

A COMPARISON OF PHYSICAL THERAPY, CHIROPRACTIC MANIPULATION, AND PROVISION OF AN EDUCATIONAL BOOKLET FOR THE TREATMENT OF PATIENTS WITH LOW BACK PAIN

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ABSTRACT

Background and Methods There are few data on the relative effectiveness and costs of treatments for low back pain. We randomly assigned 321 adults with low back pain that persisted for seven days after a primary care visit to the McKenzie method of physical therapy, chiropractic manipulation, or a minimal intervention (provision of an educational booklet). Patients with sciatica were excluded. Physical therapy or chiropractic manipulation was provided for one month (the number of visits was determined by the practitioner but was limited to a maximum of nine); patients were followed for a total of two years. The bothersomeness of symptoms was measured on an 11-point scale, and the level of dysfunction was measured on the 24-point Roland Disability Scale.

Results After adjustment for base-line differences, the chiropractic group had less severe symptoms than the booklet group at four weeks ($P=0.02$), and there was a trend toward less severe symptoms in the physical-therapy group ($P=0.06$). However, these differences were small and not significant after transformations of the data to adjust for their non-normal distribution. Differences in the extent of dysfunction among the groups were small and approached significance only at one year, with greater dysfunction in the booklet group than in the other two groups ($P=0.05$). For all outcomes, there were no significant differences between the physical-therapy and chiropractic groups and no significant differences among the groups in the numbers of days of reduced activity or missed work or in recurrences of back pain. About 75 percent of the subjects in the therapy groups rated their care as very good or excellent, as compared with about 30 percent of the subjects in the booklet group ($P<0.001$). Over a two-year period, the mean costs of care were \$437 for the physical-therapy group, \$429 for the chiropractic group, and \$153 for the booklet group.

Conclusions For patients with low back pain, the McKenzie method of physical therapy and chiropractic manipulation had similar effects and costs, and patients receiving these treatments had only marginally better outcomes than those receiving the minimal intervention of an educational booklet. Whether the limited benefits of these treatments are worth the additional costs is open to question. (N Engl J Med 1998;339:1021-9.)

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BACK pain is a major health problem because of its high prevalence^{1,2} and costs in terms of health care expenditures³⁻⁵ and lost productivity.⁶ Although there are many non-surgical treatments, there is little evidence that any are particularly effective. Systematic reviews have concluded that chiropractic spinal manipulation appears to be effective in some subgroups of patients with back pain⁷⁻⁹ and this is one of the few treatments recommended in clinical-practice guidelines on the care of adults with low back pain in the United States.¹⁰ The effectiveness of physical therapy for back pain has not been well studied, and the results of comparisons of physical therapy with chiropractic manipulation have conflicted.¹¹⁻¹⁴ A popular form of physical therapy,¹⁵ the McKenzie method, has not been rigorously evaluated¹⁶ or compared with spinal manipulation. We compared the effectiveness and cost of the McKenzie method of physical therapy, chiropractic manipulation, and provision of an educational booklet for the treatment of low back pain.

METHODS

Study Sites

This study was conducted at Group Health Cooperative of Puget Sound, a large staff-model health maintenance organization (HMO) in Washington. Subjects were recruited from two Seattle-area primary care clinics between November 1993 and September 1995. Physical therapy was provided in a facility adjacent to these clinics, and spinal manipulation was performed by four chiropractors in solo practice. The study protocol was approved by the institutional review boards of Group Health Cooperative and the University of Washington, and all subjects gave written informed consent.

Subjects

Patients 20 to 64 years of age who saw their primary care physician for low back pain and who still had pain seven days later were eligible for the study. Physicians referred potential subjects to a research assistant, who obtained consent and collected information on the subjects' history of back pain, sociodemographic characteristics, general health, and expectations of improvement. General health was evaluated with the general health perceptions and mental health subscales of the Medical Outcomes Study

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Short-Form Health Survey (SF-36).^{17,18} The score on each of the subscales ranges from 0 (worst) to 100 (best). Subjects were excluded if they had mild or no pain seven days after the visit to the physician, a history of back surgery, sciatica, systemic or visceral causes of the pain, osteoporosis, a vertebral fracture or dislocation, severe neurologic signs, spondylolisthesis, coagulation disorders, or a severe concurrent illness. Subjects who had received corticosteroid therapy, were pregnant, were involved in claims for compensation or litigation because of the back injury, had received physical therapy or chiropractic or osteopathic manipulative treatment for their current back pain, or visited practitioners other than their primary care physicians were also excluded. Use of pain medications was not a reason for exclusion.

Randomization

After base-line data had been collected, the subjects were randomly assigned without stratification to receive physical therapy, chiropractic manipulation, or an educational booklet with the use of sealed, opaque envelopes. Because a pilot study suggested a trend toward worse outcomes in the group that received the booklet, but similar outcomes in the other two groups, we allocated 40 percent of subjects to physical therapy, 40 percent to chiropractic manipulation, and 20 percent to the educational booklet.

Treatments

Because Washington laws prohibit physical therapists from performing spinal manipulation and chiropractors from using physical therapies such as ultrasonography, the clinical practices are distinct.

Physical Therapy

In the McKenzie approach, patients are placed in one of three broad categories (derangement, dysfunction, and postural syndrome) that determine therapy.^{19,20} In this formulation, most back, buttock, and leg pain is thought to result from a "derangement syndrome," treated by exercises that "centralize" pain from the feet, legs, or buttocks to the lower back.²¹ Patients are taught to perform exercises that centralize their symptoms and to avoid movements that peripheralize them. This method relies on patient-generated forces and emphasizes self-care.

Physical therapy was provided by 13 therapists with a median of 14 years of experience. McKenzie Institute faculty trained the therapists before the study, and all but one therapist passed an advanced McKenzie credentialing examination. Subjects received McKenzie's *Treat Your Own Back* book¹⁹ and a lumbar-support cushion. Therapists were asked to avoid adjuncts such as heat, ice, transcutaneous electrical nerve stimulation, ultrasonography, and back classes. The first visit was scheduled within four days after randomization, and up to eight more visits were scheduled, at the discretion of the therapist, over the ensuing month.

Chiropractic Manipulation

The most common method of chiropractic manipulation²² was used: a short-lever, high-velocity thrust directed specifically at a "manipulable lesion." This procedure is typically performed with the patient lying on his or her side on a segmental table. No other physical treatments were permitted. Chiropractors evaluated patients according to their usual procedures and were allowed to make the same recommendations about exercise and activity restrictions that they usually did. An exercise sheet was used that emphasized stretching and strengthening but excluded extension exercises, an important part of McKenzie therapy. The HMO gave the chiropractors any radiographs of the subjects that were less than three years old. The need for additional radiographs was determined by the chiropractor.

The chiropractors had 6 to 14 years of experience, and one had a master's degree in exercise physiology. Two had advanced training in chiropractic orthopedics, and one in sports chiropractic.

The initial visit was scheduled within four days after randomization, and up to eight additional visits were scheduled, at the discretion of the chiropractor, over the ensuing month. A chiropractor consultant observed the chiropractors at the start and end of the study and confirmed their compliance with the treatment protocol.

Educational Booklet

A minimal-intervention control group received an educational booklet to minimize potential disappointment with not receiving a physical treatment. The booklet discussed causes of back pain, prognosis, appropriate use of imaging studies and specialists, and activities for promoting recovery and preventing recurrences. A previous trial found that the use of this booklet as a supplement to standard care was not associated with improved outcomes, even though subjects considered the booklet useful.²³

Outcome Measures

Because back pain often recurs, both short-term outcome (1, 4, and 12 weeks) and long-term outcome (1 to 2 years) were assessed. The assessment of short-term outcome focused on the effects of the assigned treatment on symptoms, the level of function, and the level of disability; the assessment of long-term outcomes focused on recurrences of low back pain and the use of back-related health care. At base line and at all follow-up visits, subjects rated how "bothersome" back pain, leg pain, and numbness or tingling had been during the preceding 24 hours. An 11-point scale was used in which a score of 0 indicated that the symptoms were "not at all bothersome" and a score of 10 that the symptoms were "extremely bothersome." The score for the most bothersome symptom was used. A similar scale has shown substantial construct validity.²⁴

A modified²⁴ Roland Disability Scale^{25,26} was used to measure the patients' ability to function. The scores on this scale are based on the answers to 23 yes-no questions about daily activities and can range from 0 (none of the 23 daily activities limited by back pain) to 23 (all 23 activities limited by back pain). This instrument is reliable, valid, and sensitive,^{24,27} and the questions are easily administered by telephone.

Disability was measured with questions from the National Health Interview Survey about the number of days spent in bed, spent home from work or school, or with reduced activity.²⁸ These questions were modified to refer specifically to back-related restrictions.

The subjects' use of health care for back-related problems was identified by a review of encounter forms completed by physical therapists and chiropractors, automated data on utilization for HMO-covered services, and questionnaires on visits not covered by the HMO. The subjects were asked to rate their care for back pain (excellent, very good, good, fair, or poor) at one and four weeks.

Assessment of Outcome

Data on outcomes at one and four weeks were collected by telephone; subsequent outcomes were assessed by mail with telephone follow-up. Interviewers were unaware of the subjects' study assignment; however, after the outcomes had been recorded at four weeks, subjects indicated which treatment they had been assigned. Those who had received chiropractic or physical therapy were asked about their compliance with therapy and the estimated length of their visits.

Costs of Care

The study paid for the costs of the study treatments. Nonstudy treatments were covered (within contract limitations) by the subjects' health insurance. The subjects typically had office-visit copayments of \$5 to \$10 and drug copayments of \$5 per one-month supply of medications. Physical therapy was covered for all HMO enrollees on a physician's referral and with a visit copy-

ment. About one third of the subjects had coverage for chiropractic services, which did not require a physician's referral but did require a copayment. The cost of care was determined from the HMO's cost-accounting system and reflects the costs to the HMO. Thus, out-of-pocket expenses for patients are not included.

Statistical Analysis

The study was designed to have at least 80 percent power to detect a 2.5-point difference in the scores on the Roland Disability Scale and a 1.5-point difference in the scores on the bothersomeness scale for the comparison between physical therapy and chiropractic care. These differences are consistent with those considered minimally important.²⁴

Data were analyzed according to the intention to treat. The Roland Disability and bothersomeness-of-symptoms scores were analyzed as continuous variables by analysis of covariance after adjustment for base-line values.²⁹ A common set of base-line variables predictive of these scores was included in all analyses of covariance (age, age squared, SF-36 mental health score, SF-36 general health perceptions score, previous physical therapy, and subjects' expectations of the likelihood of improvement). Because the primary outcomes were not normally distributed (i.e., many subjects had substantial symptoms or dysfunction), we used a square-root transformation before analysis so that the data better met the assumptions of the parametric test.²⁹

Nonparametric tests were used to confirm the results of the parametric analyses. For dichotomous outcomes, logistic regression was used, with adjustment for base-line values whenever available.²⁹ For all comparisons of the three treatment groups a P value of 0.05 was considered to indicate statistical significance, and Sidak's method for pairwise comparisons was used to adjust for multiple comparisons.³⁰ All P values were two-tailed.

RESULTS

Recruitment and Follow-up of Patients

Of 3800 patients who were potentially eligible for the study, 714 (19 percent) met the initial inclusion criteria. The most common reasons for exclusion were severe concurrent conditions (27 percent), involvement in claims for compensation or litigation because of the back injury (20 percent), or visits to practitioners other than their primary care physicians (19 percent). A total of 493 patients (69 percent) agreed to participate, and 323 remained eligible one week later. Two subjects were excluded after randomization (one because of a urinary tract infection and one because of pancreatic cancer). Thus, 66 were assigned to receive the booklet, 122 to chiropractic, and 133 to physical therapy. Between 89 and 96 percent of the subjects responded to each of the follow-up questionnaires.

Base-Line Characteristics

The typical subject was approximately 40 years old, white, well educated, and employed (Table 1). The mean scores on the SF-36 general health perceptions subscale were above national norms (77.1 vs. 71.4),³¹ but the mean scores on the mental health subscale were below national norms (71.2 vs. 76.5). Most subjects had previously received treatment for back pain, and about one third had previously received physical therapy and one third chiropractic care (some had had both). Most subjects had

had back pain for less than six weeks, and 59 percent had had back pain for less than three weeks.

There were only a few significant differences in base-line characteristics among the treatment groups (Table 1): subjects in the chiropractic group were less likely to have used chiropractic services previously, subjects in the physical-therapy group had more bothersome symptoms, and subjects in the educational-booklet group reported fewer days with restricted activity and lower expectations that their condition would improve in a month's time.

Study Treatments

Ninety-six percent of the subjects in the chiropractic group and 97 percent of the subjects in the physical-therapy group visited their assigned provider at least once. The mean number of chiropractic visits exceeded the mean number of physical-therapy visits by 50 percent (6.9 vs. 4.6, $P < 0.001$). According to the subjects' reports, the total amount of time spent with the provider was virtually identical in the two groups (about 145 minutes). No important adverse effects of treatment were reported in any of the groups.

Chiropractic

Chiropractors obtained radiographs for 63 percent of the subjects (58 of 92) who had not undergone radiography at the HMO. The most common diagnoses were sprain or strain (about 50 percent of subjects) and facet syndrome (30 percent). Eighty-two percent of the subjects underwent manipulation at the initial visit. All subjects underwent manipulation of the lumbar or lumbosacral region (or both). In addition, 54 percent underwent sacral or sacroiliac manipulation, 27 percent thoracic manipulation, 12 percent cervical manipulation, and 6 percent manipulation of the hip, pelvis, or ischium. Sixty-four percent of the subjects underwent manipulation of more than one level of the spine. Other treatments included ice packs (20 percent), brief localized massage (49 percent), and exercises in the office (41 percent) or at home (58 percent).

Physical Therapy

Ninety-two percent of the subjects were given a diagnosis of "derangement." At four weeks, 78 percent of the subjects reported that they had performed the recommended exercises on at least four of the preceding seven days. Most subjects reported regular use of the lumbar roll (71 percent) and recommended sitting posture (83 percent). Therapists considered 55 percent of their patients to be complying with recommended exercises.

Cost

All 66 subjects in the booklet group were mailed a \$1 booklet (Table 2). The mean cost of chiroprac-

TABLE 1. BASE-LINE CHARACTERISTICS OF THE SUBJECTS.*

CHARACTERISTIC	BOOKLET GROUP (N=66)	CHIROPRACTIC GROUP (N=122)	PHYSICAL-THERAPY GROUP (N=133)	ALL SUBJECTS	
				NO. OF VALUE	SUBJECTS†
Age (yr)	40.1±11.2	39.7±9.4	41.8±11.5	40.7±10.7	321
Female sex (%)	42	53	47	48	321
Employed or self-employed (%)	85	91	89	89	321
Cigarette smoker (%)	11	17	19	17	313
General health perceptions score‡	75.7±20.7	77.3±16.5	77.6±16.9	77.1±17.6	313
Mental health score‡	69.8±17.4	70.6±15.7	72.5±16.6	71.2±16.4	313
History of LBP					
>2 Prior episodes of LBP (%)	54	58	56	56	321
First sought care for LBP in preceding year (%)	40	40	29	36	321
Prior physical therapy for LBP (%)	37	31	32	33	310
Helpfulness§	5.1±3.6	5.7±3.2	6.1±2.9	5.7±3.2	100
Prior chiropractic for LBP (%)	40	24	35	32	313
Helpfulness§	6.2±3.1	7.2±2.3	7.0±2.4	6.8±2.6	92
Current episode of LBP					
Duration <6 wk (%)	72	83	77	78	313
Bothersomeness of symptoms in preceding 24 hours¶	5.3±1.8	5.5±2.1	6.0±2.5	5.7±2.2	313
Roland Disability score	11.7±5.4	12.1±5.5	12.2±5.6	12.0±5.5	313
≥1 Day of bed rest due to LBP in preceding week (%)	22	35	24	28	313
≥1 Day of work lost due to LBP in preceding week (%)	30	39	41	38	279
≥1 Day of restricted activity due to LBP in preceding week (%)	52	72	65	65	312
Taking medication for LBP (%)	77	82	84	81	313
Taking narcotic analgesics for LBP (%)	8	13	15	13	313
Recent LBP care very good to excellent (%)	34	42	50	43	305
Expect LBP to be much better in a month's time (%)	59	79	71	71	305

*Plus-minus values are means ±SD. The following differences among the groups were significant: prior chiropractic treatment was less likely in the chiropractic group (P=0.04), the mean bothersomeness score was higher in the physical-therapy group (P=0.04), and the booklet group was less likely to have had ≥1 day of restricted activity due to back pain in the preceding week (P=0.02) and had a lower expectation that back pain would be much better in one month's time (P=0.02). The treatment groups were similar with respect to the following variables: 79 percent overall had attended college, 89 percent were white, 68 percent were married, 39 percent had a family income of more than \$50,000 per year, 21 percent had a job requiring lifting more than 9 kg (20 lb) at a time, 57 percent had actively exercised in the preceding week, 6 percent considered their health fair or poor, 4 percent had ever been hospitalized for a back problem, 60 percent had read articles about back pain (mean helpfulness of readings on back pain on a scale of 0 to 10, 5.8), 10 percent had pain that extended below the knee, and 53 percent had had back symptoms during most of the preceding 24 hours. LBP denotes low back pain.

†The sample sizes for questions on the base-line questionnaire are slightly lower than those for questions on the initial eligibility questionnaire because of the loss of a diskette with base-line data for eight subjects (one in the booklet group, three in the chiropractic group, and four in the physical-therapy group).

‡Scores can range from 0 to 100, with higher scores indicating better function.

§Scores can range from 0 to 10, with higher scores indicating greater helpfulness.

¶Scores can range from 0 to 10, with higher scores indicating more bothersome symptoms.

||Scores can range from 0 to 23, with higher scores indicating greater reductions in daily activities.

tic treatment was \$226.08 per subject, 18 percent of which was for radiography. The cost of physical therapy averaged \$238.54 per subject, with visits to providers accounting for 93 percent of the cost.

Other Treatments

Eighteen percent of the subjects in the booklet group visited a health care provider for back pain during the study month, and only 8 percent of the

subjects in the chiropractic group and 9 percent of those in the physical-therapy group visited providers other than those assigned. The reported use of exercise was almost identical in the three groups at base line (about 57 percent) and one month (about 81 percent). During the month, the percentage of subjects who used back-pain medication of any type decreased from 82 percent to 18 percent in the chiropractic group, from 84 percent to 27 percent in

TABLE 2. MEAN COSTS OF THE TREATMENTS.*

GROUP	PERCENT OF SUBJECTS INCURRING COST†	NO. OF UNITS	COST PER UNIT	TOTAL COSTS	MEAN COST PER SUBJECT
					dollars
Booklet (n=66)					
Booklet	100	66	1.00	66.00	1.00
Mean total cost per subject					1.00
Chiropractic (n=122)					
Visits	96	807	28.01	22,604.07	185.28
Plain films (anteroposterior and lateral)	63‡	74	67.26	4,977.24	40.80
Mean total cost per subject					226.08
Physical therapy (n=133)					
Visits	97	589	49.99	29,444.11	221.38
McKenzie book	94	125	8.50	1,062.50	7.99
Lumbar roll	92	122	10.00	1,220.00	9.17
Mean total cost per subject					238.54

*Costs are in 1995 dollars.

†Four percent of subjects in the chiropractic group and 3 percent of subjects in the physical-therapy group did not visit their assigned provider at all.

‡Chiropractors ordered radiographs for 58 of the 92 subjects (63 percent) who had not undergone radiography at the HMO. We assumed that the chiropractors would also have ordered radiographs for 63 percent of the 25 subjects who had undergone radiography at the HMO.

the physical-therapy group, and from 77 percent to 32 percent in the booklet group ($P < 0.05$ for the differences among the groups after adjustment for base-line use). Fewer than 2 percent of the subjects reported using corsets, braces, traction, transcutaneous electrical nerve stimulation, or injections.

Outcomes

Data on primary outcomes are shown in Table 3. The bothersomeness of symptoms differed among the groups at base line ($P = 0.04$) and after 4 weeks ($P = 0.007$) and 12 weeks ($P = 0.02$). After adjustment for the base-line bothersomeness scores and the prognostic covariates, the differences among groups remained significant at 4 weeks ($P = 0.02$) but not at 12 weeks ($P = 0.06$) (Fig. 1). Pairwise comparisons showed that the chiropractic group had less severe symptoms than the booklet group at four weeks ($P = 0.02$), and there was a trend toward less severe symptoms in the physical-therapy group ($P = 0.06$). After square-root transformation to adjust for the non-normal distribution of the outcome measures, the differences among the treatment groups were no longer significant at 4 weeks ($P = 0.14$) or 12 weeks ($P = 0.19$).

Differences in the Roland Disability scores among the groups were small and approached significance only at one year ($P = 0.05$), with greater dysfunction in the booklet group than in the other two groups. Adjustment for the base-line Roland Disability score and the other covariates had little effect (Table 3 and Fig. 2). There were no significant differences between groups at one year after square-root transfor-

mation ($P = 0.13$) or with the use of the nonparametric test ($P = 0.16$). There were few interactions between the treatment and the subjects' characteristics, but in the booklet group, poorer mental health scores were associated with worse outcomes. There were no significant differences among the chiropractors or the therapists with respect to their effect on the subjects' symptoms (e.g., $P = 0.71$ and $P = 0.22$, respectively, at four weeks) or function (e.g., $P = 0.51$ and $P = 0.30$, respectively).

The number of days of back-related disability was similar among the groups. In the 11 months after treatment, the percentages of subjects reporting reduced activity were similar (36 percent in the booklet group, 33 percent in the chiropractic group, and 35 percent in the physical-therapy group; $P = 0.94$) as were the percentages who reported the need for bed rest (9 percent, 8 percent, and 11 percent, respectively; $P = 0.81$) and the percentages who reported missing work (17 percent, 7 percent, and 13 percent, respectively; $P = 0.28$). Approximately 50 percent of the subjects in each group reported recurrences at one year, and 70 percent reported recurrences during the second year, but there were no significant differences among the groups in the percentages who sought care for back pain. For example, during the second year, 24 percent of the subjects in the booklet group reported visits to any provider for back pain, as compared with 29 percent of the subjects in the chiropractic group and 20 percent of the subjects in the physical-therapy group ($P = 0.29$). Analysis of HMO records yielded similar results (data not shown).

TABLE 3. BOTHERSOMENESS OF SYMPTOMS AND ROLAND DISABILITY SCORES AT BASE LINE, 4 WEEKS, AND 12 WEEKS.*

VARIABLE	BOOKLET GROUP	CHIROPRACTIC GROUP	PHYSICAL-THERAPY GROUP	P VALUE	
				UNADJUSTED	ADJUSTED†
Base line					
No. of subjects	65	119	129		
Bothersomeness of symptoms — mean (95% CI)	5.3 (4.9–5.7)	5.5 (5.1–5.8)	6.0 (5.6–6.5)	0.04	—
Roland Disability score — mean (95% CI)	11.7 (10.4–13.0)	12.1 (11.2–13.1)	12.2 (11.2–13.1)	0.83	—
4 Weeks					
No. of subjects	60	118	129		
Bothersomeness of symptoms — mean (95% CI)	3.1 (2.4–3.9)	1.9 (1.5–2.2)	2.3 (1.9–2.8)	0.007	0.02
Roland Disability score — mean (95% CI)	4.9 (3.8–6.0)	3.7 (2.9–4.5)	4.1 (3.3–4.9)	0.25	0.28
12 Weeks					
No. of subjects	63	118	117		
Bothersomeness of symptoms — mean (95% CI)	3.2 (2.4–4.0)	2.0 (1.6–2.4)	2.7 (2.2–3.2)	0.02	0.06
Roland Disability score — mean (95% CI)	4.3 (3.1–5.5)	3.1 (2.4–3.9)	4.1 (3.2–5.0)	0.15	0.28

*CI denotes confidence interval for unadjusted means. Higher scores indicate more severe symptoms or dysfunction.

†The P values pertain to analyses that were adjusted for the base-line value of the outcome measure and prognostic variables (age, age squared, SF-36 general health perceptions and mental health scale scores, previous physical therapy, and patient's expectation of the likelihood of improvement in one month's time). Pairwise comparisons adjusted for these same variables yielded the following results for the bothersomeness of symptoms: at 4 weeks, chiropractic group vs. booklet group, $P=0.02$; physical-therapy group vs. booklet group, $P=0.06$; chiropractic group vs. physical-therapy group, $P=0.93$; and at 12 weeks, chiropractic group vs. booklet group, $P=0.06$; physical-therapy group vs. booklet group, $P=0.37$; and chiropractic group vs. physical therapy group, $P=0.66$. The respective values for the Roland Disability score were as follows: at 4 weeks, chiropractic group vs. booklet group, $P=0.32$; physical-therapy group vs. booklet group, $P=0.50$; chiropractic group vs. physical-therapy group, $P=0.97$; and at 12 weeks, chiropractic group vs. booklet group, $P=0.45$; physical-therapy group vs. booklet group, $P=1.00$; and chiropractic group vs. physical-therapy group, $P=0.45$. The pairwise comparisons were adjusted to account for multiple comparisons.

Total costs of care to the HMO for low back pain over a two-year period differed by less than 2 percent in the chiropractic and physical-therapy groups and were almost three times as high as in the booklet group (Table 4). Although most of the higher costs in the chiropractic and physical-therapy groups were attributable to the treatments themselves (Tables 2 and 4), the cost of other HMO services for low back pain was also lower in the booklet group than in the other two groups.

At both one and four weeks, about 75 percent of the subjects in the physical-therapy and chiropractic groups rated their care as "very good" to "excellent," as compared with about 30 percent of the subjects in the booklet group ($P<0.001$). However, about one quarter of the subjects in the booklet group failed to answer this question, possibly because only 18 percent received care during this period.

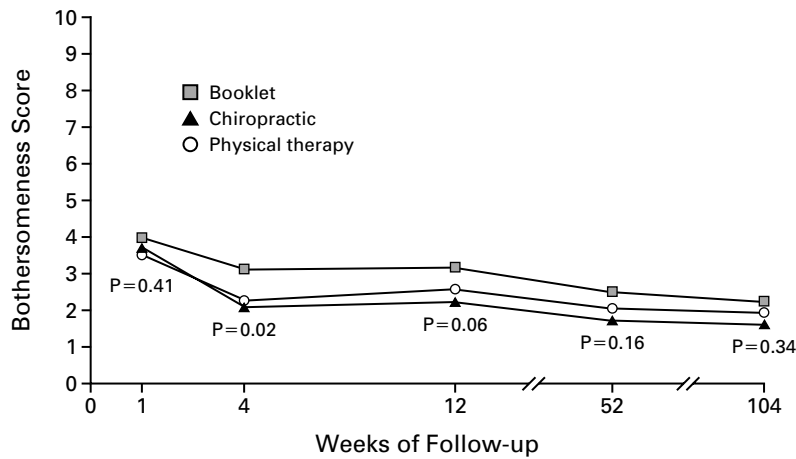
DISCUSSION

For patients with low back pain, we found that physical therapy and chiropractic manipulation had similar effects on symptoms, function, satisfaction with care, disability, recurrences of back pain, and subsequent visits for back pain. Although chiroprac-

tic treatment involved more visits than physical therapy, the total time spent with either a chiropractor or a physical therapist was similar (about 2.5 hours) as was the total cost of the treatments (\$226.08 and \$238.54, respectively).

Among other rigorous studies comparing chiropractic and physical therapy, a British study concluded that chiropractic was more beneficial,^{11,12} whereas a Swedish study found no significant differences in outcomes or costs.¹⁴ The British study found the benefits of chiropractic treatment to be most evident among patients who had previously been treated by chiropractors, a group presumably favorably inclined toward chiropractic care. Neither study included a no-treatment comparison group. A Dutch study found that manual therapy (manipulation and mobilization) and physiotherapy (exercise, massage, and physical-therapy methods) had similar effects and were superior to continued treatment by a general practitioner.³²

We found that patients who received chiropractic manipulation or physical therapy had only marginally better outcomes than those who received only an educational booklet. Because only 18 percent of the subjects in the booklet group sought additional care



NO. OF SUBJECTS					
Booklet	56	60	63	55	55
Chiropractic	114	118	118	109	116
Physical therapy	127	129	117	122	121

Figure 1. Bothersomeness of Symptoms.

The values are least-squares means, adjusted for the base-line bothersomeness scores and prognostic variables (age, age squared, SF-36 general health perceptions and mental health scale scores, previous physical therapy, and subjects' expectations of the likelihood of improvement). Higher scores indicate more severe symptoms.

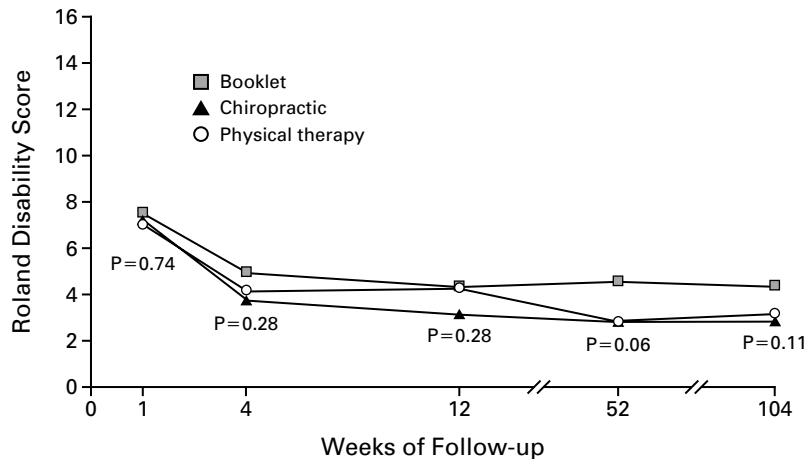


Figure 2. Roland Disability Scores.

The values are least-squares means, adjusted for the base-line Roland Disability scores and prognostic variables (age, age squared, SF-36 general health perceptions and mental health scale scores, previous physical therapy, and subjects' expectations of the likelihood of improvement). Higher scores indicate greater disability. The numbers of subjects are the same as in Figure 1.

TABLE 4. MEAN COSTS OF CARE FOR LOW BACK PAIN OVER A TWO-YEAR PERIOD.

TYPE OF COST	BOOKLET GROUP (N=66)	CHIROPRACTIC GROUP (N=122)	PHYSICAL-THERAPY GROUP (N=133)
	dollars		
Study treatments and supplies (mo 1)	1	226	239
HMO services for low back pain*			
First year	87	114	134
Second year	65	89	64
Total costs	153	429	437

*These costs include the costs to the HMO for office visits, radiology, laboratory tests, and medications but exclude the costs of the study treatments. Patients' copayments are not included. There were no hospitalizations or operations for back problems in the two-year period. The mean number of months of continued enrollment in the HMO was similar in the three groups over the 24-month period (range, 20.8 to 21.5 months).

during the month after randomization, this group was similar in some respects to a no-treatment control group. Although some outcomes for the chiropractic and physical-therapy groups were superior to those for the booklet group, the differences were small and, after adjustment, were significant only for the bothersomeness of symptoms at four weeks and the subjects' satisfaction with care at one and four weeks. None of the observed differences in symptoms or function exceeded the predefined criteria for clinical importance — that is, a 2.5-point difference in the scores on the Roland Disability Scale or a 1.5-point difference in the scores on the bothersomeness scale. The difference in the bothersomeness of symptoms was not significant after data transformation to compensate for the skewed distribution of scores. Thus, although chiropractic manipulation and physical therapy may slightly reduce symptoms, their main benefit for patients with low back pain appears to be increased satisfaction with care. Because only a small fraction of subjects in the booklet group received care during follow-up, their responses to questions about satisfaction with care are difficult to interpret.

The marginally better outcome of the physical treatments raises the possibility that effects were nonspecific. Although nearly all subjects in the physical-therapy and chiropractic groups had repeated contact with providers, most subjects in the booklet group had none. Patients may find such contact satisfying and this may affect their perceptions of symptoms. A positive association between the number of treatments (contact with providers) and improvement of back-related symptoms has been reported.³³

We found no significant differences among the groups in recurrences of back pain or in the use of

services during follow-up. This casts doubt on the ability of the self-care-oriented McKenzie physical therapy to reduce the utilization of services. The overall costs of care for back pain were lowest in the booklet group, so there was no evidence that the higher initial costs of the physical treatments were offset by later savings.

The relative costs of chiropractic and McKenzie treatments could differ in other settings. The number of visits was left to the discretion of providers (who were aware that both costs and benefits would be measured), and the smaller number of visits to McKenzie therapists (HMO employees) than to chiropractors (in private practice) may reflect differences in practice styles.¹⁵

The generalizability of this study is limited by the use of a single health care system, the use of specific forms of chiropractic and physical therapy, the use of one month of therapy, and the exclusion of patients with sciatica. The chiropractic manipulative technique was chosen because it was well understood and widely practiced. The extent to which McKenzie therapy in this study resembled that provided elsewhere is less clear. The McKenzie therapists received special training and were among a small number worldwide who had passed a certification examination. Thus, it seems unlikely that the effectiveness of McKenzie therapists would be greater in other settings.

Whether the small benefits of these treatments are worth their additional costs is open to question. Given the limited benefits and high costs, it seems unwise to refer all patients with low back pain for chiropractic or McKenzie therapy. Ideally, there would be some way of identifying the subgroups that are most likely to benefit from one or both of these therapies, though we were unable to identify any predictive characteristics. In any event, these results and those of another recent study¹⁴ suggest that for low back pain, there are no clear advantages of chiropractic manipulation — in terms of either effectiveness or cost — over physical therapy.

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REFERENCES

1. Sternbach RA. Survey of pain in the United States: the Nuprin pain report. *Clin J Pain* 1986;2:49-53.
2. Frymoyer JW. Back pain and sciatica. *N Engl J Med* 1988;318:291-300.
3. Cypress BK. Characteristics of physician visits for back symptoms: a national perspective. *Am J Public Health* 1983;73:389-95.
4. Frymoyer JW, Cats-Baril WL. An overview of the incidences and costs of low back pain. *Orthop Clin North Am* 1991;22:263-71.
5. Hart LG, Deyo RA, Cherkin DC. Physician office visits for low back pain: frequency, clinical evaluation, and treatment patterns from a U.S. national survey. *Spine* 1995;20:11-9.
6. Salkever DS. Morbidity cost: national estimates and economic determinants. NCHSR research summary series. Rockville, Md.: National Center for Health Services Research, October 1985. (DHHS publication no. (PHS) 86-3393.)
7. Assendelft WJJ, Koes BW, van der Heijden GJMG, Bouter LM. The effectiveness of chiropractic for treatment of low back pain: an update and attempt at statistical pooling. *J Manipulative Physiol Ther* 1996;19:499-507.
8. Koes BW, Assendelft WJJ, van der Heijden GJMG, Bouter LM. Spinal manipulation for low back pain: an updated systematic review of randomized clinical trials. *Spine* 1996;21:2860-71.
9. Shekelle PG, Adams AH, Chassin MR, Hurwitz EL, Brook RH. Spinal manipulation for low-back pain. *Ann Intern Med* 1992;117:590-8.
10. Bigos SJ, Bowyer OR, Braen GR, et al. Acute low-back pain problems in adults. Clinical practice guideline no. 14. Rockville, Md.: Agency for Health Care Policy and Research, December 1994. (AHCPR publication no. 95-0642.)
11. Meade TW, Dyer S, Browne W, Townsend J, Frank AO. Low back pain of mechanical origin: randomised comparison of chiropractic and hospital outpatient treatment. *BMJ* 1990;300:1431-7.
12. Meade TW, Dyer S, Browne W, Frank AO. Randomised comparison of chiropractic and hospital outpatient management for low back pain: results from extended follow up. *BMJ* 1995;311:349-51.
13. Postacchini F, Facchini M, Palieri P. Efficacy of various forms of conservative treatment in low back pain: a comparative study. *Neuroorthopedics* 1988;6:28-35.
14. Skargren EI. Cost and effectiveness analysis of chiropractic and physiotherapy treatment for low back pain and neck pain: six-month follow-up. *Spine* 1997;22:2167-77.
15. Battie MC, Cherkin DC, Dunn R, Ciol MA, Wheeler KJ. Managing low back pain: attitudes and treatment preferences of physical therapists. *Phys Ther* 1994;74:219-26.
16. Koes BW, Assendelft WJJ, van der Heijden GJMG, Bouter LM, Knipschild PG. Spinal manipulation and mobilisation for back and neck pain: a blinded review. *BMJ* 1991;303:1298-303.
17. Ware JE Jr, Sherbourne CD. The MOS 36-item Short-Form Health Survey (SF-36). I. Conceptual framework and item selection. *Med Care* 1992;30:473-83.
18. McHorney CA, Ware JE, Raczek AE. The MOS 36-item Short-Form Health Survey (SF-36). II. Psychometric and clinical tests of validity in measuring physical and mental health constructs. *Med Care* 1993;31:247-63.
19. McKenzie R. *Treat your own back*. 6th ed. Waikanae, New Zealand: Spinal Publications, 1985.
20. *Idem*. *The lumbar spine: mechanical diagnosis and therapy*. Lower Hutt, New Zealand: Spinal Publications, 1981.
21. Donelson R. The McKenzie approach to evaluating and treating low back pain. *Orthop Rev* 1990;19:681-6.
22. Haldeman S, Phillips RB. Spinal manipulative therapy in the management of low back pain. In: Frymoyer JW, ed. *The adult spine: principles and practice*. Vol. 2. New York: Raven Press, 1991:1581-605.
23. Cherkin DC, Deyo RA, Street JH, Hunt M, Barlow W. Pitfalls of patient education: limited success of a program for back pain in primary care. *Spine* 1996;21:345-55.
24. Patrick DL, Deyo RA, Atlas SJ, Singer DE, Chapin A, Keller RB. Assessing health-related quality of life in patients with sciatica. *Spine* 1995;20:1899-908.
25. Roland M, Morris R. A study of the natural history of back pain. I. Development of a reliable and sensitive measure of disability in low-back pain. *Spine* 1983;8:141-4.
26. *Idem*. A study of the natural history of low-back pain. II. Development of guidelines for trials of treatment in primary care. *Spine* 1983;8:145-50.
27. Deyo RA. Measuring the functional status of patients with low back pain. *Arch Phys Med Rehabil* 1988;69:1044-53.
28. National Center for Health Statistics, Ries PW. Current estimates from the National Health Interview Survey, United States, 1984. Vital and health statistics. Series 10. No. 156. Washington, D.C.: Government Printing Office, 1986. (DHHS publication no. (PHS) 86-1584.)
29. Fisher LD, van Belle G. *Biostatistics: a methodology for the health sciences*. New York: John Wiley, 1993.
30. Sidak Z. Rectangular confidence regions for the means of multivariate normal distributions. *J Am Stat Assoc* 1967;62:626-33.
31. McHorney CA, Kosinski M, Ware JE Jr. Comparisons of the costs and quality of norms for the SF-36 health survey collected by mail versus telephone interview: results from a national survey. *Med Care* 1994;32:551-67.
32. Koes BW, Bouter LM, van Mameren H, et al. The effectiveness of manual therapy, physiotherapy, and treatment by the general practitioner for nonspecific back and neck complaints: a randomized clinical trial. *Spine* 1992;17:28-35.
33. Coxhead CE, Inskip H, Meade TW, North WRS, Troup JDG. Multi-centre trial of physiotherapy in the management of sciatica symptoms. *Lancet* 1981;1:1065-8.

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