain and RCTs published since the reviews were conducted.

**Data Extraction:** Two authors independently extracted data from the reviews (including number of RCTs, type of back pain, quality assessment, and conclusions) and original articles (including type of pain, comparison treatments, sample size, outcomes, follow-up intervals, loss to follow-up, and authors' conclusions).

**Data Synthesis:** Because the quality of the 20 RCTs that evaluated acupuncture was generally poor, the effectiveness of acupuncture for treating acute or chronic back pain is unclear. The three RCTs that evaluated massage reported that this therapy is effective for subacute and chronic back pain. A meta-regression analysis of the results of 26 RCTs evaluating spinal manipulation for acute and chronic back pain reported that spinal manipulation was superior to sham therapies and therapies judged to have no evidence of a benefit but was not superior to effective conventional treatments.

**Conclusions:** Initial studies have found massage to be effective for persistent back pain. Spinal manipulation has small clinical benefits that are equivalent to those of other commonly used therapies. The effectiveness of acupuncture remains unclear. All of these treatments seem to be relatively safe. Preliminary evidence suggests that massage, but not acupuncture or spinal manipulation, may reduce the costs of care after an initial course of therapy.

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For author affiliations, see end of text.

See related article on pp 871-881.

**B**ack pain and its sequelae place an enormous burden on society, health care systems, and the economies of developed countries (1). More than 50% of Americans experience back pain each year; most have pain for more than 1 week (2). In the United States, \$25 billion is spent annually on medical care services for back problems and another \$50 billion is spent on lost productivity and disability payments (3). Despite the high prevalence of back pain and the numerous conventional medical treatments used for this problem, few treatments are supported by strong scientific evidence (4, 5). The limited effectiveness of conventional treatments has contributed to a high level of patient dissatisfaction with medical care for back pain (6). Thus, it is not surprising that back and neck problems are the main reasons why complementary and alternative medical (CAM) therapies are used and CAM providers are consulted (7, 8).

Spinal manipulation, performed mostly by chiropractors in the United States (9), is the most popular CAM therapy for back pain in this country (7). Chiropractic has been licensed in all 50 states since 1974 (10) and is covered by most insurance plans (11). Massage therapy has become increasingly popular over the past decade and is currently licensed, or otherwise regulated, in 30 states (12). In 1997, 11% of Americans used massage, making 114 million visits to massage therapists (7). Although less common than chiropractic and massage, acupuncture, which is licensed in 39 states, is the third most frequently used CAM therapy

for back pain in the United States. A recent study found that back pain is the most common reason for visiting chiropractors (40% of visits), massage therapists (20% of visits), and acupuncturists (about 14% of visits) (8). Few studies have evaluated the many other CAM therapies used for back pain; these include mind-body therapies (such as yoga, meditation, and tai chi), physical treatments (such as magnets, spa therapy, the Feldenkrais method, the Alexander technique, and Pilates-based exercises), botanicals (such as willow bark and Devil's claw), and supplements (such as glucosamine sulfate and chondroitin sulfate).

Over the past quarter century, numerous randomized, controlled trials (RCTs) have evaluated CAM therapies for back pain; in the past decade, reviews and meta-analyses of these trials have proliferated. The poor quality, inconsistent conclusions, and biases of many studies and reviews have led to confusion. We attempt to provide clinicians, patients, and health plans with a clear and balanced understanding of the current evidence about the effectiveness, safety, and cost of the CAM therapies most often used by Americans to treat low back pain: acupuncture, massage therapy, and spinal manipulation.

## METHODS

### Data Sources

We identified systematic reviews of RCTs that evaluated acupuncture, massage therapy, and spinal manipula-

tion for nonspecific back pain published since 1995. In addition, we identified original articles that described results of RCTs published since the reviews were conducted. In accordance with the Cochrane Collaboration Back Review Group's guidelines for systematic reviews for spinal disorders (13), both the reviews and the subsequent original articles were identified by using a computerized search of MEDLINE (from 1966 to April 2002), EMBASE (from 1988 to 1 September 2001), and the Cochrane Controlled Trials Register (through September 2001). We used the specific therapies (*acupuncture*, *massage*, or *manipulation*) and *back pain*, *low back pain*, and *backache* as search terms. We also retrieved reference lists from recent original publications to identify additional trials. We searched MEDLINE for articles on the safety of acupuncture, massage, and lumbar manipulation. Because observational data on the relative costs of CAM and conventional care are subject to substantial bias as a result of the noncomparability of patients seeking care from CAM and conventional providers (14, 15), we extracted cost data only from the few effectiveness RCTs that measured cost. Two authors independently extracted descriptive data characterizing the reviews and original articles. Discrepancies were resolved after we jointly reviewed the original documents.

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## RESULTS

### Acupuncture

#### Effectiveness

In 1997, a nonadvocate, multidisciplinary panel was convened by the National Institutes of Health to evaluate the effectiveness of acupuncture. The panel concluded that, although basic research has "begun to elucidate the mechanisms of action of acupuncture" and promising results have emerged from clinical studies of acupuncture for emesis and postoperative dental pain, the value of acupuncture for other conditions (including back pain) was inconclusive and worthy of further study (16). Since this report, one meta-analysis (17) and two best-evidence syntheses (19, 20) have evaluated acupuncture for back pain (Table 1). A total of 14 RCTs were identified in these reviews; 11 were included in all 3. Most trials focused on nonspecific chronic back pain. The trials had serious limitations, including small sample sizes, inadequate acupuncture treatment, and high dropout rates.

Ernst and White (17), who considered 9 trials suitable for a meta-analysis, concluded that 1) acupuncture was superior to various control interventions and 2) evidence was insufficient to determine whether acupuncture was superior to placebo. Ernst and White asserted that their conclusions were based "largely on rigorous research"; however, the other reviews (19, 20), which used different

quality rating scales, rated the studies less favorably and believed that meta-analysis would be inappropriate because the trials were heterogeneous in terms of design, type and duration of back pain, acupuncture treatment protocols, and outcome measures. Furthermore, van Tulder and colleagues (19) noted that "most of the studies did not meet the current standards for conducting and reporting of RCTs." They concluded that the "review did not clearly indicate that acupuncture is effective in the management of back pain" and that high-quality RCTs were needed. Smith and colleagues (20) also concluded that more high-quality primary trials would be needed before clinically meaningful conclusions could be reached.

Since the publication of these 3 reviews, we identified 6 additional published RCTs (Table 2) (27–32). In the largest trial, 262 patients with low back pain that had persisted for at least 6 weeks after a physician visit were randomly assigned to receive individualized Traditional Chinese Medical acupuncture, therapeutic massage, or self-care educational materials (30). Most patients had pain persisting for more than 1 year. Both treatment protocols proscribed use of herbs and oriental massage. After an average of 8 treatments over a 10-week period, acupuncture was found to be less effective than massage but equal to self-care educational materials in decreasing pain and improving function. Because there was no untreated comparison group, this study could not determine whether acupuncture was ineffective or merely less effective than massage.

An Australian study randomly assigned 130 patients with chronic spinal pain (82% had low back pain) to receive acupuncture, chiropractic spinal manipulation, or nonsteroidal anti-inflammatory medication (27). Among the 77 patients who completed the study, neither back dysfunction nor pain significantly improved by the end of the 4-week treatment period in the acupuncture group.

A Scottish study randomly assigned 60 elderly patients with chronic back pain to receive 4 weeks (2 sessions/week) of treatment with transcutaneous electrical nerve stimulation (TENS) or acupuncture (28). Acupuncture and TENS had similar effects on the severity of pain and use of analgesic medication. The acupuncture group, but not the TENS group, had a small but statistically significant short-term improvement in spinal flexion. Because a Cochrane Review has concluded that there is no evidence for the efficacy of TENS, it remains unclear whether either treatment was more effective than placebo (35).

A Swedish study randomly assigned 50 patients with chronic lumbar pain to 8 weekly treatments of acupuncture or a placebo control in which a disconnected TENS unit was used (29). At the 1-month and 6-month follow-up evaluations, patients receiving acupuncture were significantly more likely to improve than were those receiving placebo.

A Norwegian study randomly assigned 60 patients with acute low back pain to receive standardized acupuncture treatment for 2 weeks or enterosoluble naproxen at

**Table 1. Recent Systematic Reviews of Randomized, Controlled Trials Evaluating the Effectiveness of Acupuncture, Massage, or Spinal Manipulation for Back Pain\***

Study, Year [Search Period] (Reference)	Review Features	Total RCTs, <i>n</i>	RCTs by Back Pain Type, <i>n</i>
<b>Acupuncture†</b>			
Ernst and White, 1998 [1969–96] (17)	Meta-analysis	12 (9 suitable for meta-analysis)	8 chronic 1 acute 2 mixed 1 unspecified
van Tulder et al., 1999 [1966–96] (19)	Best-evidence synthesis	11	6 chronic 3 mixed 2 unspecified
Smith et al., 2000 [1966–98] (20)	–	13 (8 back pain, 3 neck pain, 2 both)	6 chronic 2 acute
<b>Massage‡</b>			
Ernst, 1999 [1966–97] (21)	–	4	1 chronic 1 acute 2 mixed
Furlan et al., 2000 [1966–99] (22)	Best-evidence synthesis	4	1 chronic 1 acute 2 mixed
<b>Spinal manipulations§</b>			
Koes et al., 1996 [1966–95] (23)	Systematic narrative review	36	12 acute 8 subacute or chronic 12 mixed 1 sciatica 3 unspecified
Bronfort, 1999 [1966–96] (25)	Best-evidence synthesis	39	14 acute 14 chronic 9 mixed 2 sciatica
Assendelft et al., 2003 [1966–January 2000] (26)	Meta-analysis	39 (38 included in statistical pooling)	7 acute 7 mixed

\* RCT = randomized, controlled trial; SMT = spinal manipulative therapy; TENS = transcutaneous electrical nerve stimulation.

† 11 RCTs were common to all 3 reviews.

‡ 3 RCTs were common to the 2 reviews.

§ 30 RCTs were common to all 3 reviews. Studies by Bronfort and Koes et al. had 35 RCTs in common.

500 mg twice daily for 10 days (31). Patients receiving acupuncture used substantially less analgesic medication after the first week of treatment and had fewer recurrences of low back pain after 6 and 18 months. However, pain relief between the groups did not differ.

Finally, a German study randomly assigned 131 consecutive outpatients of an orthopedic department who had chronic low back pain to receive 12 weeks of active physical therapy alone (the control treatment) or in conjunction with real acupuncture or sham acupuncture (32). Real acupuncture was found to be superior to the control treatment but not to sham acupuncture in reducing pain intensity and disability.

### Safety

Although tens of millions of acupuncture needles are used annually in the United States (36), only about 50 cases of complications resulting from acupuncture have

been reported in the medical literature over the past 20 years. Two recent prospective studies of practitioners in the United Kingdom found no serious events in 66 000 consultations (37, 38). The most noteworthy problems associated with acupuncture were fainting (10 patients); unexpected severe, prolonged exacerbation of symptoms (12 patients); pain at the needle site (6 patients); needle left in place (5 patients); seizure after needle insertion (1 patient with epilepsy); and slurred speech (1 patient). In a systematic review of acupuncture safety that included 9 prospective studies and almost a quarter of a million treatments, the most serious adverse effects were 2 cases of pneumothorax and 2 cases of a broken needle (39). Odsberg and colleagues (40) reported no serious adverse effects in a study of almost 9300 acupuncture treatments given by Swedish physiotherapists. Minor bleeding was the most commonly reported side effect (15% of treatments). The current standard use of disposable needles in the United States (required by law in many states) has substantially

Table 1—Continued

Quality Assessment Scale (Reference)	Conclusions of Reviews
Jadad scale (18) and adequacy of acupuncture	"The odds ratio of improvement with acupuncture compared with control intervention was 2.30 (95% confidence interval, 1.28–4.13). For sham-controlled, evaluator-blinded studies, the odds ratio was 1.37 (95% confidence interval, 0.84–2.25). Acupuncture was shown to be superior to various control interventions, although there is insufficient evidence to state whether it is superior to placebo."
Cochrane Back Review Group (13)	". . . no evidence showing acupuncture to be more effective than no treatment, . . . moderate evidence indicating that acupuncture is not more effective than trigger-point injection or transcutaneous electrical nerve stimulation, . . . limited evidence that acupuncture is not more effective than placebo or sham acupuncture . . ."
Oxford Pain Validity Scale (20)	"There is no convincing evidence for the analgesic efficacy of acupuncture for back or neck pain . . ."
None	"All trials are burdened with methodological flaws . . . it is impossible to draw reliable conclusions."
Cochrane Back Review Group (13)	"There is limited evidence showing that massage is less effective than manipulation immediately after the first session and moderate evidence showing it is less effective than TENS during the course of sessions in relieving pain and improving activity. At the completion of treatment and at 3 weeks after discharge there is no difference among massage and manipulation, electrical stimulation, or corsets, but this evidence is limited."
Koes et al. (24)	"The efficacy of spinal manipulation for patients with acute or chronic low back pain has not been demonstrated with sound randomized clinical trials. There certainly are indications that manipulation might be effective in some subgroups of patients with low back pain"
Not stated	"There is moderate evidence of short-term efficacy for SMT in the treatment of acute low back pain and for SMT combined with mobilization for chronic low back pain." The evidence is "inconclusive for the longer-term efficacy of SMT and mobilization for the treatment of any type of low back pain."
Cochrane Back Review Group (13); Jadad scale (18)	"There is no evidence that spinal manipulative therapy is superior to other standard treatments for patients with acute or chronic low back pain."

reduced the risk for infection, which was an important concern in previous decades.

### Cost

Only one RCT that evaluated acupuncture for back pain measured costs (30). In this trial, a course of acupuncture treatment (average, 8.0 visits) cost \$352. A comparison of the subsequent costs of back care services after 1 year of follow-up revealed no evidence of savings for the acupuncture group (costs were \$252) compared with the group that received \$50 worth of self-care educational materials (costs were \$200) ( $P > 0.05$ ).

### Therapeutic Massage

#### Effectiveness

Until recently, massage received little attention from researchers studying back pain. The two recent systematic reviews of massage for back pain (Table 1) each identified four RCTs, three of which were included in both (total of

five) (21, 22). All five of these trials included massage only as a control treatment for various physical treatments. These massage control treatments were poorly described and often involved superficial massage techniques, brief treatment sessions (10 to 15 minutes), or few sessions (<5). Both reviews concluded that high-quality trials were needed before the value of massage for back pain could be determined.

Since these reviews, at least three published RCTs have evaluated the effectiveness of massage for back pain (Table 2). Preyde (33) randomly assigned 104 patients with low back pain lasting 1 week to 8 months to comprehensive massage therapy (including stretching exercises), soft tissue manipulation alone, remedial exercise with posture education, and sham laser therapy. All patients received 6 treatments over a 1-month period; outcomes were measured at the end of the treatment period and 1 month later. At the 1-month follow-up, comprehensive massage and soft tissue manipulation were found to be superior to sham laser ther-

**Table 2. Recent Randomized, Controlled Trials Evaluating Acupuncture, Massage, or Spinal Manipulation for Back Pain Published Too Late To Be Included in Systematic Reviews Summarized in Table 1\***

Study, Year (Reference)	Type and Duration of Pain	Treatments	Sample Size, <i>n</i>	Types of Masking
<b>Acupuncture</b>				
Giles and Müller, 1999 (27)	Spine pain duration >13 wk (82% of cases were low back pain)	3–4 wk of: 1. Acupuncture (6 treatments) 2. Chiropractic spinal manipulation (6 treatments) 3. Nonsteroidal anti-inflammatory medication	1. 46 2. 49 3. 31	None (self-administered questionnaires)
Grant et al., 1999 (28)	Chronic (>6 mo)	8 sessions over 4 wk 1. Acupuncture 2. TENS	1. 32 2. 28	Assessor
Carlsson and Sjölund, 2001 (29)	Chronic (>6 mo)	Weekly for 8 wk, then 2 treatments during follow-up 1. Acupuncture 2. Mock TENS	1. 34 2. 16	Assessor
Cherkin et al., 2001 (30)	Mixed (>6 wk; most patients had pain for >1 y)	≤10 treatments over 10 wk 1. Acupuncture 2. Massage 3. Self-care educational materials	1. 94 2. 78 3. 90	Assessor
Kittang et al., 2001 (31)	Acute	1. Acupuncture for 2 wk (number of sessions not specified) 2. Naproxen (500 mg twice daily for 10 d)	1. 30 2. 30	Assessor (at 3 and 6 mo)
Leibing et al., 2002 (32)	Chronic (≥6 mo)	In addition to 26 sessions of active physiotherapy over 12 wk: 1. No additional treatment 2. 20 sessions of traditional acupuncture over 12 wk 3. 20 sessions of "sham" (minimal) acupuncture over 12 wk	1. 46 2. 40 3. 45	Assessor and patients (acupuncture groups only)
<b>Massage</b>				
Preyde, 2000 (33)	Mixed (1 wk–8 mo)	6 treatments in 1 mo 1. Comprehensive massage (soft tissue manipulation plus remedial exercise) 2. Soft tissue manipulation 3. Remedial exercise 4. Sham laser therapy	1. 26 2. 27 3. 24 4. 27	Not stated
Cherkin et al., 2001 (30)	Mixed (>6 wk; most patients had pain for >1 y)	≤10 treatments over 10 wk 1. Massage 2. Acupuncture 3. Self-care educational materials	1. 78 2. 94 3. 90	Assessor
Hernandez-Reif, 2001 (34)	Chronic (≥6 mo)	2 treatments per week for 5 wk 1. Massage 2. Progressive muscle relaxation	1. 12 2. 12	Not stated

\* TENS = transcutaneous electrical nerve stimulation. For spinal manipulation, the most recent review included in Table 1 (26) included all randomized, controlled trials evaluating spinal manipulation for back pain through January 2000. No additional randomized, controlled trials published between January 2000 and April 2002 were identified.

apy (for pain and function) and to exercise (for pain). Results for comprehensive massage and soft tissue manipulation did not differ substantially.

Another recent RCT compared massage therapy with progressive muscle relaxation (34). Twelve patients with chronic low back pain were randomly assigned to each of these treatments. After ten 30-minute sessions over 5 weeks, massage was found to be superior to progressive muscle relaxation for pain, depression, flexion, and sleep.

Finally, Cherkin and colleagues (30) randomly assigned 262 patients with persistent low back pain to receive therapeutic massage, Traditional Chinese Medical acupuncture, or self-care educational materials. At the end of the 10-week treatment period (and about 8 massage or

acupuncture visits), therapeutic massage was superior to both acupuncture (function) and self-care educational materials (function and symptoms). At 1 year, massage remained superior to acupuncture (symptoms and function) but not self-care educational materials. The benefits of massage continued for 1 year, even though the patients randomly assigned to receive massage were not significantly more likely to receive massages during the final 6 months of follow-up.

#### Safety

Although some forms of massage involve substantial force, massage is generally considered to have few adverse effects. Possible contraindications for massage include deep

Table 2—Continued

Primary Outcomes	Follow-up	Follow-up >85%	Results
Dysfunction, pain	4 wk	No	No statistical comparisons made among groups. Acupuncture group did not show significant improvement in function or pain over time.
Pain, analgesic use, spinal flexion	4 d and 3 mo after final treatment	Yes	No significant difference between treatments.
Global improvement, pain, analgesic use	1, 3, and 6 mo after treatment	Yes	Acupuncture superior to placebo for global improvement at 1, 3, and 6 mo after treatment and for pain reduction at 1 and 3 mo after treatment (all $P < 0.05$ ).
Dysfunction, bothersomeness of symptoms	4, 10, and 52 wk after randomization	Yes	At 10 wk, acupuncture less effective than massage on the dysfunction scale ( $P = 0.01$ ). After 1 y, acupuncture less effective than massage (symptoms, $P < 0.002$ ; dysfunction, $P = 0.05$ ). Acupuncture and self-care education did not significantly differ at 10 wk or 1 y
Pain, stiffness, analgesic use, new episodes of back pain	1 wk and 3, 6, and 18 mo	Yes	No differences in reduction of pain or stiffness after 6 mo. Patients receiving acupuncture used fewer analgesic drugs during the first week after start of treatment than those receiving naproxen ( $P < 0.05$ ) and reported fewer new episodes of back pain during 18-mo follow-up ( $P < 0.05$ ).
Pain, disability	At end of 12-wk treatment period and 9 mo later	No	Acupuncture superior to control at end of treatment (pain, $P < 0.001$ ; disability, $P < 0.001$ ) and after 9 mo (disability, $P < 0.016$ ). Differences between acupuncture and sham acupuncture not significant.
Function, pain	At end of 1-mo treatment period and again 1 mo later	Yes	At 1-mo follow-up, both comprehensive massage and soft tissue manipulation were superior to sham laser for pain and function and superior to exercise for pain (all $P < 0.05$ ). Comprehensive massage and soft tissue manipulation did not significantly differ.
Dysfunction, bothersomeness of symptoms	4, 5, and 52 wk after randomization	Yes	At 10 wk, massage was superior to acupuncture (dysfunction, $P = 0.01$ ) and self-care education (symptoms, $P = 0.01$ ; dysfunction, $P < 0.001$ ). After 1 y, massage was superior to acupuncture (dysfunction, $P = 0.05$ ; symptoms, $P = 0.002$ ) but did not differ significantly from self-care education.
Pain, depression, anxiety, sleep, flexion, serotonin levels, dopamine levels	Immediately after treatment period	Not stated	Massage group reported less pain ( $P < 0.05$ ) and depression ( $P = 0.05$ ), improved sleep ( $P = 0.03$ ) and flexion ( $P < 0.003$ ), and higher serotonin and dopamine levels (both $P = 0.04$ ).

venous thrombosis, burns, skin infections, eczema, open wounds, bone fractures, and advanced osteoporosis; however, reports of serious adverse effects (such as bone fractures and liver rupture) are extremely rare (41). In addition, some patients may have allergic reactions to oils used by massage therapists. Minor adverse effects, such as “significant pain or discomfort” during or shortly after treatment, were noted for 13% of the 74 patients receiving massage in a recent trial (30).

### Cost

Only one study has examined the potential cost savings associated with massage (30). In addition to producing clinically significant benefits, mean costs for additional

services for back care in the massage group (\$139) were about 40% lower than those in the acupuncture (\$242) and self-care (\$200) groups. However, the differences in cost were not statistically significant ( $P = 0.15$ ). Initial treatment costs averaged \$377 for massage, \$352 for acupuncture, and \$50 for self-care educational materials.

### Spinal Manipulation Effectiveness

Table 1 summarizes the most recent reviews of spinal manipulation. These reviews identified a total of 52 RCTs; 30 were included in all three reviews. The systematic review by Koes and colleague of 36 RCTs (23) found the evidence inadequate to conclude that spinal manipulation was efficacious for acute or chronic low back pain. Bron-

**Table 3. Spinal Manipulation Therapy for Acute and Chronic Low Back Pain: Comparison with Sham or Ineffective Therapies and with Other Recommended Therapies\***

Type of Low Back Pain	Short-Term Pain		Long-Term Pain		Short-Term Function		Long-Term Function	
	Compari- sons	Improvement on 100-mm VAS (95% CI)	Compari- sons	Improvement on 100-mm VAS (95% CI)	Compari- sons	Improvement on RDQ (95% CI)	Compari- sons	Improvement on RDQ (95% CI)
	<i>n</i>		<i>n</i>		<i>n</i>		<i>n</i>	
<b>Acute</b>								
SMT compared with: Sham or ineffective therapies	9	4 (0 to 8)	4	-2 (-9 to 5)	4	1.7 (0 to 3.4)	1	5.4 (-3.2 to 13.9)
Other recommended therapies	7	0 (-4 to 5)	5	-4 (-11 to 2)	6	0 (-1.5 to 1.5)	5	0.6 (-5.2 to 6.5)
<b>Chronic</b>								
SMT compared with: Sham or ineffective therapies	8	5 (1 to 9)	3	4 (-4 to 12)	4	3.4 (1.6 to 5.2)	2	2.2 (-5.4 to 9.8)
Other recommended therapies	7	2 (-2 to 6)	5	1 (-5 to 8)	5	1.7 (0 to 3.3)	4	-2.5 (-8.7 to 3.6)

\* RDQ = Roland Disability Questionnaire; SMT = spinal manipulative therapy; VAS = visual analogue scale.

fort's best-evidence synthesis of 39 RCTs (including 35 of the RCTs included in the review of Koes and colleagues) (25) reported moderate evidence of short-term efficacy of spinal manipulation for acute back pain and for chronic back pain (when the spinal manipulation was combined with mobilization). Both reviews considered all comparison groups, including general practitioner care, physiotherapy, exercises, traction, and bed rest, as homogeneous.

The most recent meta-analysis (26), published in this issue, included RCTs reported through January 2000; this meta-analysis used meta-regression techniques to estimate the effectiveness of spinal manipulative therapy compared with other advocated therapies. Data were analyzed from 38 RCTs, including 12 in which manipulation was given in combination with other therapies. Thirty of the trials in this review were included in Koes and colleagues' review and 33 were included in the Bronfort review. This meta-analysis suggested that spinal manipulative therapy was superior to sham manipulation and therapies considered ineffective for back pain but was not superior to other standard treatments. The results were similar for acute and chronic back pain. We summarize the results of an analysis of the subgroup of 26 RCTs that assessed manipulation as the sole or predominant component.

Separate meta-regression models were developed for short-term (<6 weeks) and long-term (>3 months) outcomes for pain and function. Estimates of effects were presented with 95% CIs for relative improvement for the spinal manipulation group compared with the comparison group on a 100-mm visual analogue scale for pain and the Roland Disability Questionnaire for function. Comparison treatments were categorized as either 1) sham manipulation or other therapies judged to have no benefit (such as traction, corset, bed rest, home care, topical gel, no treatment, diathermy, and minimal massage) or 2) other recom-

mended therapies (such as general practitioner care, analgesics, physical therapy, exercises, and back school).

Meta-regression models found statistically significant benefits only when spinal manipulation was compared with sham therapies or ineffective therapies (Table 3). There is no evidence that spinal manipulation is substantially more or less effective than other conventional therapies for either chronic or acute back pain. Sensitivity analyses that assessed the effects of study quality, presence of leg pain, and profession of manipulator did not substantially alter the results.

### Safety

Systematic studies indicate that patients often report minor symptoms after spinal manipulation (42). Serious complications associated with spinal manipulation have been documented only in case reports, which attribute these complications to cervical manipulation, misdiagnosis, presence of a bleeding disorder, presence of a herniated disc, or improper technique. Failing to correctly diagnose spinal tumors or metastatic disease, which led to a delay in appropriate treatment, was the main complication of misdiagnosis. The cauda equina syndrome, the most serious complication of lumbar spinal manipulation, occurred in patients presenting with symptoms or signs of a herniated disc.

Case reports may underestimate the true number of adverse events or may be so poorly documented that a cause-and-effect relationship is not established. Risk estimates for the cauda equina syndrome as a complication of lumbar spinal manipulation are low, ranging from about one case per 100 million manipulations (9) to less than one case per 1 million treatments (43).

### Cost

The only randomized study that compared the efficacy and costs of chiropractic care to a “placebo” (an educational booklet) reported borderline improvement in symptoms but no evidence that chiropractic manipulation treatments (costing \$280) reduced the number or costs of back care services during the 2 years after treatment (44). An RCT comparing chiropractic care and physical therapy found no difference in costs or effectiveness (45).

### DISCUSSION

Because the quality of the research evaluating the effectiveness of the most popular CAM therapies used for low back pain is generally poor, clear conclusions are difficult to reach. Fortunately, the larger and better-designed studies published in the past 5 years elucidate the potential value of these therapies. Acupuncture for acute back pain has not been well studied, and although about 10 RCTs have evaluated the use of acupuncture for chronic back pain, its value remains in question. Recent studies suggest that acupuncture is more effective than no treatment or sham treatment, is as effective as other medical interventions of questionable value (for example, TENS and nonsteroidal anti-inflammatory drugs for chronic back pain), but is less effective than massage. The three trials designed to evaluate massage as a treatment for subacute and chronic back pain have all found positive effects, especially on patient function. Finally, the preponderance of evidence from the numerous trials of spinal manipulation (including chiropractic manipulation) for back pain indicate that this treatment has real, but modest, benefits for both acute and chronic low back pain. The risks of lumbar manipulation, massage, and acupuncture are low, and serious adverse experiences are extremely rare and generally not life-threatening.

Because costs have rarely been measured in trials of CAM therapies, little is known about the cost-effectiveness of these treatments for back pain. Data from one RCT suggest that the initial costs of a course of massage therapy may be justified by the substantial improvements in functional outcomes and reduced use of health care services for back pain during the year after treatment (30). The modest benefits of manipulation (44) and questionable benefits of acupuncture (30) were not associated with any future cost savings.

The conduct and interpretation of trials of CAM therapies for back pain are complicated by the common use of various techniques; adjuncts to these techniques (such as herbs for acupuncture, aromatherapy for massage, and ultrasound for manipulation); and lifestyle recommendations. Acupuncture, massage, and chiropractic or osteopathic manipulation are not single, well-defined monotherapies but rather collections of various interventions that are often tailored to the needs of individual patients and that reflect the specific practitioner’s training and preferences. In ad-

dition to their limited applicability, fastidious trials that evaluate CAM treatments using restrictive treatment protocols are difficult to design because convincing sham therapies are hard to construct and blinding is problematic. Pragmatic trials that attempt to evaluate treatments as they are commonly delivered in active clinical practice may produce more useful results and should be encouraged.

Although the effectiveness of acupuncture for back pain remains unclear, initial studies suggest that massage is effective for persistent back pain; these studies have also shown that spinal manipulation has small clinical benefits, similar to those of other commonly used therapies, for acute and chronic back pain. All of these CAM treatments seem to be relatively safe. In addition, because there is growing evidence that patient expectations affect outcomes (46–48), allowing patients to choose the treatment they believe will be most helpful may improve results. Thus, decisions to offer CAM therapies to patients should consider effectiveness, safety, costs, the relative effectiveness of these therapies compared with conventional treatments, and patient preferences and expectations.

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**Requests for Single Reprints:** Daniel C. Cherkin, PhD, Center for Health Studies, Group Health Cooperative, 1730 Minor Avenue, Suite 1600, Seattle, WA 98101.

Current author addresses are available at [www.annals.org](http://www.annals.org).

### References

1. Deyo RA, Cherkin D, Conrad D, Volinn E. Cost, controversy, crisis: low back pain and the health of the public. *Annu Rev Public Health*. 1991;12:141-56. [PMID: 1828670]
2. Sternbach RA. Survey of pain in the United States: the Nuprin pain report. *Clin J Pain*. 1986;2:49-53.
3. Frymoyer JW, Cats-Baril WL. An overview of the incidences and costs of low back pain. *Orthop Clin North Am*. 1991;22:263-71. [PMID: 1826550]
4. Bigos S, Bowyer O, Braen G, Brown K, Deyo R, Haldeman S, et al. Acute Low Back Problems in Adults. Clinical Practice Guideline No. 14. Rockville, MD: Agency for Health Care Policy and Research, Public Health Service, U.S. Department of Health and Human Services; December 1994. AHCPR publication no. 95-0642.
5. van Tulder MW, Koes BW, Bouter LM. Conservative treatment of acute and chronic nonspecific low back pain. A systematic review of randomized controlled trials of the most common interventions. *Spine*. 1997;22:2128-56. [PMID: 9322325]



6. How is your doctor treating you? Consumer Reports. 1995;Feb:81-8.
7. Eisenberg DM, Davis RB, Ettner SL, Appel S, Wilkey S, Van Rompay M, et al. Trends in alternative medicine use in the United States, 1990-1997: results of a follow-up national survey. *JAMA*. 1998;280:1569-75. [PMID: 9820257]
8. Cherkin DC, Deyo RA, Sherman KJ, Hart LG, Street JH, Hrbek A, et al. Characteristics of visits to licensed acupuncturists, chiropractors, massage therapists, and naturopathic physicians. *J Am Board Fam Pract*. 2002;15:463-72. [PMID: 12463292]
9. Shekelle PG, Adams AH, Chassin MR, Hurwitz EL, Brook RH. Spinal manipulation for low-back pain. *Ann Intern Med*. 1992;117:590-8. [PMID: 1388006]
10. Sandefur R, Coulter ID. Licensure and Legal Scope of Practice. In: Cherkin DC, Mootz RD, eds. *Chiropractic in the United States: Training Practice and Research*. Rockville, MD: Agency for Healthcare Policy and Research; December 1997:33. AHCPR publication no. 98 N002.
11. Jensen GA, Roychoudhury C, Cherkin DC. Employer-sponsored health insurance for chiropractic services. *Med Care*. 1998;36:544-53. [PMID: 9544594]
12. American Massage Therapy Association. Accessed at [www.amtamassage.org](http://www.amtamassage.org) on 19 November 2002.
13. van Tulder MW, Assendelft WJ, Koes BW, Bouter LM. Method guidelines for systematic reviews in the Cochrane Collaboration Back Review Group for Spinal Disorders [Editorial]. *Spine*. 1997;22:2323-30. [PMID: 9355211]
14. Nyiendo J, Haas M, Goldberg B, Sexton G. Patient characteristics and physicians' practice activities for patients with chronic low back pain: a practice-based study of primary care and chiropractic physicians. *J Manipulative Physiol Ther*. 2001;24:92-100. [PMID: 11208221]
15. Coulter ID, Hurwitz EL, Adams AH, Genovese BJ, Hays R, Shekelle PG. Patients using chiropractors in North America: who are they, and why are they in chiropractic care? *Spine*. 2002;27:291-6; discussion 297-8. [PMID: 11805694]
16. NIH Consensus Conference. Acupuncture. *JAMA*. 1998;280:1518-24. [PMID: 9809733]
17. Ernst E, White AR. Acupuncture for back pain: a meta-analysis of randomized controlled trials. *Arch Intern Med*. 1998;158:2235-41. [PMID: 9818803]
18. Jadad AR, Moore RA, Carroll D, Jenkinson C, Reynolds DJ, Gavaghan DJ, et al. Assessing the quality of reports of randomized clinical trials: is blinding necessary? *Control Clin Trials*. 1996;17:1-12. [PMID: 8721797]
19. van Tulder MW, Cherkin DC, Berman B, Lao L, Koes BW. The effectiveness of acupuncture in the management of acute and chronic low back pain. A systematic review within the framework of the Cochrane Collaboration Back Review Group. *Spine*. 1999;24:1113-23. [PMID: 10361661]
20. Smith LA, Oldman AD, McQuay HJ, Moore RA. Teasing apart quality and validity in systematic reviews: an example from acupuncture trials in chronic neck and back pain. *Pain*. 2000;86:119-32. [PMID: 10779669]
21. Ernst E. Massage therapy for low back pain: a systematic review. *J Pain Symptom Manage*. 1999;17:65-9. [PMID: 9919867]
22. Furlan AD, Brosseau L, Welch V, Wong J. Massage for low back pain. *Cochrane Database Syst Rev*. 2000;CD001929. [PMID: 11034734]
23. Koes BW, Assendelft WJ, van der Heijden GJ, Bouter LM. Spinal manipulation for low back pain. An updated systematic review of randomized clinical trials. *Spine*. 1996;21:2860-71; discussion 2872-3. [PMID: 9112710]
24. Koes BW, Assendelft WJ, van der Heijden GJ, Bouter LM, Knipschild PG. Spinal manipulation and mobilisation for back and neck pain: a blinded review. *BMJ*. 1991;303:1298-303. [PMID: 1836153]
25. Bronfort G. Spinal manipulation: current state of research and its indications. *Neurol Clin*. 1999;17:91-111. [PMID: 9855673]
26. Assendelft WJ, Morton SC, Yu EI, Suttrop MJ, Shekelle PG. Spinal manipulative therapy for low back pain. Meta-analysis of effectiveness relative to other therapies. *Ann Intern Med*. 2003;138:871-81.
27. Giles LG, Müller R. Chronic spinal pain syndromes: a clinical pilot trial comparing acupuncture, a nonsteroidal anti-inflammatory drug, and spinal manipulation. *J Manipulative Physiol Ther*. 1999;22:376-81. [PMID: 10478769]
28. Grant DJ, Bishop-Miller J, Winchester DM, Anderson M, Faulkner S. A randomized comparative trial of acupuncture versus transcutaneous electrical nerve stimulation for chronic back pain in the elderly. *Pain*. 1999;82:9-13. [PMID: 10422654]
29. Carlsson CP, Sjölund BH. Acupuncture for chronic low back pain: a randomized placebo-controlled study with long-term follow-up. *Clin J Pain*. 2001;17:296-305. [PMID: 11783809]
30. Cherkin DC, Eisenberg D, Sherman KJ, Barlow W, Kaptchuk TJ, Street J, et al. Randomized trial comparing traditional Chinese medical acupuncture, therapeutic massage, and self-care education for chronic low back pain. *Arch Intern Med*. 2001;161:1081-8. [PMID: 11322842]
31. Kittang G, Melvaer T, Baerheim A. [Acupuncture contra antiphlogistics in acute lumbago]. *Tidsskr Nor Laegeforen*. 2001;121:1207-10. [PMID: 11402745]
32. Leibing E, Leonhardt U, Koster G, Goerlitz A, Rosenfeldt JA, Hilgers R, et al. Acupuncture treatment of chronic low-back pain—a randomized, blinded, placebo-controlled trial with 9-month follow-up. *Pain*. 2002;96:189-96. [PMID: 11932074]
33. Preyde M. Effectiveness of massage therapy for subacute low-back pain: a randomized controlled trial. *CMAJ*. 2000;162:1815-20. [PMID: 10906914]
34. Hernandez-Reif M, Field T, Krasnegor J, Theakston H. Lower back pain is reduced and range of motion increased after massage therapy. *Int J Neurosci*. 2001;106:131-45. [PMID: 11264915]
35. Milne S, Welch V, Brosseau L, Saginur M, Shea B, Tugwell P, et al. Transcutaneous electrical nerve stimulation (TENS) for chronic low back pain. *Cochrane Database Syst Rev*. 2001;CD003008. [PMID: 11406059]
36. Lytle CD. An overview of acupuncture. Center for Devices and Radiological Health. Washington, DC: Food and Drug Administration; May 1993.
37. MacPherson H, Thomas K, Walters S, Fitter M. The York acupuncture safety study: prospective survey of 34 000 treatments by traditional acupuncturists. *BMJ*. 2001;323:486-7. [PMID: 11532841]
38. White A, Hayhoe S, Hart A, Ernst E. Adverse events following acupuncture: prospective survey of 32 000 consultations with doctors and physiotherapists. *BMJ*. 2001;323:485-6. [PMID: 11532840]
39. Ernst E, White AR. Prospective studies of the safety of acupuncture: a systematic review. *Am J Med*. 2001;110:481-5. [PMID: 11331060]
40. Odsberg A, Schill U, Haker E. Acupuncture treatment: side effects and complications reported by Swedish physiotherapists. *Complement Ther Med*. 2001;9:17-20. [PMID: 11264965]
41. Ernst E, ed. *The Desktop Guide to Complementary and Alternative Medicine: An Evidence-Based Approach*. Edinburgh: Mosby; 2001:60-1.
42. Senstad O, Leboeuf-Yde C, Borchgrevink C. Frequency and characteristics of side effects of spinal manipulative therapy. *Spine*. 1997;22:435-40; discussion 440-1. [PMID: 9055373]
43. Assendelft WJ, Bouter LM, Knipschild PG. Complications of spinal manipulation: a comprehensive review of the literature. *J Fam Pract*. 1996;42:475-80. [PMID: 8642364]
44. Cherkin DC, Deyo RA, Battie M, Street J, Barlow W. A comparison of physical therapy, chiropractic manipulation, and provision of an educational booklet for the treatment of patients with low back pain. *N Engl J Med*. 1998;339:1021-9. [PMID: 9761803]
45. Skargren EI, Carlsson PG, Oberg BE. One-year follow-up comparison of the cost and effectiveness of chiropractic and physiotherapy as primary management for back pain. Subgroup analysis, recurrence, and additional health care utilization. *Spine*. 1998;23:1875-83; discussion 1884. [PMID: 9762745]
46. Crow R, Gage H, Hampson S, Hart J, Kimber A, Thomas H. The role of expectancies in the placebo effect and their use in the delivery of health care: a systematic review. *Health Technol Assess*. 1999;3:1-96. [PMID: 10448203]
47. Kalaoukalani D, Cherkin DC, Sherman KJ, Koepsell TD, Deyo RA. Lessons from a trial of acupuncture and massage for low back pain: patient expectations and treatment effects. *Spine*. 2001;26:1418-24. [PMID: 11458142]
48. Mondloch MV, Cole DC, Frank JW. Does how you do depend on how you think you'll do? A systematic review of the evidence for a relation between patients' recovery expectations and health outcomes. *CMAJ*. 2001;165:174-9. [PMID: 11501456]

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**Current Author Addresses:** Drs. Cherkin and Sherman: Center for Health Studies, Group Health Cooperative, 1730 Minor Avenue, Suite 1600, Seattle, WA 98101.

Dr. Deyo: Departments of Medicine and Health Services, University of Washington, 146 North Canal Street, Suite 300, Seattle, WA 98103-8652.

Dr. Shekelle: RAND, 1700 Main Street, PO Box 2138, Santa Monica, CA 90407.

