COST-EFFECTIVENESS OF CHIROPRACTIC CARE
October 2022

Anthony L. Rosner, Ph.D., LL.D. [Hon.]

I. ECONOMIC BURDEN OF LOW BACK AND NECK PAIN

I.A. Spending and Gross Domestic Product burden:

In the United States, health care estimated spending in 2016 for the 100 most expensive health conditions of the 154 health conditions analyzed placed low back and neck pain in the top rank with expenditures of $134.5B. Other musculoskeletal disorders placed second at $129.8B. These two categories added together were more than twice as expensive as the next costliest item (diabetes). Private and public insurance carried over 90% of these costs.[1] In 2020, national healthcare expenditures grew 9.7% to $41 trillion, or $12,500 per person. That accounted for 19.7% of the total gross domestic product (GDP)[2] and represents the continuing increase of the proportion of the GDP and per capita spending from 2008-2018 (Figure 1).[3]

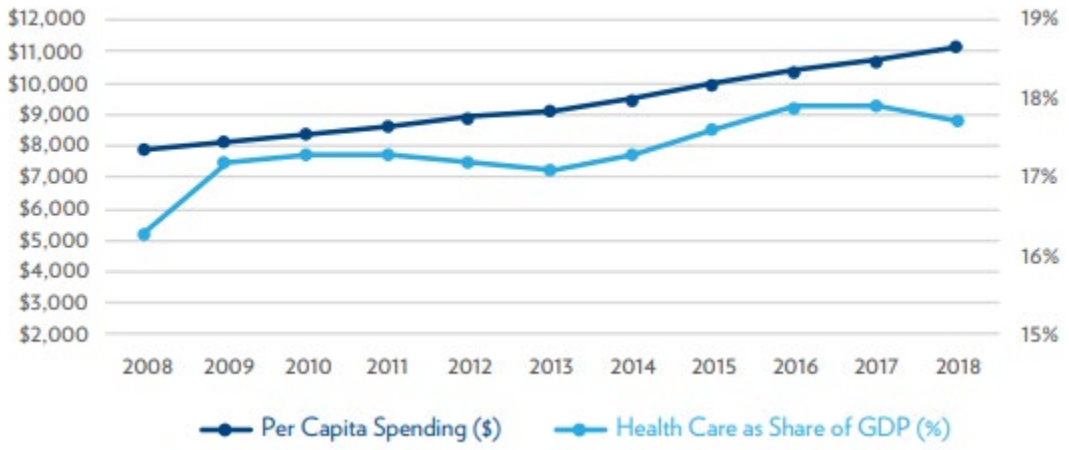


FIGURE 1: Increases in healthcare as share of GDP and per capita health spending, 2008-2018

One would imagine that these prohibitive healthcare costs were replicated by payouts borne by Workers Compensation Bureaus.That appears to be the case, since total Workers' Compensation and employer costs in 2017 were $97.4B, $62.0B of which was paid out by Workers' Compensation.[4]

I.B. Significant cost drivers:

To prevent a complete engulfing of both the GDP and Workers' Compensation budgets by these rising healthcare expenditures, it is imperative to corral these costs with a reevaluation of the most significant cost drivers and to impose controls and alternatives. From the US health care spending by payer and health condition data cited above,[4] a plausible starting point for such an initiative would be musculoskeleltal conditions, low back pain and neck pain in particular. For spine problems in particular, several primary drivers of medical expenditures have been identified:

1. Prescription medications in 2018 dollars:
    a. $30B in 1980.[5]
    b. $335B in 2018, a $1117% increase.[5]
    c. $2,389 per capita in 2008, $3,649 per capita 2018, a 52.7% increase.[3]
    d. The share of spending by insurers has increased dramatically, with consumers paying 57% of costs out of pocket in 1957 and just 15% in 2018.[5]
    e. $7.3B for back and neck problems in 1995.[6]
    f. $19.8B for back and neck problems in 2007, a 271% increase.[6]
2. The wider use of expensive newer drugs (gabapentin, fentanyl, time-release oxycodone).[7] These have been called "blockbuster" in that they have generated at least $1B in sales annually.
3. Spine surgeries:
    a. The mean inflation-adjusted cost for cervical spine surgery increased 64% from $11,799 to $19,379 from 2001 to 2013.[8]
    b. Rates of cervical fusions rose from 14.7 to 45 per 1000,000 beneficiaries from 1992 to 2005 even after adjustment for age, sex, and race.[9]
    c. After adjusting for inflation, average overall payments to physicians for spinal claims increased 13.6% from 2014 to 2016.[10]
    d. United states spine surgery rates rose 55% in the 1980s, while rates of spinal fusions tripled during the 1990s and accounted for an increasing proportion of all spine procedures.[9]
4. Hospital care, 32.7% share of national health expenditures.
5. Outpatient visits, $30.8B, 35% of total spine-related expendires in 2005.[6]
6. Medical imaging and diagnostic tests.[11]
7. Spinal injections.[12]
8. Increasing use of spinal fusion surgery and instrumentation.[9]
9. Medical errors: In 2008, medical errors cost the United States $19.5B directly associated with additional medical costs (ancillary services, prescription drugs, inpatient and outpatientcare), $1.4B attributed to increasd mortality rates and $1.1B due to 10M days of lost productivity.[13]

I.C. Chiropractic alternative:

One of the most visible alternatives to managing back and neck pain is chiropractic, a suite of non-invasive interventions which includes high-velocity, low-amplitude guided thrusts, lower velocity manipulations and mobilizations, flexion and distraction, the application of hot and cold compresses, and electrical stimulation. A vast majority of studies presented in the peer-reviewed literature have demonstrated the cost-effectiveness and efficacy of chiropractic and manual therapy compared to orthodox medicine and physical therapy. These have appeared from the multiple perspectives of private insurers, out-of-pocket, Medicare, and Workers Compensation distributions.

It will be the goal of this monograph to review these cost savings achieved by chiropractic care. In so doing, this presentation will refute a number of studies that have suggested a cost burden rather than savings produced by chiropractic care,[14] [15,] [16]with particular focus upon Workers' Compensation reviews and especially upon one particular study delivered to the Department of Consumer and Business Services delivered to the state of Oregon in 2006.[17]

II. UTILIZATION OF CHIROPRACTIC

National Health Interview Survey (NHIS) data taken from the Sample Adult files at five-year intervals (1997, 2002, 2007, and 2012) as well as from the Adult Alternative Medicine files for 2002, 2005, and 2007 revealed significant increases of chiirorpactic utilization as well as preference over other healthcare providers for spine-related problems. Specifically:

1. Reported use of chiropractic increased from 7.61% in 1997 to 19.11% in 2012 ($p<0.001$)
2. The odds ratio (OR) of seeing a chiropractor over other healthcare providers was >>1.00:
    a. Ranged from 3.09 to 4.31 except in 2012 when physical therapists were highest.
    b. Was 2.40 for chiropractic compared to osteopathic manipulation.
3. The odds ratios favoured avoding alternatives compared to chiropractic intervention:
    a. Odds ratio was 9.35 over surgery.
    b. Odds ratio was 9.50 over physical therapy.

Overall, the general use of chiropractic was found to be slowly increasing; however, utilization was still low compared to that of more traditional primary care providers such as M.D.s and nurse practitioners. Of the sample taken, only 19.15% received a recommendation from a medical doctor to seek chiropractic manipulation.[18]

In a Medicare population, Whedon found that the regional supply of chiropractors was predictive of use of chiropractic care by Medicare beneficiaries but did not predict the number of visits per user. Specifically, chiropractic supply and overall use was strongly and positively correlated (Spearman's rho 0.68, $p<0.001$). Low back problems were strongly associated with chiropractic use (OR 21.6) as were cervical spine problems (OR 14.3).[19]

A comprehensive analysis of chiropractic care across 28 study states by the Workers' Compensation Research Institute found that in states in which workers could choose their own providers, there was a strong correlation of the use of chiropractic with the supply of chiropractors. Conversely, where employers had control over the selection of providers, the prevalence of chiropractic care was lowest among the 28 study states. In other words, the election of providers by employers rather than employees served as a strong deterrent to chiropractic utilization. These results are shown dramatically in Figure 2.[20] The authors of this study suggested that historical data may have been interpreted by employers and insurers to show that chiropractic care contributed to the rapid growth in medical costs in a number of states in the early 1990s. Consequently, employers and insurers hesitated to choose chiropractors for care. **What this report will demonstrate, however, is precisely the opposite: that chiropractic care compared to care by medical doctors and physical therapists provides substantial cost savings, both direct and indirect due to shorter treatment periods and the relative absence of side effects.**

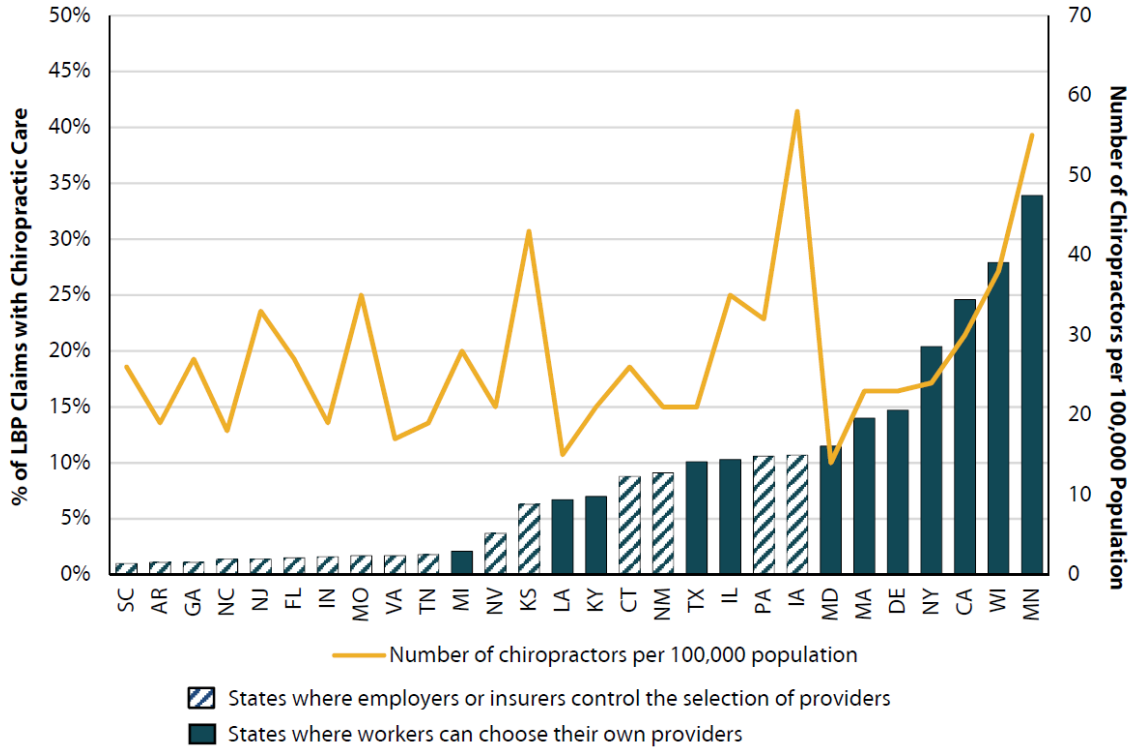


FIGURE 2: Interstate variation in the prevalence of chiropractic care, provider choice regulations, and supply of chiropractors

III. RELATIVE EFFICIENCY OF CHIROPRACTIC CARE

III.A. Reduction of surgery and early MRI:

An assessment was made of the early predictors of lumbar spine surgery within 3 years among Washington State workers filing new workers compensation temporary total disability claims for back injuries, Baseline variables associated with surgery in a moultivariate model found greater injury severity, higher Roland-Morris Disability Questionnaire scores with surgeons as first providers seen for the injury. About 42.7% of workers who first saw a surgeon had surgery, contrasting with only 1.5% of those who first saw a chiropractor.[21] The same data source revealed that patients who first consulted a chiropractor had a reduced likelihood of having an early MRI (OR 0.53).[22]

III.B. Reduction of disability:

Turner, 2008[23]

Yet another study using the same data source found that out of a sample size of 1885, the following percentages of patients were found to be disabled at 1 year of follow-up, showing a distinct reduction when a chiropractor was the first provider (Table 1).

Table 1: Significant Baseline Predictors
In Final Multodomain Model of Work
Disability 1 Year after Submission of a

Back Injury Work-Loss Claim

First provider after injury	Disabiled at 1 Year (%)
Primary care	12
Occupational medicine	26
Chiropractor	5
Other	23

Cifuentes, 2011[24]

Data extracted from the administrative records of a large insurance company that represented approximately 10% of the US workers' compensation with claims filed in Illinois, Massachusetts, Maryland, New Hampshire, New York, Texas and Wisconsin between January 1 and December 31, 2006 identified 11,420 nonspecific low back pain cases. Disability episodes were defined as the worker being completely unable to work on a temporary basis due to the health related impairment, with the beginning and duration determined for each claimant. A health maintenance period was defined as the period after the initial disability episode had ended and the person had returned to work for more than 14 days. If the claimant returned to work but on a reduced basis of time and/or wages, that individual was included in the health maintenance periods. The hazard ratios for disability recurrence by provider were found as:

2.0 (95% CI 1.0,3.9) Physical therapists
1.6 (95% CI 0.9,6.2) Physicians
1.0 (95% CI 0.4,3.8) Chiropractors

From Table 2, the following trends were apparent:

1. When chiropractors were involved at first contact, rates of surgery were reduced.
2. When chiropractors were involved at first contact, opioid use was reduced.
3. When chiropractors were involved at first contact, duration of disability was reduced.

Statistically, this meant that one was twice as likely to end up disabled if care was received from a physical therapist rather than a chiropractor. And one was 60% more likely to become disabled if a physician was chosen instead.

Table 2: Frequency of Severity Indications by Categories of Exposure

Exposure Categories	Surgery during Disability Episode or Health Maintenance Care Period	Opiod Use During Disability Episode	Opioid Use During Health Maintenance Care Period	Duration (days) of FIrst Episode of Disability
Type of provider health maintenance care period				
Only or mostly chiropractor (184)	1 (0.5)	25 (13.6)	15 (8.1)	49 (33)
Only or mostly physical therapist (213)	10 (4.7)	43 (20.2)	24 (11.3)	58 (42)
Only or mostly physicians (773)	14 (5.1)	84 (30.8)	54)19.8)	119 (89)
Chiropractor and physical herapist combined (47)	1 (2.1)	7 (14.9)	11 (23.4)	62 (36)
Any other combination (31)	0 (0.0)	7 (22.6)	4 (12.9)	73 (49)
Type of provider during disability period				
Only or mostly chiropractor (242)	2 (0.8)	31 (12.8)	22 (9.1)	56 (33)
Only or mostly physical therapist (428)	9 (2.1)	80 (18.7)	45 (10.5)	74 (50)
Only or mostly physicians (102)	15 (14.7)	44 (43.1)	25 (24.5)	141 (128)
Chiropractor and physical therapist combined (62)	3 (4.8)	17 (27.4)	12 (19.4)	133 (102)

Any other combination (60)	1 (1.7)	12 (20.0)	7 (11.7)	57 (42)
Preferred type of provider (both periods combined)				
Chiropractic loyalist (159)	0 (0.0)	17 (10.7)	11 (6.9)	43 (28)
Physical therapy loyalist (158)	5 (3.2)	27 (17.1)	13 (8.2)	50 (39)
Physician loyalist (54)	7 (13.0)	26 (48.2)	18 (33.3)	171 (150)
Physical theraspy to physician (159)	4 (1.9)	38 (23.9)	24 (15.1)	100 (77)
Switchers and other combination provider (218)	11 (5.1)	58 (26.6)	42 (19.3)	88 (57)

III.C. Chiropractic care: Substitution or add-on?

Metz, 2004[25]

From the point of view from one managed care health plan, adding coverage for chiropractic care did not result in an increase of neuromusculoskeleltal complants. Specifically, rates of neuromusculoskeleltal compalints in IDC-9e categories were compared between a group of 3,129,752 subscribers with chiropractic coverage with 5,197,686 insured members without chiropractic coverage. Instead of finding an uptick of complaints with chiropractic services added, the rate of complaints per 1000 member years (162.0) was actually *slightly lower* for insured members compared to that seen with the cohort lacking chiropractic coverage (171.3). This indicated that patients were using chiropractic care as a direct substutiton for medical care rather than an add-on.[25] Assuming that the total costs of chiropractic care are at least equal to—or most likely lower as this report will demonstrate—that would indicate that the possibility of adding chiropractic coverage to an insurance plan would add no cost burden and most likely would result in cost *savings.*

IV. METHODOLOGICAL CONCERNS:

In actual figures, it has been shown that 80% of the total cost of chiropractic treatment is billed from the chiropractor, whereas only 20% of the total medical costs of treatment appear on bills directly from the medical physician.[26] This is because costs from a medical provider are typically unbundled, excluding additional costs from referrals, medications, even hospitalizations and surgeries.

IV.A. Minimal criteria:

To begin with appraisal of cost-effectiveness studies, one must assess the minimal criteria and common deficiencies of cost-effectiveness studies. In reviewing cohort studies in occupational low back pain, Baldwin identifies 6 requirements:[27]

1. The sample must be identified immediately after the onset of pain.
2. The study must obtain data on the prior history of back pain.
3. Standardized outcomes measures must be collected.
4. The total costs of an episode of back pain must be measured accurately.
5. Costs must be evaluated from the viewpoint of a pre-identified payor.
6. Multivariate models must be used to control for patient differences.

IV.B. Common deficiencies:

Looking at the other side of the coin, Branson has cited 5 common *deficiencies* in investigations pertaining to cost-effectiveness:[28]

1. Patient characteristics (severity, chronicity) are not factored in.
2. Standardized diagnoses within or between providers is not controlled in retrospective studies.
3. Payments actually received as not the same as those billed.
4. There is an absence of all direct costs, such as
    a. All visits to the provider;
    b. Prescription and nonprescription drugs or supplements;
    c. Laboratory costs;
    d. Diagnostic imaging;
    e. Referral to specialists; and
    f. Hospital costs.
5. There is a poor representation of *indirect* costs, such as
    a. Workdays lost by the patient;
    b. Retraining for replacement labor;
    c. Caregivers to assist in domestic duties;
    d. Iatrogenic events; and
    e. Legal costs.

Other deficiencies have cited as follows:

1. Sample sizes may be too small.[27]
2. There is variation of coverages of costs:[27] Differences in coverage benefits or fee schedules for different providers may exist.[29]
3. Patients may seek care with more than one provider type.[29]
4. Administratve data sets will not indicate which provider had the most influence on the use of medicl and system resources.[29]
5. Work productivity has not been assessed. It has been reported that the vast majority (76.6%) of lost productive time has been attributed to reduced performance at work and not work absence.[30]

V. FACTORS AFFECTING COSTS WITH CHIROPRACTIC UTILIZATION:

V.A. Chiropractors as first point of contact:

V.A,I. Stano, 1995:[31]

An early study by Stano drew from fee-for-service claims information provided by large corporations with self-insured plans, including all patients with claims from any provider for one or more of 493 ICD-9-CM neuromusculoekeletal (NMS) claims over the 2-year period from July 1, 1988-June 30, 1990. It involved 7077 patients with 9314 episodes of care with 6823 clearly identifying chiropractors or medical physicians as first-contact providers. Controls were in place for patient and insurance characteristics. Table 3 indicates that costs for medically initiated costs consistently exceeded costs for chiropractor-initiated episodes for compariable trigger codes with differences across all conditions combined statistically significant at the 1% level.[31]

Table 3: Episode Comparisons between Chiropractic and Medical Providers

Episode Characeristic	Mean Total Cost Per Episode	Difference	P-value
All Costs Chiropractic	$493		

Medical	$1000	$597	<0.01
1-Day Episodes Excluded Chiropractic Medical	 $760 $1991	 $1237	 <0.01
All Outpaitnet Costs Chiropractic Medical	 $425 $554	 $129	 <0.01
1-Day Outpatient Costs Excluded Chiropractic Medical	 $647 $1027	 $380	 <0.01

V,A.2. Fritz, 2016:[32]

A retrospective study of new LBP consultations (first contact of provider) was conducted between January 1, 2012 and January 31, 2013 using claims from the University of Utah Health Plans (UUHP). The UUHP was a non-profit insurer and integrated subsidiary of University of Utah Health Care. Enrollees had private, employer-based coverage between the ages of 18 and 60. A new LBP consultation was devided as a provider visit occurring during the inclusion dates associated with a LBP-related ICD-9 code as a primary or secondary diagnosis for whom no charges associated with LBP were received in the prior 90 days. Patients presenting at the entry visit with an ICD-9 code indicative of a possible non-musculoskeletal cause for back pain including kidney, gall bladder stone, urinary tract infection, or with a red flag condition that may have required urgent management were excluded.

It can be seen from Table 4 that chiropractic patients showed a higher percentage of continuing care from the same provider after the entry visit. As a result, advanced imaging, emergency department visits, consultations with spinal surgeons and spinal surgeries were conspicuously lower than with the other providers, except for physical therapy in the category of spinal surgeries. Total LBP costs were significantly lower except for physical therapy.

Entry in chiropractic was associated with a decreased risk for advanced imaging (OR = 0.21, p=0.001) or a surgeon visit (OR = 0.13, p=0.005) while showing an increase of care duration (standardized regression coefficient = 0.51, p<0.001).[32]

Table 4: Outcomes by Entry Visit

Exposure Categories	All p(atints (n = 747)	Primary care (n = 409)	Chiropractic (n = 207)	Physiatry (n = 83)	Physical therapy (n = 48)
Received LBP care after entry visit	71.9%	60.1%	91.8%	77.1%	77.1%
Episode of care duration (median days, IQR)	56 (0.247)	20 (0.211)	146 (24.298)	56 (1.241)	44 (5.192)
Radiographs	32.7%	30.1%	29.5%	62.1%	16.7%
Advanced imaging	12.6%	14.2%	**3.4%**	31.3%	6.2%
Emergency department visit	4.4%	6.1%	**1.9%**	4.6%	2.1%
Spinal injection	9.2%	8.6%	**3.4%**	31.3%	2.1%
Surgeon visit	4.8%	5.4%	**1.0%**	10.8%	6.2%
Surgery	2.4%	2.2%	**0.5%**	9.6%	0%

Total LBP costs (mean, 95% CI)	$1194 ($1043,$1345)	$1167 ($965,$1382)	**$878 ($664,$1092)**	$2283 ($1665,$2900)	$904 ($638,$1171)

Radiographs were of the lumbo-pelvic region.
Advanced imaging included MRI or CT scanning of the lumbo-pelvic region.
Emergency department visit was beyond the entry visit.
Spinal injections were fluroscopically guided epidural injections of the lumbar spine or sacroiliac joint.
Office visit with a spine surgeon (orthopaedic or neurosurgeon) was beyond the entry visit.
Surgical procedure included discetomy, laminectomy, fusion or rhizotomy of the lumbosacral region.
CI = confidence interval

Differences in training and scope of practice of the provider were likely significant influences upon these outcomes. In addition, a recent review found that chirorpactors and physical therapists were more likely to follow guideline-adherent care for LBP than primary care doctors.[33]Although rates of co-morbidities and amoking were lower for patients beginning care in chiropractic or physical therapy, these factors were controlled in the analysis—although the potential for selection bias could not be eliminated. The sample was small and involved a single insurer in one geographical region, limiting the generalizability of the results.

V.A.3. Liliedahl, 2010:[34]

A second study, although involving yet another single general health insurer, involved a much larger patient base of 85,402 members. A CTP code was applied for an originating office visit to either a medical physician or doctor of osteopathy, chiropractic manipulation, or an emergency department visit. Total episode costs for each episode of LBP included the cost paid by the insurer for all services provided during the episode, with episodes defined as all reimbursed care delivered between the first and last encounter with a health care provider for low back pain. A 60-day period without an encounter closed the episode. The point was to compare paid claims and risk adjusted costs between those episodes of care initiated with an MD with those initiated with a DC. The results are shown in Tables 5A and 5B, the latter using the data in Table 5A adjusted for each patient's disease burden using Symmetry Pharmacy Risk Groups.:[34]

Table 5A: Comparison of Episode Cost by Initial Provider Type

Exposure Categories	Provider	n	Mean	Standard Error	% Difference
Allowed amount	DC MD	36,280 66,158	$755.65 $1037.04	$9.38 $12.47	27.13%
Paid amount	DC MD	36,280 66,158	$452.23 $740.07	$8.03 $10.73	38.89%

Table 5B: Comparison of Risk-Adjusted Episode Cost by Initial Provider Type

Exposure Categories	Provider	n	Mean	Standard Error	% Difference
R-adjusted paid amount	DC MD	36,280 66,158	$532.54 $661.10	$9.56 $29.16	19.45%

VI.A.4. Houweling, 2015[35]

Differences in outcomes, patient satisfaction and related health care costs in spinal, hip, and shoulder pain patients who initated are with either medical doctors (MDs) or doctors of chiropractic (DCs). The retrospective cohort design involved 403 patients who had seen MDs and 316 whose first contact were DCs for their complaints. Patients previously had contacted a Swiss telemedicine provider regarding advice about their complaint.

Health care costs were determined in a subsample of patients by reviewing the claims database of a Swiss insurance provider. The database was a record of all health care bills paid by the insurer including type and date of service.

Patient demographics and complaints were matched at baseline with the exception of (i) a slightly elevated age of chiropractic patients, (ii) more shoulder complaints in the chiropractic cohort, (iii) more neck pain in the medical cohort, (iv) more hip pain in the chiropractic cohort, and (v) insidious onset in the chiropractic cohort.

Patients consulting MDs had significantly lower reduction in their numerical pain rating score (difference of 0.32) and were significantly less likely to be satisfied with the care received (odd ratio = 1.79) and outcome of care (odds ratio = 1.52).

Mean healthcare costs per patient over 4 months were significantl lower in patients initially consulting chiropractors (Table 6).

Table 6: Comparison of Total Spinal, Hip, and Shoulder Pain-Related Health Care Costs Per Patient (in US Dollars)

Analysis	Medical ($)	Chiropractic ($)	Difference (95% CI)[a]	p-value
Multiple imputation analysis (n = 719)	922.59 (1234,45)	506.97 (882.33)	-3-528.69,-206.62)7.66	0.001
Complete case analysis (n = 326)	1144.79 (1403.21)	672.48)641.25)	-415.23 (-681.84,-148.62)	0.002

Values are mean (SD)
[a]Adjusted for age, sex, pain, location, number of complaints, pain duration, baseline pain score, and language
CI = confidence interval; SD = standard deviation

V.B. Reduction of surgery and hospitalization

V.B.1. McMorland, 2010[36]

In a trial out of a small patient base with unilateral lumbar radiculopathy who had failed at least 3 months of nonoperative management including treatment with analgesics, lifestyle modification, physiotherapy, massage therapy, and/or acupunctureother medical management, 60% benefited from spinal manipulation to the same degree as if they underwent surgical intervention.[36]

V.B.2. Keeney 2013[21]

With injured workers choosing their medical provider in Washingfton State, after controlling for injury severity and othe measures, workers with an initial visit for the injury to a surgeon had almost 9 times the odds of receiving lumbar spine surgery compared with those seeing primary care providers. Workers whose first visit to a chiropractor had significantly reduced odds of surgery (adjusted odds ratio 0.22, 95% CI 0.10,0.50). A total of 42.5% of workers who first saw a surgeon had surgery within 3 years, in contrast to only 1.5% of those who first saw a chiropractor.[21] As Cherkin has suggested, however, it is possible tha this result indicates that “who you see is what you get.”[37]

V.B.3. Davis, 2021[21, 38]

A mirror image study sought to determine the effects of *reduced* access to chiropractic care due to relocation of 39,278 older adult chiropractic care users during 2010-2014. A reduction in access to chiropractic care was defined as deceasing one quintile or more in chiropractor per population ratio after relocation. Among those who experienced a reduction in acess to chiropractic care versus those who did not understandably showed an increase in the rate of visits to primary care physicians for spine conditions. That increase was an annual elevation of 32.3 visits per 1000 (95% CI 1.4,63.1) together with an annual increase of 5.5 surgeries per 1000 (95% CI, 1.3,9.8).[38]

V.B.4. Sarnat[39]

With an awareness of the potential benefits of complementary and alternative medicine (CAM), nonpharmaceuticaly-oriented physicians licensed to diagnoise, notably chiropractic physicians, gained entry into a well-defined structure along with their more conventional allopathic ounterparts to create an integrated healthcare system encompassing both CAM and conventional medicine within a single comprehensive insurance structure. This entity in the Chicago area became known as an altnative medicine independent provider association formed to function within the classical HMO format. It was incoproated in 1997 as Alternative Medicine, Inc. Its function was to allow subscriber direct access to chirorpactors who were embedded in this organization.

An analysis of 21,743 member months over a 4-year period from January 1, 1999 through December 31, 2002 revealed a variety of diagnoses with neuromusculoskeletal complaints largely, but not exclusively, managed by chiropractors. If diagnoses required a treatment that required the use of pharmaceuticals or surgery, then an appropriate referral was made to a conventional medical specialist. As shown in Table 7A, reductions in both outpatient surgeries and categories of hospitalizations were apparent with AMI, allowing first contact with chiropractors as “primary care providers.” [39]

Table 7A: AMI Outcomes Comparison with HMO Network Data, 1999-2002*

Exposure Categories	AMI percentage utilization vs HMO	AMI percentage reduction vs HMO
Outpatient surgical cases per 1000	56.8%	43.2%
Hospital admissions per 1000	57.0%	43.0%
Hospital days per 1000	41.6%	58.4%
Average length of stay	76.2%	23.8%

AMI = Alternative Medicine, Inc.; HMO = health maintenance organization
#Obstetrics admissions excluded from comparison percentages.

V.B.5. Sarnat, 2007[40]

An additional 3-year follow-up revealed largely the same outcomes, although what is presumed to be a marked reduction in the lengths of hospital stays during the more recent period minimized the difference between the AMI and HMO groups in that category (Table 7B). Over a 7-year period, chiropractic first contact providers managed their enrolled members without requiring a referral.[40]

Table 7B AMI Outcomes Comparison with HMO Network Data, 1999-2005*

Exposure Categories	AMI percentage utilization vs HMO	AMI percentage reduction vs HMO
Outpatient surgical cases	38%	62%
Hospital admissions	40%	60%
Hospital days	41%	59
Average length of stay	94%	6%

AMI = Alternative Medicine, Inc.; HMO = health maintenance organization
#Obstetrics admissions excluded from comparison percentages.

The data not allowing a regression analysis or traditional statistical analyses to be performed was a limitation of the study, limiting descriptive comparisons to be made beween the identified populations as subsets of the entire HMO population. In addition, the fact that these data were observational allowed a long-term correlation to be made but did not report causal outcomes. Finally, differences in baseline characteristics between the integrative medicine group and the conventional IPA could not be controlled.

V.C. Reduction of prescription use, including opioids

V.C.1. Sarnat, 2004,2007[39, 40]

The AMI study just described disclosed also disclosed a significant reduction of pharmaceutical usage, especially in the follow-up period extended to 2005 (Table 8).[39, 40] This was most likely a reflection of the major role of pharmaceuticals as cost drivers in the more recent years as described in items #1 and 2 in section I.B. above.

Table 8: AMI Outcomes Comparison with HMO Network Data, 1999-2005*

Exposure Categories	AMI percentage utilization vs HMO	AMI percentage reduction vs HMO
Pharmaceutical usage (cost)		
1999-2002	48.2%	51.8%\
1999-2005	15%	85%

AMI = Alternative Medicine, Inc.; HMO = health maintenance organization
#Obstetrics admissions excluded from comparison percentages.

V.C.2. Ndetan, 2020[18]

Among the 1,235 respondents to the adult Complementary and Alternative Medicine (ACAM) Survey (a component of the National Health Interview Survey conducted by the National Center for Health Statistics) in 2012 who used chiropractic manipulation as their top therapy for a spine-related “top condition,” just 21,66% reported that they also used prescriptions for this problem (odds ratio 0.44, 95% CI 0.35,0.55).[18]

V.C.3. Trager, 2022[41]

A massive deidentified, aggregated electronic health records database from 73 million patients and 52 healthcare organizations across the United States was used to study adjults aged 18-49 with a diagnosis of radicular low back pain. The number, percentage and odds ratio of patients receiving a benzodiazepine prescription over 3, 6, and 12 months follow-up yielded 9206 patients

per cohort receiving or not receving chiropractic spinal manipulative therapy. The odds of receiving a benzodiazepine prscription were significantly reduced in the chiropractic group over all follow-up windows prematching and postmatching (p<0.0001). The odds ratios are shown in Table 9, reinforcing the use of chiropractic spinal manipulative theraspy as a first-line nonpharmacological option for adults with radicular low back pain:[41]

Table 9: Hazard Ratios of Benzodiazepine Prescription Fills among Recipients of Chiropractic Care Compared to Non-Recipients

Follow-Up (months)	Hazard Radio (HR)
3	0.56 (95% CI 0.50,0.64)
6	0.61 (95% CI 0.55,0.68)
12	0.67 (95% CI 0.62,0.74)

CI = confidence interval; HR = hazard ratio

V.C.4. Whedon, 2020, 2022[42, 43]

Proposing that utilization of pain management by nonpharmacological means may present unnecessary use of opioids, Whedon and his colleagues employed a retrospective cohort design to analyze health claims data from three contiguous New England states for the years 2012-2017. Adults aged 18-84 years in a health plan with spinal pain with office visits to a primary care physician or chiropractor were included. Risks of filling a prescription for opioids were determined among the 101,221 recipients. Overall, Table 10 shows significantly elevated risks among those patients who did not see a chiropractor for spinal pain:

Table 10 Risk of Opioid Prescription Fill among Patients with Spinal Pain not Consulting a Chiropractor for Spinal Pain

State	Hazard Radio (HR)	P-value
Connecticut	1.55 (95% CI 1.11,2.17)	0.010
New Hampshire	2.03 (95% CI 1.92-2.14)	<0.0001
Massachusetts	1.73 (95% CI 1.64,1.82)	<0.0001

CI = confidence interval; HR = hazard ratio

Essentially, patients with spinal pain who saw a chiropractor had half the risk of filling an opioid prescription. Among those who saw a chiropractor within 30 days of diagnosis, the risk reduction was greater as compared with those whose first visit was after the acute phase.[42] For 9,536 Medicare beneficiaries diagnosed with spinal pain who were receipients of chiropractic care and 46,593 who were non-receipients, the results were essentially the same. Specifically, the adjusted risk of filling an opioid prescription within 365 days of the intial visit was 56% lower among receipits of chiropractic care as compared to non-recipients (hazard raio 0.44 (95% CI 0.40-0.49).[43]

V.C.5.Emary, 2022[44]

Furthermore, in a retrospective study of 945 patient records in a Canadian community health center, the result was the same: Patients with noncancer spinal pain who were under chiropractic care showed a 52% lower risk of initiating a prescription for opioids at 1 year after presentation, the hazard ratio being 0.48 (99% CI 0.29,0.77). It was 71% lower in patients who received chiropracic services within 30 days of either index visit, the hazard ratio being 0.29 (99% CI 0.13,0.68)). Finally, patients whose index visit date was in a more recent calendar year than the study period (January 2014-December 2020) also were less likely to receive opioids with a hazard ratio of 0.86 (99% CI 0.76,0.97).[44]

V.C.6.Zack, 2019[45]

Even more telling was a meta-analysis and systematic review presented at the American Academy of Pain Medicine's 2019 Annual Meeting, which reported that patients who visited a chiropractor were 49% less likely to receive an opioid prescription.[45] In terms of the addictive capacities of opioids and the current opioid crisis,[46-48] this finding is highly significant.

V.D. Reduction of over-the-counter medication

Ndetan, 2020[18]

Among the 1,235 respondents to the adult Complementary and Alternative Medicine (ACAM) Survey (a component of the National Health Interview Survey conducted by the National Center for Health Statistics) in 2012 who used chiropractic manipulation as their top therapy for a spine-related "top condition," just 34.04% reported that they also used over-the-counter medications for this problem (odds ratio 0.80, 95% CI 0.65,0.99).[18]

V.E. Reduction of imaging

V.E.1.Graves, 2011[22]

Interviews with a cohort of 1885 workers after they submitted a workers' compensation claim for a back injury sought to identify demographic, job-related, psychosocial, and clinical factors assoiated with the use of magnetic resonance imaging (early MRI) within 6 weeks of injury. Early MRI could be associated with an increased use of services for treatment along with costs. A total of 362 (19.8%) received an early MRI. Multivariable regression found that having a chiropractor as the initial provider was associated with a reduced likelihood of early MRI (risk ratio 0.53, 95% CAI 0.42,0.66). [22]

V.E.2. Legoretta, 2004[49]

A study that compared an additional insurance coverage benefit for chiropractic for 700,000 health plan members with 1,000,000 members without such benefits was interpreted to demonstrate the effects of chiropractic access in healthcare expenditures, hospitalizations, and utilizations of plain film radiographs and magnetic resonance imaging. In a 4-year retrospective analysis, decreases among the insured chiropractic cohort were significant ($p<0.001$) in all four categories, as shown in Figure 3.

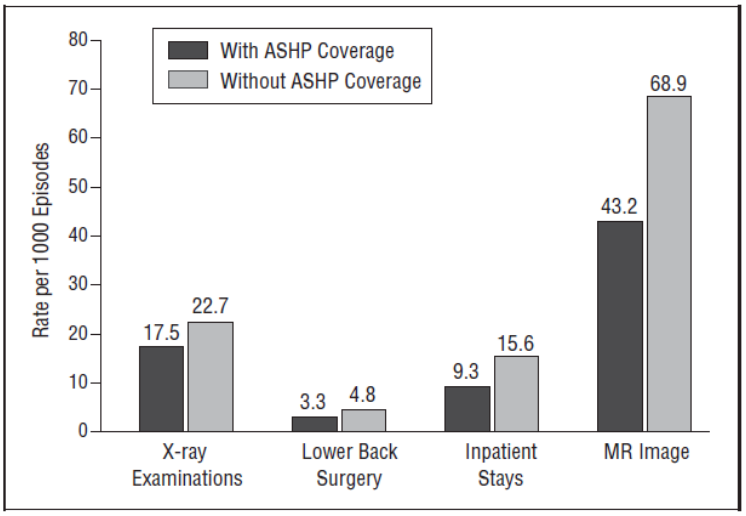


FIGURE 3: Access to high resource-utilizing components of neuromusculoskeletal care. ASHP = American Speciality Health Plans; MR = magnetic resonance.

V.E.3. Nelson, 2005[50]

A retrospective claims analysis in a managed care health plan from April 1, 1997 through March 30, 2001 determined the effects of a chiropractic benefit on the rates of specific diagnostic and therapeutic procedures for the treatment of back and neck pain. A total of 32 ICD-9 codes for neck pain and 41 codes for low back pain were identified as representing the two groups of conditions. Episodes were defined with clean periods of 45 days with no claims, such that all services using a back pain or neck pain code with a maximum gap of 45 days between claims were grouped into one episode of care. A per-patient rate represented the overall probability that any individual with a low back or neck pain complaint during the study period would receive the procedure under investigation.

As shown by Table 11A for back pain, significant reductions of utilization of surgery, CT/MRI services, plain film radiographic services, and inpatient care were highly significant ($p<0.01$) in the patient group with chiropractic coverage compared to the cohort lacking this benefit. The same was evident in patients with neck pain (Table 11B)

Table 11A: Back Pain Treatment Profile

Treatment	With Chiropractic Coverage	No Chiropractic Coverage
Surgical rate		
Per 1000 patients	5.88* (-13.7%)	6.81*
Per 1000 episodes	3.26* (-32.1%)	4.80*
CT/MRI rate		
Per 1000 patients	77.95* (-20.3%)	97.79*
Per 1000 episodes	43.19* ((-37.2%)	68.88*
Inpatient visits		
Per 1000 patients	16.71* (-24.8%)	22.22*
Per 1000 episodes	9.26* _(-40.1%)	15.65*
Plain-film X-ray rate		
Per 1000 patients	315.80* (-2.2%)	322.86*
Per 1000 episodes	174.96* (-23.1%)	227.41*

CT = computerized tomography; MRI = magnetic resonance imaging
*p<0.01 comparing with chiropractic coverage vs. without chiropractic coverage.

Table 11B: Neck Pain (Cervical Spine) Treatment Profile

Treatment	With Chiropractic Coverage	No Chiropractic Coverage
Surgical rate		
Per 1000 patients	7.01* (-31.1%)	101.07*
Per 1000 episodes	3.87* (-49.4%)	7.65*
CT/MRI rate		
Per 1000 patients	47.16* (-25.7%)	63.48*
Per 1000 episodes	26.09* (-45.6%)	47.98*
Inpatient visits		
Per 1000 patients	7.21* (-31.1%)	10,.47*
Per 1000 episodes	3.98* (-49.5%	7.88*
Plain-film X-ray rate		
Per 1000 patients	282.16* (-12.5%)	322,49*
Per 1000 episodes	156.12* (-36.0%)	243.74*

CT = computerized tomography; MRI = magnetic resonance imaging
*p<0.01 comparing with chiropractic coverage vs. without chiropractic coverage.

V.E.4. Graves, 2012[51]

A nonrandomized cohort study of Washington State workers' compensation claimants with nonspecific low back pain revealed similar results. Patients with a mild or major sprain/strain were less likely to undergo an MRI within 6 weeks if they consulted a chiropractor (18.2%) than a primary care physician (50.4%). With radiculopathy, the likelihood of undergoing an MRI was also considerably less after consultation with a chiropractor (22.4%) than a primary care physician (49.5%).[51]

V.F. Proposed reduction of spine injections

V.F.1. Peterson, 2013[52]

Age- and sex-matched patients with MRI-confirmed lumbar disc herniations were treated either with high-velocity, low-amplitude spinal manipulative therapy (SMT) or nerve root injections (NRI). At 1 month follow-up, the SMT group displayed an "improvement" Patient Global Impression at 76.5% compared to 62.7% in the NRI cohort. Numerical pain scale ratings were the same in both groups. The average cost was $558.75 for the SMT treatment compared to $729.61 for the NRI.[52]

V.F.2. U.S. Food and Drug Administration, 2014[53]

Elsewhere, rare but serious neurologic adverse events have been reported with epidural corticosteroid injections, including spinal cord infarction, paraplegia, quadriplegia, cortical blindness, stroke, and death.[53] In light of these findings, substitution of chiropractic care for spinal injections may be indicated in many instances.

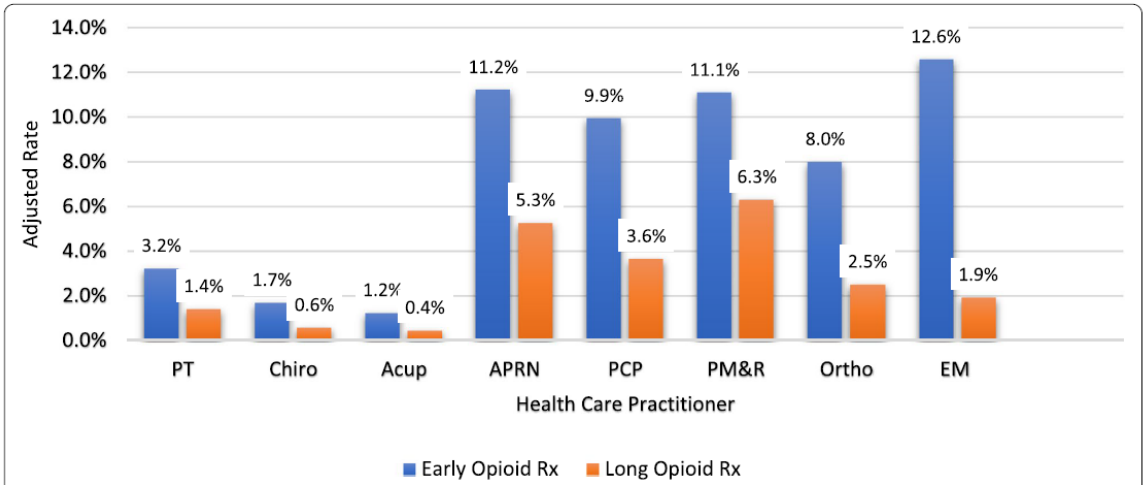
V.G. Combined categories

V.G.1. Harwood, 2022[54]

A total of 3,799,593 claims data from individuals aged 18 and older who were privately insured were retrospectively assigned to cohorts based on the first provider seen at the index data of LBP diagnosis. Individuals with LBP 6 or an opioid prescription 6 months prior to the index date were

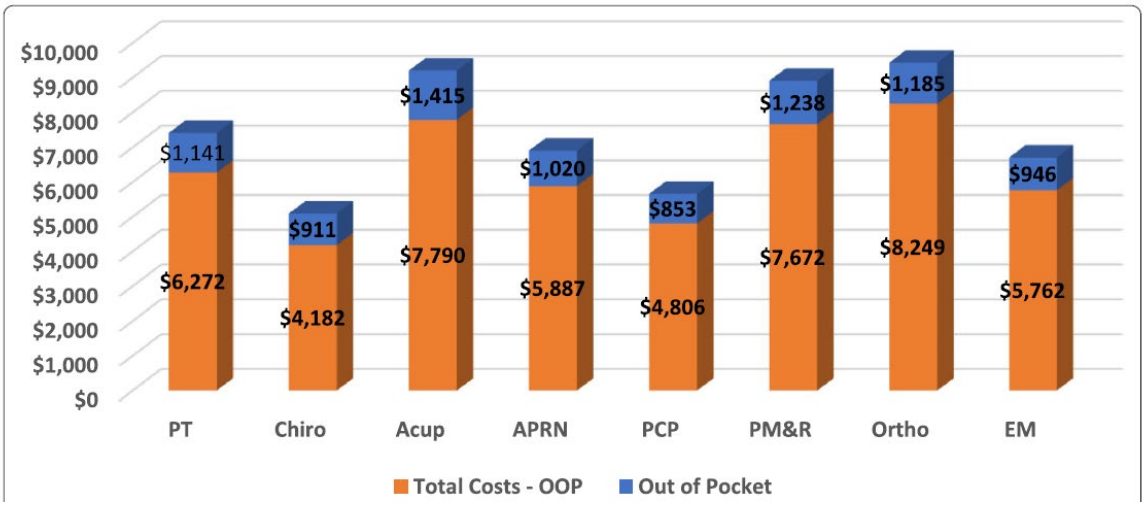
excluded.Outcome measure included (i) use of imaging, (ii) back surgery rates, (iii) hospitalization rates, (iv) emergency department visits, (v) early and long-term opioid use, and (vi) costs (out of pocket and total costs of care). A two-stage residual inclusion estimation approach was used, comparing copay for the initial provider visit and differential distance as the instrumental variable to reduce selection bias in the choice of first provider, controlling for demographics.

Frequencies of early and long opioid prescriptions were signficiently lower when care began with chiropractic or acupuncture and highest for those who began with an emergency medicine physician or advanced practice registered nurse (Figure 4). Total cost of care was lowest when starting with a chiropractor ($5093) or primary care physician ($5659) and highest when starting with an orthopedist ($9434) or acupuncturist ($9205) (Figure 5):



PT = physical therapist; Chiro = chiropractor; Acup = acupuncturist; APRN = advanced practice registered nerse; PCP = primary care physician; PM&R = physical medicine and rehabilitation physician; Ortho = othorpedist; EM = emergency medicine physician.

FIGURE 4: Early and long opioid prescription (adjusted rates) by first provider seen for low back pain.



PT = physical therapist; Chiro = chiropractor; Acup = acupuncturist; APRN = advanced practice registered nerse; PCP = primary care physician; PM&R = physical medicine and rehabilitation physician; Ortho = othorpedist; EM = emergency medicine physician

FIGURE 5: Adjusted health care costs, total and out of pocket costs by first provider seen for low back pain.

Chiropractors ranked among the lowest in terms of early and late opioid use, imaging, hospitalizations, surgery, or having a serious illness and showed the highest use of emergency department visits of all 8 healthcare professions studied (Table 12).

Table 12: Health Care Ranking by First Provider Seen

Venue	PT	Chiro	Acu	APRN	PCP	PM&R	Ortho	EM
Early Opioid Rx	6	7	8	2	4	3	5	1
Late Opioid Rx	6	7	8	2	3	1	4	5
MR/CT	6	7	8	3	5	2	1	4
Any Radiography	7	6	8	4	5	3	1	2
Had ED Visit	8	1	5	4	7	3	6	2
Hospitalization	6	8	4	5	7	2	1	3
Had Surgery	4	7	8	3	6	2	1	5
Had Serious Illness	3	8	4	5	7	2	1	6

1 = highest use; 8 = lowest use
PT = physical therapist; Chiro = chiropractor; Acup = acupuncturist; APRN = advanced practice registered nerse; PCP = primary care physician; PM&R = physical medicine and rehabilitation physician; Ortho = othorpedist; EM = emergency medicine physician

V.G.2. Davis, 2021[38]

The reduction of access to chiropractic care described above in IV.B produced an additional cost of $8,075 per 1000 beneficiaries on primary care and $106,892 on spine surgeries. If the effect of reduced chiropractic care were extrapolated to the entire Medicare population of 3.4 M chiropractic care users, there would be an additional 110M visits to primary care physicians producing an annual cost of $27.5M and additional 19,000 additional spine surgeries costing $363.4 M.

In this study, each individual served as his or her own control, and the reduction in access to chiropractic care after relocation acted as a proxy for loss of the chiropractic benefit. This study was considered to be among the first to utilize a rigorous methodology to review the indirect effect of access to chiropractic care on medical services use.

VI. OBSTACLES TO COST SAVINGS AND CHIROPRACTIC UTILIZATION

VI.A. National

In 1978, the National Center for Health Care Technology recommended to Medicare what procedures it should cover in the effort to control healthcare costs. This was opposed by both the American Medical Association and Health Industry Manufacturers Association. By 1981, the budget for the agency was zeroed.[55]

In 1989, the Agency for Health Care Policy and Research was created in another attempt to control healthcare costs. It published guidelines for back pain which were critical and questioned

the necessity of spinal surgery. The North American Spine Society said that the guidelines were a waste of taxpayer money. The Center for Spine Advocacy almost succeeded in killing the entire Agency,[55] which was forced out of publishing guidelines.

VI.B. Oregon

In Oregon, concerns about the high overall costs of the workers' compensation system, rapidly rising medical costs, high utilization of medical services, and disability duration were all factors which drove the state legislature in 1990 to produce Senate Bills 1197 and 1198. While the original draft bills limited the authority of attending physiciains to only medical doctors and doctors of osteopathy, a legislative amendment extended the attending physician authority to oral and maxillofacial surgeons and chiropractors (ORS 656.005 (12) (b). Ostensibly to cap costs, the amendment limited the time a chiropractor could be an attending physician to "a period of 30 days from the date of [the] first visit or on the initial claim for 12 visits, whichever first occurs."[17]

The immediate effect was seen as the chiropractors' share of medical payments declined from 16% pre-reform in 1989 to 3% post-reform in 1992. For maximum medical improvement, the payment share for chiropractic care fell from 15% in 1989 to 10% post-reform.[56]

The 1990 reform also ruled out any maintenance care regimens that have been extensively shown to increase the number of pain-free days and reduce periods of disability. Maintenance care has been reported to be followed by approximately 30% of Scandinavian chiropractic patients[57] Both Descarreaux[58] and Senna,[59] for example presented treatment regimens of 12 visits for 1 month *followed by* treaments every 2[59] or 3[58] weeks for an additional 9 months. The Nordic Maintenance Program, a protocol first conceived in 2014[60] mimicking the clinical decision-making process and approach of Scandianvian chiropractors, prescribed maintenance interventions every 1-3 months out to a period of 10 months[61] or 1 year.[62] The result was a reduction of days of bothersome low back pain[61, 62] as well as an increase of pain-free periods.[62] The reduction of the number of bothersome days with maintenance care is strikingly illustrated in Figure 6:[61]

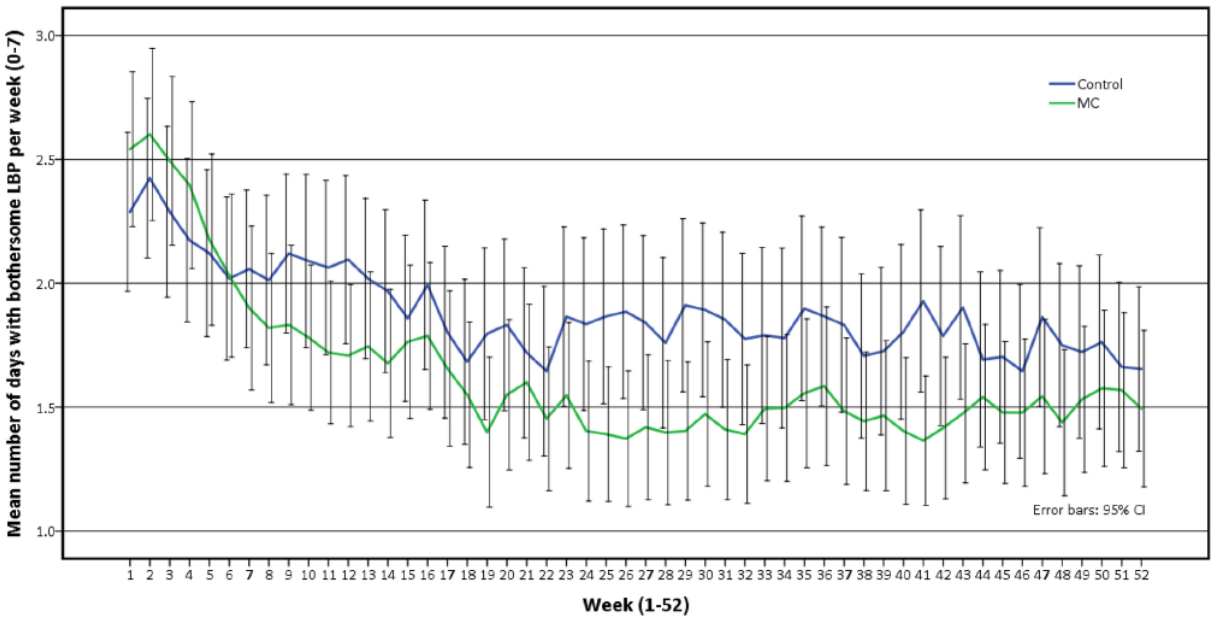


FIGURE 6: Mean number of days with bothersome LBP per week, observed data. LBP = nonspecific low back pain; MC = maintenance care; CI = 95% confidence interval.

The improvements of these benchmarks have implications for cost savings. Patients undergoing maintenance care are regarded as having a single episode rather than several, bypassing having to endure a costly evaluation at each visit and saving time in the process. One study actually found that healthcare use was smallest among patients who received maintenance care from a chiropractor as opposed to those receiving care from other healthcare professionals.[24]

Thus, the legislative limit imposed by the Oregon legislature has blocked a potentially cost-saving practice by chiropractors that could extend for up to a year and requiring more than 12 visits. The shorter disability periods that have been shown for extended chiropractic care would translate to an earlier return to work, producing even more indirect cost savings that have been denied by this legislation.

VI.C. Georgia

Restrictions to access and proposed cost savings afforded by chiropractic care is dramatically shown in several years of workers' compensation benefit distributions in the state of Georgia. Since low back pain has been proposed to represent 33% of all workers' compensation costs and 16% of all workers' compensation claims,[63] it is striking to observe that chiropractic care received *less than 2%* of the workers' compensation benefits paid out from 2003-2008. Physical therapists, on the other hand, received 16-22% of those reimbursements (Table 13).[64, 65]

Table 13: Workers' Compensation Benefits Paid in Georgia for Low Back Pain by Provider

s	2003	2004	2005	2006	2007	2008
A = Chiropractor	581,687	$184,654	$793,589	$4,484,855	$7,583,844	$4,241,274
A/B (%)	**0.8**	**1.0**	**0.6**	**1.2**	**1.8**	**1.3**
B = Physician	$71,025,150	&18,786,118	$130,307,360	$362,446,563	$399,633,913	$334,813,733
	1.000	1.000	1.000	1.000	1.000	1.000
C = Physical Therapist	$15,669,193	$4,087,587	$20,198,688	$56,028,827	$65,088,871	$55,078,650
C/B	22.1	21.8	15.5	15.5	16.3	16.5
TOTAL	$87,276,030	$21,199,517	$872,657,620	$2,444,883,292	$2,763,214,938	$2,356,984,700

Reasons for this restriction are unclear, but there is no question that potential cost savings have been squandered with this grossly skewed distribution of benefits to providers.

VI.D New Jersey

A comparison of benchmarks of workers' compensatin distributions across 16 states conducted by the Workers' Compensation Research Institute in 2012 revealed a striking statistic in which New Jersey was an outlier: the expenses for medical management services (bill review, utilization review, provider network fees) were among the highest. [66] These findings suggest that the

administrative workings of HMOs and private insurers were a primary driver on which a report limiting access to chiropractic services--the Oregon Practices and Procedures[67]-- was based.

►In a comparison of administrative costs of health insurers mixed in with employers' health benefits programs, hospitals, practitioners' offices, nursing homes, and home care agencies in 1999, Woolhandler and Himmelstein found that the costs per capita in the U.S. was $1,059, representing 31.0% of healthcare expenditures. The largest share of the costs were in the administrative costs of practitioners, hospital administration, and insurance overhead. In Canada, by contrast, the per capita cost was just $307, representing just 16.7% of healthcare expenditures.[68]

►In a much more pointed study, Himmelstein and Woolhandler concluded that "extensive research, herein reviewed, shows that for-profit health institutions provide inferior care *at inflated prices.*[69]*.*

►The U.S. experience also demonstrates that market mechanisms nurture unscrupulous medical businesses and undermine medical institutions unable or unwilling to tailor care to profitability. The commercialization of care in the United States *has driven up costs* by diverting money to profits and by funding a vast increase in management and financial bureaucracy, which now consumes 31% of total health spending." The authors actually propose that the Veterans Health Administration by contrast is by far a leader for excellence and innovation. They conclude by stating that "the poor performance of U.S. health care is directly attributable to reliance on market mechanisms and for-profit firms, and should warn other nations from this path."[69]

►Himmelstein and Woolhandler continue their critique of HMOs with a quotation of a chief architect of HMOs referring to "profitability (as)…the mandatory condition of survival"[3] which has led to investor-owned firms overtaking the charitable, public and professional bodies that had previously overseen the financing and delivery of healthcare.[69]

►To make matters worse, two major streams of government funding have found their way into private health insurance: (a) tax subsidies for private insurance totaling $188.6B in 2004 and which primarily benefit wealthy taxpayers,[70] and (b) government purchase of private insurance for public employees totaling $120.2B in 2005.[69]

►Adding yet further proof to the argument that HMOs fail to save healthcare expenditures—indeed quite the opposite—is the series of events that followed Medicare encouraging elderly people to enroll in private HMOs beginning in the mid-1980s. Beginning with a major scandal resulting in the loss of tens of millions of taxpayer dollars to a major political donor,[71] HMOs proceeded to "cherry pick" by retaining healthier-than-average seniors and "spitting out the pits"; i.e. returning sick patients and their high costs to competitors or the traditional fee-for-service Medicare program. [72-75] Other times HMOs, facing too many unprofitable patients in a particular sector, simply ceased operations in that area and dumped those patients back into Medicare, disrupting care for millions[76] and raising Medicare costs by approximately $2B.[77] and raising Medicare costs by approximately $2B.[77] The burden of administrative costs was shown to be 15% in the largest Medicare HMO[78] while just 3% in traditional Medicare.[69] This is perhaps one of the most egregious examples of how HMOs have attempted to show cost savings in healthcare by simply dumping more intensive and costly interventions into the hands of other parties.

►Even with these tactics, HMOs found themselves burdened with what they regarded as unsustainable expenses, such that they have managed to persuade the government to bail them out with the result that Medicare now actually pays private plans $77B annually, such that each of the 8M Medicare enrollees who have been switched to an HMO brings a payment 12% above that which would have been paid for comparable care in the traditional Medicare program.[79]

Additional references by Sullivan address the topic of HMOs failing to provide cost savings. Sullivan's comprehensive report provides an additional challenge to the "folklore" that HMOs or managed care plans are more efficient and cost-effective than traditional fee-for-service plans.[80]

►Bypassing for the moment whether HMOs achieve lower prices by fewer services or by extracting discounts, Sullivan instead argues that administrative costs and profit have actually driven up costs, a phenomenon that is conveniently bypassed when HMOs have attempted to demonstrate that they have driven down *medical* costs.[80]

►Sullivan also suggests that cost shifting to payers other than the HMO itself (such as workers' compensation programs and unpaid family caregivers, extracting large discounts) or selecting lower risk persons as members may have driven HMO premiums downward, having nothing to do with efficiency of managing healthcare costs overall.[80]

VII. LEADING STUDIES

VII.A. Databases from insurers and practitioners

VII.A.1. Smith, 1997[81]

A retrpective analysis of episodes constructed using 208 ICD-9-CM codes from 2 years of insurance claims data from a large population of beneficiaires in the prive fee-for-service sector was conducted. Specifically, the data were derived from fee-for-service claims information of large corporations with self-insured plans covering approximately 2M beneficiaries from the period July 1, 1988 through June 30, 1990. Medical management was represented by a medical or osteopathic physician, a hospital or medical facility, or a physical therapist. Multiple episodes of care were monitored with crossovers between provider groups at a minimum (12% for DCs, 18% for MDs). It can be seen that total insurance payments within and across episodes were markedly lower for chiropractically initiated episodes, as shown in Table 14. Chiropractic and medical patients were comparable in measures of severty, although the chiropractic cohort included a greater proportion of chronic cases. [81]

Table 14: Comparison of Chiropractic and Medical Management of Chronic, Recurrent Conditions over Two and Three Episodes of Care for Patients with Two Episodes (Second Episode any Provider). DC and MD Represent First-Contact Chiropractic or Medical Provider.

	DC Mean (SD)	MD Mean (SD)	p-value
n	311	579	
Total payment, 1st episode	635 (1559)	1272 (4233)	0.001
Total payment, 2nd episode	658 (2297)	1505 (4373)	0.000
Total payment, both episodes	1294 (3076)	2778 (6205)	0.000
Lapse (Days)	202 (139)	194 (128)	0.380

Values shown are in US dollars
SD = standadrd deviation

VII.A.2. Stano, 2002:[82]

At the observational level, a prospective, practice-based study was undertaken in 13 general medical practices and 51 chiropractic community-based clinics. A total of 2263 out of 2872 study patients had complete 1-year records of services. The data included billing records, chart audits, and provider questionaires which were assigned relative value units converted into dollar costs (1995). The mean costs associated with chiropractic patients ($214) were significantly higher for those for all medical patients ($123). Referred medical costs ($217), however, approximated those encountered by the chiropractic group. Pain (visual analog scale) and disability (Oswestry Disability Scale) results were about the same in both groups.

For medical patients, prescription drug costs were included; however, costs for patients who might have undergone surgery were *not* included. In addition, it was suspected prescription drug use determined from the charts of medical patients may have been underestimated. Considering the hospital and physician charges averaging $13,990 per claim in 1993[83] (close to the time this study was performed), and the reduction surgeries and hospitalizations afforded by chiropractic compared to medical health care described above in section V.B., ultimate cost savings would be expected to be credited to chiropractic care. In this early study, the authors recognized that more sophisticated modelling efforts were needed to properly assess long-term outcomes and costs.[82]

VII.A.3. Dagenais, 2015[84]

A comprehensive search strategy was conducted to perform a systematic literature review to compare healthcare costs for patients with any type of spine pain who received chiropractic care or care from other healthcare providers. Only studies in English between 1993 and 2015 were included. Indexed search terms and free text search terms related to chiropractic care were used as an adaptation of the Cochrane Back Review Group search strategy. Sources included the OvidSP interface for the Medline, Embase, NHS Economic Evluation Database, and Health Technology Assesment databases with additional searches conducted in the CEA registry, Index to Chiropractic Literature, and EconLit databases as well as references from previous related reivews and author files. A total of 1276 citations and 25 eligible studies were admitted. Summaries for healthcare costs were summarized for studies examing (i) private health plans, (ii) workers compensation plans, and (iii) clinical outcomes.

Within the 12 studies included in the private insurers' group, mean costs for chiropractic care were two-thirds of the costs experienced with non-chiropractors (Table 15). In 11 (92%) of those studies, costs were lower for patients whose spine pain was managed with chiropractic care. The only study in which chiropractic costs were higher was also the only study to examine costs billed by healthcare providers rather than costs allowed or paid by health plans. It is possible that at least part of the reduced costs of chiropractic services shown in the remaining 11 studies was the result of limitations by healthcare plans not necessarily as severe for other healthcare professions (primarily medical doctors).

Table 15: Cost Comparison of Chiropractic and Non-Chiropractic Care For Low Back Pain within Private Insurers' Group

Provider	# Members/Claims	Cost ($)
Chiropractic		
Range	97-36,280	264-6171
Mean	5149	2022
SD	10,222	2332
Median	1624	712

Comparator (non-chiropractic)		
Range	101-66,158	166-9958
Mean	11,456	3375
SD	18,764	3481
Median	4910	1992

SD = standard deviation

VII.A.4. Hurwitz, 2016[85]

This investigation compared the utilization and costs generated by medical doctors (MD), doctors of chiropractic (DC), and physical therapists (PT) for the treatment of low back pain in North Carolina. Low-back pain-related closed claim data from the North Carolina State Health Plan for Teachers and State Employees from 2000 to 2009, Blue Cross Blue Shield, using the *International Classification of Diseases, 9th Revision (ICD-9).* Approximately 600,000 covered beneficiaries representing state employ ees, dependents, and retirees were represented. Low back pain patients were stratified into uncomplicated low back pain (ULBP) and complicated low bak pain (CLBP) groups on the assumption that the ULBP patients were less likely to have radicular pain and would thus require fewer healthcare services. Medicare and non-North Carolina residents were excluded.

For uncomplicated low back pain (Table 16A):
1. DC-only costs were 1/3-1/9 of those for MD-only costs
2. MD-DC costs were 1/3-1/6 of those for MD-only costs.
3. MD-PT costs were 20-40% higher than those for MD-DC costs.
4. DC-Referral charges were generally 70-80% of those for MD-Referral costs.
5. MD-DC-Referral changes were generally 55-75% of those for MD-PT-Referral costs.

Table 16A: Number of Patients and Mean Total Allowed Charges per Patient for Uncomplicated Low Back Pain, by Care Pattern and Year: North Carolina State Health Plan for Teachers and State Employees, 2000-2009

	DC-Only		MD-Only		MD-DC		MD-PT	
Year	**No.**	**Costs ($)**	**No.**	**Costs ($)**	**No.**	**Costs ($)**	**MD-PT**	**Costs ($)**
2000	2398	1173	3786	608	584	1505	269	1878
2001	2896	1464	5212	769	873	1657	423	2080
2002	3258	1396	6154	740	903	1663	479	2024
2003	2943	1678	6192	847	984	1662	524	2368
2004	2866	1940	6392	895	931	1771	613	2494
2005	3072	1912	6697	923	1045	1857	694	2619
2006	3180	2051	6501	958	1081	1749	707	2226
2007	4147	1407	8448	928	884	1731	819	2000
2008	3849	1429	9140	966	883	1920	926	2174

2009	3791	1165	10,078	978	780	1667	925	1970

	DC-Referral		MD-Referral		MD-DC-Referral		MD-PT-Referral	
Year	**No.**	**Costs ($)**	**No.**	**Costs ($)**	**No.**	**Costs ($)**	**MD-PT**	**Costs ($)**
2000	408	2081	2855	2167	556	2823	425	3384
2001	557	1855	4413	2479	937	3217	731	4322
2002	541	2001	5309	2693	985	3188	842	4847
2003	531	2083	5676	2973	1021	3171	958	5199
2004	540	2623	5873	3225	1107	3503	1142	5184
2005	590	2135	6310	3164	1136	3799	1203	5438
2006	563	2488	6570	3158	1280	3514	1327	5277
2007	548	2620	6762	3055	852	3383	1288	5129
2008	539	2662	7509	3261	850	3040	1543	5548
2009	484	2424	8396	3152	719	3807	1645	5115

DC = Doctor of Chiropractic; MD = Medical Doctor

For complicated low back pain (Table 16B):
1. DC-Only costs were generally 40-60% higher than those for MD-only patients.
2. MD-DC costs were generally 40-80% higher than those for MD-PT patients.
3. DC-Referral costs were generally 40-60% of those for MD-Referral charges.
4. MD-DC-Referral costs were generally 60-80% of those for MD-PT-Referral charges.

Table 16B: Number of Patients and Mean Total Allowed Charges per Patient for Complicated Low Back Pain, by Care Pattern and Year: North Carolina State Health Plan for Teachers and State Employees, 2000-2009

	DC-Only		MD-Only		MD-DC		MD-PT	
Year	**No.**	**Costs ($)**	**No.**	**Costs ($)**	**No.**	**Costs ($)**	**MD-PT**	**Costs ($)**
2000	1020	1571	989	907	260	2759	86	1727
2001	1093	2015	1244	1225	345	2667	173	1685
2002	1230	1721	1530	1234	389	2198	160	1571
2003	1102	1898	1397	1365	391	2315	169	1751
2004	1234	2275	1473	1269	353	2331	195	1837
2005	1506	2292	1616	1490	394	2921	186	1722
2006	1591	2707	1580	1418	503	3359	221	1792
2007	2175	1888	2142	1161	406	2548	324	1620
2008	2010	1801	2213	1332	418	3219	339	1715

2009	1867	1394	2524	1398	406	2642	404	1888

DC= Doctor of Chiropractic; MD = Medical Doctor

	DC-Referral		MD-Referral		MD-DC-Referral		MD-PT-Referral	
Year	**No.**	**Costs ($)**	**No.**	**Costs ($)**	**No.**	**Costs ($)**	**MD-PT**	**Costs ($)**
2000	147	2940	1479	5125	344	4678	244	6270
2001	187	1969	2202	6087	575	4554	425	6007
2002	194	2285	2770	5187	581	4392	504	6575
2003	214	2289	2984	5837	622	4082	569	6626
2004	215	3831	3172	6222	723	5961	658	8999
2005	246	3365	3461	5961	730	5086	728	6896
2006	261	3412	3612	6120	796	5247	821	7291
2007	277	2907	3933	5785	572	5254	823	6704
2008	268	4123	4500	5892	585	4693	1010	6156
2009	267	2843	5071	6224	526	6455	1123	7725

DC = Doctor of Chiropractic; MD = Medical Doctor

The only instance in which DC costs were higher was with complicated low back pain when DC-Only was matched against MD-Only, or when MD-DC was compared to MD-PT charges.

In sum, chiropractic care alone or DC with MD care incurred significantly lower costs for ULBP than MD care with or without PT care. The finding was reversed for CLBP, but adjusted charges for both ULBP and CLBP patients were significantly lower for DC patients (Table 17A, 17B).

For ULBP, the risk-adjusted mean charges were significantly greater in all years for MD-only vs DC-only care, MD-PT vs MD-DC care, and MD-referral vs DC-referral care. The one exception was in 2007 for MD-PT vs MD-DC care. Ratios ranged from 0.24 to 0.67, indicating that total allowed charges on average were 33-76% lower for DC patients (Table 17A).

Table 17A: Risk-Adjusted Mean Total Allowed Charges Per Patient and Cost Ratios with 95% Confidence Intervals for Uncomplicated Low Back Pain Among Patients in the Middle Quartile of Risk, by Pattern of Care and Year: North Carolina State Health Plan for Teachers and State Employees, 2006-2009

Year	**2006**	**2007**	**2008**	**2009**
DC Only	156.02	232,58	435.59	474.37
MD Only	476.15	964.79	1442.42	1418.33
Cost Ratio p-value	0.33 (0.27,0.39) <0.0001	0.24 (0.21,0.27) <0.0001	0.30 (0.27,0.33) <0.0001	0.33 (0.31,0.36) <0.0001
MD-DC	228.30	669.68	787.02	995.30
MD-PT	533.62	996.22	1780.24	1752.94

Cost Ratio p-value	0.43 (0.26.70) 0.0006	0.67 (0.44,1.02) 0.0648	0.44 (0.32, 0.60) <0.0001	0.57 (0.43,0.75) <0.0001
DC-Referral	173.43	433.26	511.89	981.15
MD-Referral	407.27	730.20	1152.94	1840.50
Cost Ratio p-value	0.43 (0.26,0.71) 0.0009	0.59 (0.36,0.98) 0.043	0.44 (0.32,0.62) <0.0001	0.53 (0.40,0.71) <0.0001
MD-DC-Referral	268.74	397.18	492.72	1533.46
MD-PT-Referral	415.31	979.15	1436.56	1613.46
Cost Ratio p-value	0.65 (0.39,1.07) 0.0927	0.41 (0.24,0.68) 0.0006	0.34 (0.24,0.50) <0.0001	0.95 (0.72,1.26) 0.7212

DC = Doctor of Chiropractic; MD = Medfical Doctor

For CLBP, risk-adjusted mean charges were significantly greater for MD-only vs DC-only care, MD-PT vs MD-DC care, and MD-referral vs DC-referral care with ratios ranging from 0.21-0.50, indicating that total allowed charges on average were 50-79% lower for DC patients (Table 17B).

Table 17B: Risk-Adjusted Mean Total Allowed Charges Per Patient and Cost Ratios with 95% Confidence Intervals for Complicated Low Back Pain Among Patients in the Middle Quartile of Risk, by Pattern of Care and Year: North Carolina State Health Plan for Teachers and State Employees, 2006-2009

Year	2006	2007	2008	2009
DC Only	137.94	221.76	437.53	519.12
MD Only	646.06	1052.26	1617.60	1801.91
Cost Ratio p-value	0.21 (0.16,0.29) <0.0001	0.21 (0.17,0.26) <0.0001	0.27 (0.23,0.32) <0.0001	0.29 (0.25,0.33) <0.0001
MD-DC	285.09	562.95	513.98	925.51
MD-PT	798.86	1614.32	1913.82	1972,60
Cost Ratio p-value	0.36 (0.15,0.83) 0.0174	0.35 (0.17,0.71) 0.0039	0.27 (0.16,0.46) <0.0001	0.47 (0.32,0.69) <0.0001
DC-Referral	208.37	444.54	775.68	592.03
MD-Referral	474.34	1088.31	1549.27	2206.18
Cost Ratio p-value	0.44 (0.29,0.95) 0.0366	0.41 (0.24,0.71) 0.0015	0.50 (0.25,0.98) 0.045	0.27 (0.17,0.42) <0.0001
MD-DC-Referral	312.66	564.97	618.70	1016.51
MD-PT-Referral	474.22	920.44	1711.37	2417.64
Cost Ratio p-value	0.66 (0.31,1.41) 0.2827	0.61 (0.30,1.24) 0.1752	0.36 (0.21,0.62) 0.0003	0.42 (0.27,0.66) <0.0001

DC = Doctor of Chiropractic; MD = Medfical Doctor

VII.A.5.Hurwitz, 2016[86]

An investigation that followed the exact protocol described above but substituting uncomplicated neck pain (UNP) for uncomplicated lower back pain (UCLP) and substituting complicated neck pain (CNP) for complicated lower back pain (CLBP) delivered essentially the same results.

For uncomplicated neck pain (Table 18A):

1. MD-only costs were 10-50% of those for DC-only costs.
2. MD-DC costs were 65-85% of those for PT-only costs.
3. MD-PT costs were 80-95% of those for MD-DC costs.
4. DC-Referral charges were generally equal to MD-Referral charges, trending lower in later years.
5. MD-DC-Referral changes were generally 65-90% of those for MD-PT-Referral costs, trending lower in later years.

Table 18A: Number of Patients and Mean Total Allowed Charges per Patient for Uncomplicated Neck Pain, by Care Pattern and Year: North Carolina State Health Plan for Teachers and State Employees, 2000-2009

	DC-Only		MD-Only		MD-DC		MD-PT	
Year	**No.**	**Costs ($)**	**No.**	**Costs ($)**	**No.**	**Costs ($)**	**MD-PT**	**Costs ($)**
2000	3735	1566	1575	762	607	2876	208	2672
2001	4833	1802	2252	831	881	3188	315	2830
2002	5728	1940	2872	883	988	2933	367	2265
2003	5596	2133	2683	865	1077	3221	328	2938
2004	6106	2342	2839	919	1082	3598	433	2789
2005	6627	2410	2943	1007	1224	3848	483	3587
2006	6904	2593	2775	1015	1253	4159	497	3128
2007	6732	1861	3669	885	864	3218	509	2513
2008	4475	1873	4081	933	771	3026	563	2809
2009	2954	1407	4367	1118	541	2259	562	2287

DC = Doctor of Chiropractic; MD = Medical Doctor

	DC-Referral		MD-Referral		MD-DC-Referral		MD-PT-Referral	
Year	**No.**	**Costs ($)**	**No.**	**Costs ($)**	**No.**	**Costs ($)**	**MD-PT**	**Costs ($)**
2000	484	2966	1992	2717	505	4326	350	5374
2001	731	3343	3103	2786	819	4984	585	4936
2002	741	3246	3621	3142	953	4692	678	6247
2003	817	3419	3785	3673	1027	4966	831	6204
2004	765	3757	3900	3875	1069	5855	919	6202
2005	840	3678	4282	3903	1185	6420	968	7459
2006	761	3529	4326	4025	1277	5697	1026	7117
2007	672	3613	4381	3528	787	5175	983	6506
2008	525	3618	5098	3647	766	4874	1116	7207

2009	418	2707	5635	3558	559	4125	1208	6598

DC = Doctor of Chiropractic; MD = Medical Doctor

For Complicated neck pain (Table 18B):

1. MD-only costs were 40-80% of those for DC-only costs.
2. MD-DC costs were equivalent to those for PT-only costs.
3. MD-PT costs were 50-70% of those for MD-DC costs.
4. DC-Referral charges were 20-40% of those of MD-Referral costs.
5. MD-DC-Referral changes were generally 60-90% of those for MD-PT-Referral costs, trending lower in later years.

Table 18B: Number of Patients and Mean Total Allowed Charges per Patient for Complicated Neck Pain, by Care Pattern and Year: North Carolina State Health Plan for Teachers and State Employees, 2000-2009

	DC-Only		MD-Only		MD-DC		MD-PT	
Year	**No.**	**Costs ($)**	**No.**	**Costs ($)**	**No.**	**Costs ($)**	**MD-PT**	**Costs ($)**
2000	524	1593	285	1118	132	3046	44	1505
2001	657	1765	398	1875	192	2756	57	2735
2002	752	1750	498	1678	191	2357	80	1574
2003	653	1850	439	1540	194	2876	87	1980
2004	691	2644	469	1632	185	3532	100	1948
2005	798	2372	439	1217	214	3876	85	2176
2006	839	2624	414	1112	225	3469	88	1663
2007	1087	1984	501	1069	148	4162	100	1623
2008	1005	1930	546	1222	160	2538	109	1693
2009	823	1568	553	1318	172	1945	119	2072

DC = Doctor of Chiropractic; MD = Medical Doctor

	DC-Referral		MD-Referral		MD-DC-Referral		MD-PT-Referral	
Year	**No.**	**Costs ($)**	**No.**	**Costs ($)**	**No.**	**Costs ($)**	**MD-PT**	**Costs ($)**
2000	55	1410	804	7513	181	5962	176	8217
2001	81	2488	1200	8233	305	6546	253	7768
2002	107	2774	1399	7668	329	6995	324	9118
2003	97	2896	1535	8124	330	6877	368	8564
2004	113	3968	1532	8963	356	8973	387	8495
2005	106	3935	1666	10,368	375	9812	425	9580
2006	101	3303	1662	8594	429	6456	446	11,647
2007	135	3401	1685	8191	288	7530	403	9800

2008	119	2857	1841	10,146	291	7558	518	8873
2009	107	3485	2130	9351	258	6414	580	10,533

DC = Doctor of Chiropractic; MD = Medical Doctor

Chiropractic care alone or combined with MD care incurred appreciably fewer charges for UNP or CNP compared to MD care with or without PT care when the care included referral providers or services. However, finding was reversed when care did not include referral providers or services.

Risk adjustments took into account patient-specific factors with the potential to affect utilization and charges. These factors include age sex, primary diagnosis, comorbidities, and use of prescription drugs. The risk scores helped to define the level of difficulty associated with the treatment of a given patient.

For UNP, the risk-adjusted mean charges were significantly greater in all years (2006-2009) for MD-only vs DC-only care, MT-PT vs MD-DC care; MD-referral vs. DC-referral care, and MD-PT-referral care vs. MD-DC-referral care. The cost ratios ranged from 0.20-0.59 among UNP patients whose risk scores were between the 40th and 60th percentiles (Table 19A).

Table 19A: Risk-Adjusted Mean Total Allowed Charges Per Patient and Cost Ratios with 95% Confidence Intervals for Uncomplicated Neck Pain Among Patients in the Middle Quartile of Risk, by Pattern of Care and Year: North Carolina State Health Plan for Teachers and State Employees, 2006-2009

Year	2006	2007	2008	2009
DC Only	206.75	236.68	379.14	525.46
MD Only	673.62	1183.79	1655.53	1912.10
Cost Ratio p-value	0.31 (0.26,0.37) <0.0001	0.20 (0.17,0.23) <0.0001	0.23 (0.20,0.26) <0.0001	0.27 (0.25,0.30) <0.0001
MD-DC	218.29	518.46	424.46	799.77
MD-PT	491.88	891.31	1547.56	1517.79
Cost Ratio p-value	0.44 (0.27,0.74) 0.019	0.58 (0.37,0.92) 0.0205	0.27 (0.19,0.40) <0.0001	0.53 (0.39,0.71) <0.0001
DC-Referral	229.23	327.76	438.51	873.55
MD-Referral	545.55	929.07	1337.18	2061.66
Cost Ratio p-value	0.42 (0.27,0.64) <0.0001	0.35 (0.24,0.51) <0.0001	0.33 (0.23,0.46) <0.0001	0.42 (0.33,0.55) <0.0001
MD-DC-Referral	232.88	365.72	529.29	1234.29
MD-PT-Referral	478.55	883.57	1464.12	2089.86
Cost Ratio p-value	0.49 (0.30,0.79) 0.0035	0.41 (0.24,0.70) 0.0011	0.36 (0.25,0.53) <0.0001	0.59 (0.42,0.82) 0.0019

DC = Doctor of Chiropractic; MD = Medfical Doctor

For CNP, the risk adjusted mean charges were significantly greater in all years (2006-2009) for MD-only vs. DC-only care; MD-PT vs MD-DC care; and MD-referral vs. DC-referral care. There were no significant between-group differences in risk-adjusted mean charges for MD-PT vs MD-

Dc care in 2007 and MD-referral vs DC-referral care in 2006. With these two exceptions, cost ratios ranged from 0.16 to 0.46 among CNP patients with risk scores between the 40th and 60th percentiles (Table 19B).

Table 19B: Risk-Adjusted Mean Total Allowed Charges Per Patient and Cost Ratios with 95% Confidence Intervals for Complicated Neck Pain Among Patients in the Middle Quartile of Risk, by Pattern of Care and Year: North Carolina State Health Plan for Teachers and State Employees, 2006-2009

Year	2006	2007	2008	2009
DC Only	156.70	224.56	486.17	508.34
MD Only	624.96	926.29	1679.15	2037.34
Cost Ratio p-value	0.25 (0.15,0.43) <0.0001	0.24 (0.16,0.36) <0.0001	0.29 (0.21,0.33) <0.0001	0.25 (0.20,0.32) <0.0001
MD-DC	129.82	311.80	293.96	787.93
MD-PT	807.72	961.33	1576.24	2564.24
Cost Ratio p-value	0.16(0.04,0.69) 0.0143	0.32 (0.06,1.65) 0.1749	0.19 (0.07,0.51) 0.0012	0.31 (0.14,0.67) 0.0032
DC-Referral	921.48	385.69	680.73	662.06
MD-Referral	466.02	1361.95	1493.83	2720.48
Cost Ratio p-value	1.98 (0.39,10.01) 0.4106	0.28 (0.11,0.74) 0.0101	0.46 (0.22,0.92) 0.0298	0.24 (0.15,0.40) <0.0001
MD-DC-Referral	200.98	615.50	663.14	1206.17
MD-PT-Referral	592.34	1150.12	3544.14	2446.44
Cost Ratio p-value	0.34 (0.09,1.29) 0.1138	0.54 (0.20,1.43) 0.2129	0.19 (0.08,0.45) 0.0002	0.49(0.24,0.99) 0.0482

DC = Doctor of Chirorpactic: MD = Medical Doctor

VII.A.6. Hurwitz, 2016[87]

An investigation that followed the exact protocol described above but substituting headache for uncomplicated neck (UNP) delivered essentially the same results.

For headache (Table 20):
1. MD-only costs were 50-70% of those for DC-only costs.
2. MD-DC-only costs were equilvalent to those for PT-only costs.
3. MD-DC costs were equivalent of those for MD-PT costs.
4. DC-Referral charges were 60-75% of those for MD-Referral costs.
5. MD-PT-Referral changes were generally 75-90% of those for MD-DC-Referral costs.

Table 20: Number of Patients and Mean Total Allowed Charges per Patient for Headache, by Care Pattern and Year: North Carolina State Health Plan for Teachers and State Employees, 2000-2009

	DC-Only		MD-Only		MD-DC		MD-PT	
Year	No.	Costs ($)	No.	Costs ($)	No.	Costs ($)	MD-PT	Costs ($)

2000	292	1213	3558	850	304	1408	42	1724
2001	362	1813	4941	1077	449	1014	69	1974
2002	449	1599	5761	1201	499	2052	84	2096
2003	375	2026	5630	1189	521	1242	84	1216
2004	405	2364	5784	1222	506	1450	90	1707
2005	404	2603	6013	1238	529	1313	92	3199
2006	433	2074	6017	1271	559	1584	98	1510
2007	557	1921	7586	1012	433	1323	112	852
2008	453	1840	8334	1209	452	1531	141	1171
2009	462	1737	9126	1232	351	1522	143	1552

DC = Doctor of Chiropractic; MD = Medical Doctor

	DC-Referral		MD-Referral		MD-DC-Referral		MD-PT-Referral	
Year	**No.**	**Costs ($)**	**No.**	**Costs ($)**	**No.**	**Costs ($)**	**MD-PT**	**Costs ($)**
2000	167	1766	2405	2606	329	2734	111	2539
2001	253	1863	3658	3159	493	4656	192	2628
2002	264	1591	4566	2884	562	2870	219	2886
2003	276	1709	4666	3132	525	3135	259	3937
2004	228	2222	4937	3420	566	3248	324	3000
2005	308	3128	5460	3699	657	3512	335	3770
2006	281	2428	5491	3371	697	4093	314	2883
2007	257	2491	5311	3343	438	3915	288	2880
2008	230	1979	5977	3199	461	3132	390	3037
2009	204	1876	6325	6325	376	4255	412	3158

DC = Doctor of Chiropractic; MD = Medical Doctor

For headache, the risk-adjusted mean charges were significantly greater in all years (2006-2009) for MD-only vs DC-only care and for MT-PT vs MD-DC care with the exception of 2007 for MD-PT vs MD-DC care. The cost ratios ranged from 0.21 to 0.90 among headache patients with risk scores between the 40th and 60th percentiles. Risk-adjusted mean changes for DC with referral care and MD with referral care were statistically similar, except for the year 2009. MD-Dc care with referrals and MD-PT care with referrals also incurred statistically similar risk-adjusted mean changes except in the year 2007 (Table 21).

Table 21: Risk-Adjusted Mean Total Allowed Charges Per Patient and Cost Ratios with 95% Confidence Intervals for Headache Among Patients in the Middle Quartile of Risk, by Pattern of Care and Year: North Carolina State Health Plan for Teachers and State Employees, 2006-2009

Year	2006	2007	2008	2009
DC Only	191.22	263.03	586.57	594.15
MD Only	454.22	1246.20	1791.73	2097.38
Cost Ratio p-value	0.42 (0.27,0.66) 0.0002	0.21 (0.15,0.29) <0.0001	0.33 (0.25,0.44) <0.0001	0.28 (0.23,0.35) <0.0001
MD-DC	249.27	454.99	615.08	1807.57
MD-PT	903.14	705.09	1700.07	2013.43
Cost Ratio p-value	0.28 (0.08,1.01) 0.0523	0.65 (0.25,1.68) 0.3694	0.36 (0.17,0.77) 0.0083	0.90 (0.48,1.67) 0.7325
DC-Referral	633.58	1299.20	1505.95	3770.40
MD-Referral	550.54	987.08	1692.51	1956.04
Cost Ratio p-value	1.15 (0.51,2.60) 0.7349	1.32 (0.62,2.79) 0.4740	0.89 (0.42,1.90) 0.7625	1.93 (1.17,3.18) 0.0104
MD-DC-Referral	440.20	516.59	861.91	1860.49
MD-PT-Referral	411.38	1541.59	1361.03	1592.62
Cost Ratio p-value	1.07 (0.43,2.67) 0.8845	0.34 (0.13,0.89) 0.0276	0.63 (0.32,1.24) 0.1833	1.17 (0.61,2.25)).6415

DC = Doctor of Chiropractic; MD = Medical Doctor

VII.B. Databases from workers' compensation studies and employers

VII.B.1. Jarvis, 1997[88]

A retrospective review of approximately 5000 claims from 1986 and 5000 claims from 1989 of injured workers in the Utah Workers Compensation Fund yielded about 1000 nonsurgical back-relateed injury claims for each year. With treatment costs apparently controlled under the aupices of a preaaproval program required of the chiropractic physician but not of the medical doctor, medical costs rather than chiropractic costs escalated in the absence of price controls. These data are shown in Table 22:

Table 22: Comparison between Provider Type of Treatment Costs, Compensation Costs and Total Costs for WCFU Nonsurgical Back Injury Codes by Year

	n	Mean ($)	SD	p-value
Treatment costs				
1986				
Chiropractic	365	552.96	614.76	0.004
Medical	844	385.27	1019.69	
1989				
Chiropractic	277	619.01	521.76	NS
Medical	708	659.18	1728.69	
Compensation costs				
1986				
Chiropractic	365	75.77	546.51	0.000
Medical	844	293.81	1207.89	
1989				
Chiirorpactic	277	91.61	268.60	0.000
Medical	714	627.92	3126.25	

tal costs				
1986				
Chiropractic	365	628.73	993.24	NS
Medical	844	679.07	2052.36	
1989				
Chiropractic	277	702.91	651.92	0.001
Medical	715	1281.72	4590.51	

For the nonsurgical back related code provided by Workers Compensation Fund of Utah, compensation funds for chiropractic were significantly lower than medical for both 1986 and 1989. Chirorpactic treatment costs were lower in 1986 while total costs were lower for chiropractic in 1989. For the low back strain code 4252, all chiropractic costs were lower than medical for both years in all categories except for 1986 (data not shown).[88]

VII.B.2. Folsom, 2002[29]

A change in the Florida Workers' Compensation statute effective January 1, 1997, mandated that medically necessary remedial treatment and attendance be rendered to claimants solely through managed care. That is borne out in Figures 7A and 7B in which it is apparent that chiropractors' share of workers' compensation cases of specified low back injuries fell in consecutive years from 1994-1999 with the exception of 1996: Compared to medical doctors (MDs), osteopaths (OTs), physical theapists (PTs), or occupational therapists (OTs), the chiropractors' share was substantially lower (Figure 7B) with the greatest decrease from 1994-1999 (Table 23).

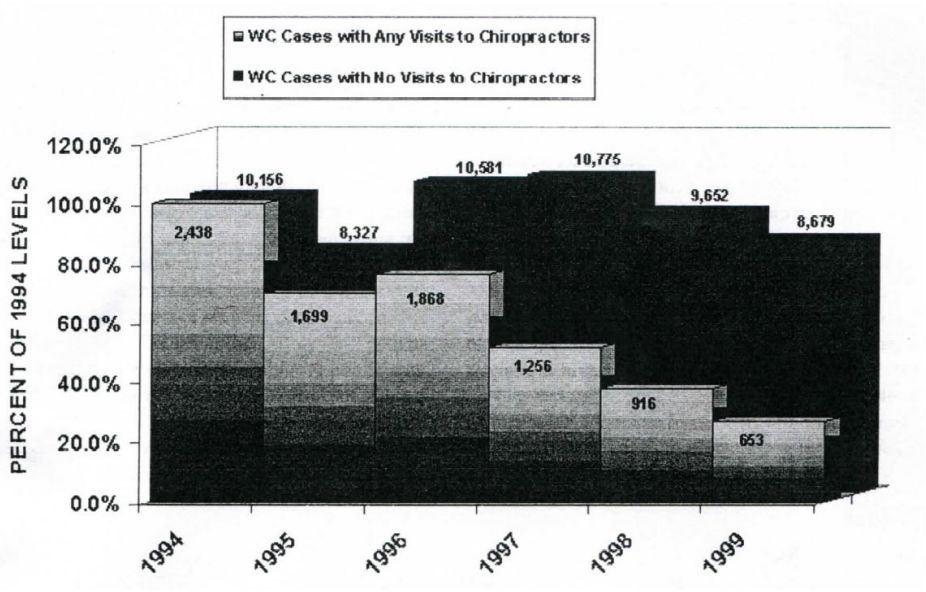


FIGURE 7A: Indexed trend of workers' compensation cases with specified lower back injuries, 1994-1999.

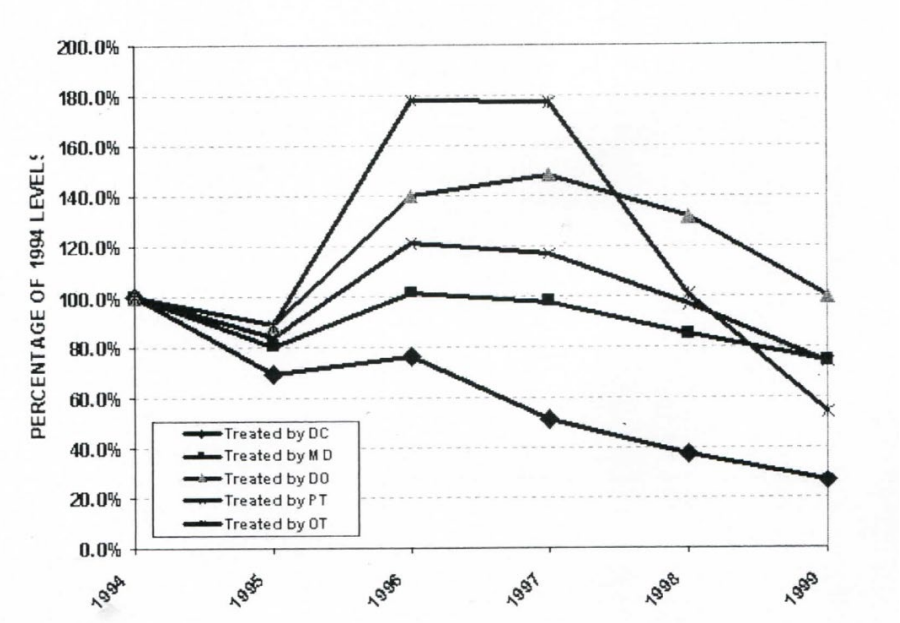


FIGURE 7B: Indexed trend of workers' compensation cases with specified lower back injuries, 1994-1999, specified by provider type.

Table 23: Absolute Trend of Workers' Compensation Cases Specified by Lower Back Injuries Specified by Use of Selected Providers, 1994-1999.

Provider type	Change from 1994-1997 (%)
Chiropractic physician (DC)	**-73.2**
Allopathic physicians (MD)	-25.8
Osteopathic physician (DO)	-0.3
Physical therapist (PT)	-26.1
Occupational therapist (OT)	-45.8

To assess whether these reductions led to a loss of cost savings, Folsom and Holloway reviewed the Florida Divison of Workers' Compensation Claims and medical file database, with specific musculoskeletal-related claims cases compared according to professional provider types and claims cost data from 1994 to 1999. A summary of comparisons between chiropractic and limited or non-chiropractic treatment of workers' compensation claims in terms of usage, costs, and outcomes revealed from 1994-1999: (i) a 219.1% reduction of claims, (ii) a 313.5% reduction of total costs per claim, (iii) a 36.5% reduction of days to maximum medical improvement, and (iv) a 70.2% reduction of the average number of days for returning to work (Figure 8). Clearly the adoption of and changes in managed care in the Florida's workers compensation system reduced access of workers to chiropractic services, and that elimination of that restriction would result in meaningful cost savings. Injury severity was not controlled.[29]

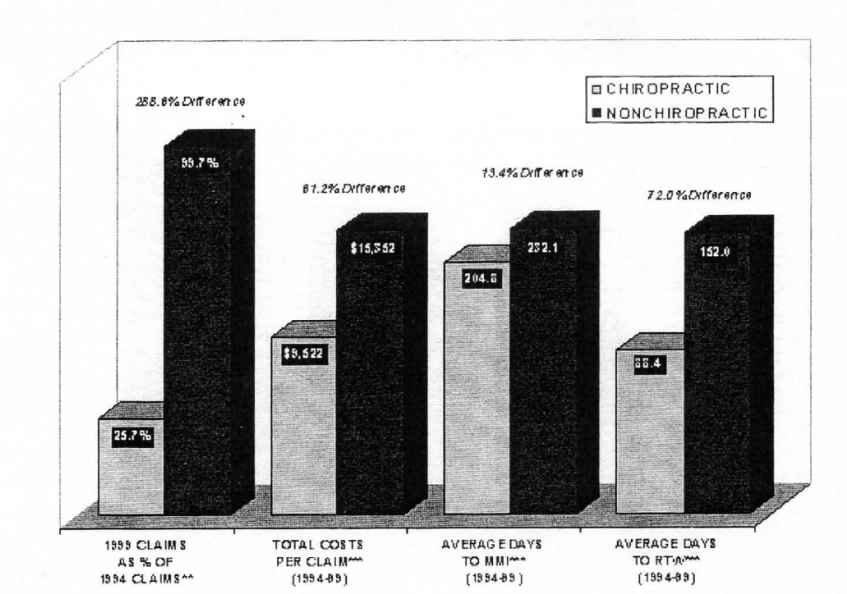


FIGURE 8: Summary of comparisons between chiropractic and limited or non-chiropractic treatment of workers' compensation claims: usage, cost, and outcomes.Chiropractic treatment was defined as specific low back cases involving ≥50% of professional feels paid to DCs; limited or nonchiropractic claims were defined as those in which <50% of professional fees went to DCs. In terms of actual savings per claim when 50% or more of the professional fees went to DCs, the savings compared to when <50% of professional fees were distributed to DCs were (a) $920 for medical payments, (b) $2295 for hospital payments, (c) $142 for rehabilitation payments, and (d) $521 for other medical payments, as shown in Figure 9:

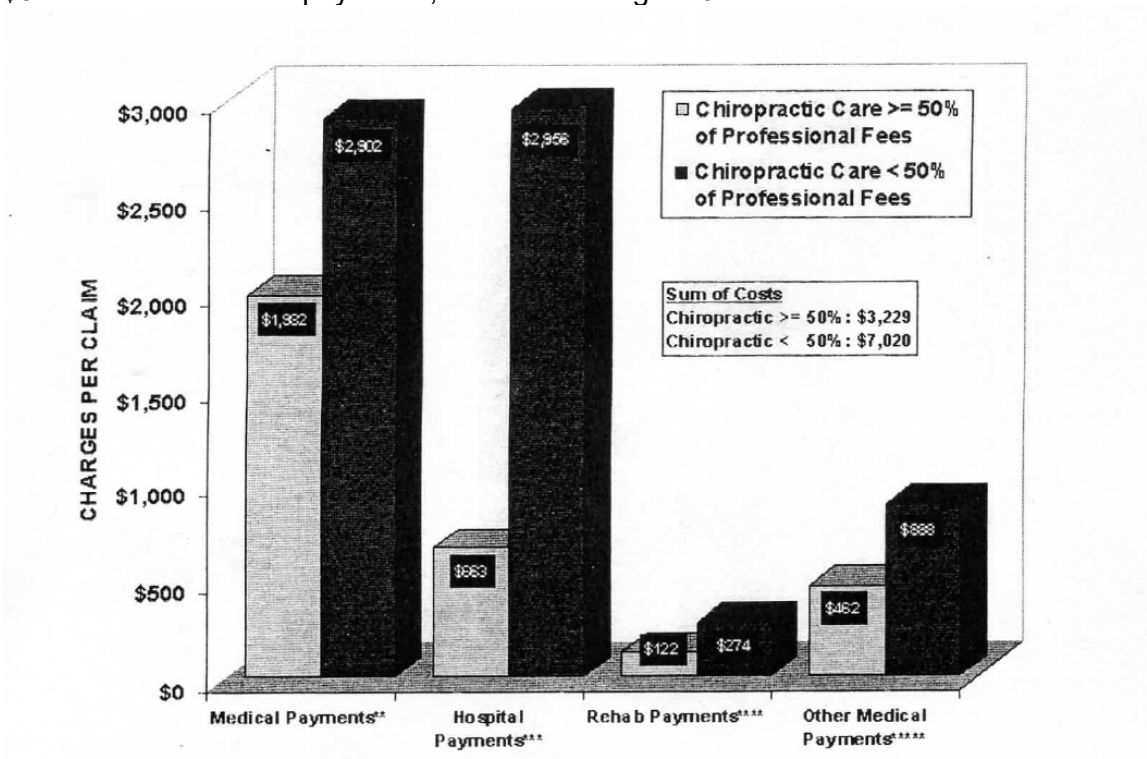


FIGURE 9: Comparison of medical costs according to 50% threshold of chiropractic involvement, representing other musculoskeleltal injuries (contusions, sprains, strains, other specific injuries, other cumulative injuries, and multiple injuries to the lower back), 1994-1999.

VII.B.3. MGT, 2003, Texas[89]

In a retrospective review of 900,000 claims from 1996, 2001, researchers sought to determine whether chiropractic was cost-effective compared to medical treatment. As in the workers' compensation claims in Georgia discussed above (IV.C.), lower back and jeck injuries accounted for 38% of all claims cost. Chiropractors treated about 30% of workers with lower back injuries bu were responsible for only 17.5% of the medical costs and 9.1% of the total costs (Figure 8). The average claim for a worker with a low-back injury was $15,884; however, if the weorker received at least 75% of care from a chiropractor, the total cost per claimant decreased by 23% to $12,202.If the chiropractor provided at least 90% of the care, the average cost fell by 52% to $7,632 (Figure 10). From these data, the study firm reached two significant conclusions: (i) chiropractors' medical costs were the lowest in the state's workers' compensation system; and (ii) chiropractic could not be blamed for the state's rising workers' compensation costs.[89]

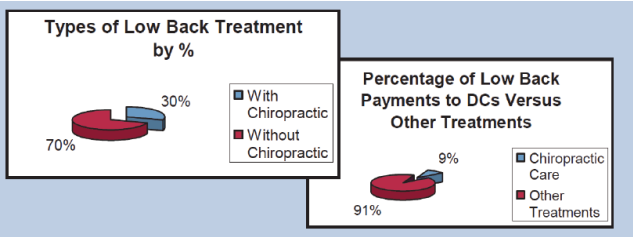


FIGURE 10: Low back treatment by chiropractor vs other providers

VII.B.4. Phelan 2004[90]

A total of 43,650 closed musculoskeletal injury claims for workers in North Carolina were included for comparison of treatment costs, lost workdays, and compensation paid workers who were treated either by medical doctors or chirorpactors. As shown by Table 24, the average number of lost workdays and combined costs were higher for patients treated by medical doctors. Combined care patients generated higher costs than patients treated by medical doctors or chiropractors alone.

Table 24: Claims, Lost Workdays, and Cost by Provider Utilization

Healthcare Provider	Lost Workdays Per Patient	MD	DC	Total Medical Cost	Compensation	Total Claim
MD Only	176	$3519				
Mean	356	$4978		$8175	$17,673	$25,848
SD				$13,623	$40,495	$48,840
DC Only						
Mean	33		$663	$756	$3318	$4074
SD	85		$433	$817	$9932	$10,250
MD and DC						
Mean	240	$4425	$748	$10,494	$23,106	$33,600
SD	390	$5704	$643	$14,676	$38,210	$47,909

DC = doctor of chiropractic; MD = medical doctor; SD= standard deviation;

With the acknowledged limitations of an insurance database, lower treatment costs, less workdays lost, and lower total claims were evident for patients treated by chirorpactors rather than medical doctors.[90]

VII.B.5.Cooper, 2007[91]

An investigative team reported the implementation of an in-house chiropractic industrial program at a large meat-packing plant in Manitonba, Canada. It entailed the early detection, treatment, prevention, and occupational management of musculoskeletal injuries 2 days each week. The program included advice on ergonomic issues, job rotation, modified duties and return to work, stretching programs, and back school. Benchmark measurements were taken during the pre-intervention period (April 2003-March 2005) and the post-intervention interval (April 2005-December 2006).

The frequency of injuries actually increased from pre- to post measurement. However:

1. Days of lost time decreased from 235.6 days per month to 134.6 days per month.
2. Workmens' compensation board data showed costs decreasing through the period:
    a. 2003: $1174.
    b. 2004: $797.
    c. 2005: $481.
    d. 2006: $677.
3. Rate premiums decreased from 5.35%-5.25% in 2004-2005 to 4.17-3.13% in 2006-2007.
4. Surgical costs recovered (saved) in the 21 months of program amounted to $900,000.

VII.B.6. Butler, 2010:[92]

Using a prospective sample of 1,831 occupational related back pain patients, Butler and Johnson applied a new method for adjusting for severity differences in the costs and benefits for treating occupational low back injuries. They combined survey data with workers' compensation claim files and medical billing information to adjust the costs and benefits of treatment using multivariate techniques. The authors emphasized the indirect cost factor—time lost from productive activities at work or in the household and losses in well-being associated with pain and restricted functionality. Combining severity data with gender, age, and limitations of physical functioning, the authors identified the patients' health capital as the defining factor which determines the comparative costs provided by healthcare providers. Under these conditions, the net benefits of treating occupational low back pain were reported as virtually identical for physician only care, physician plus physical therapy care, and chiropractic care. Net benefits of care were lower for combined physician/chiropractic care and lowest for all other forms of care (mainly, treatment by orthopaedic surgeons). Results are shown in Table 25.[92]

Table 25: Difference in Net Benefits after Adjustments for Severity and Savings in Work Loss Days

Provider type	Adjusted net benefit ($)
Physician	104,642
Physician + Physical Therapist	100,204

Chiropractor	102,457
Physician + Chiropractor	80,143
Other	46,847

Much of these collapsed differences between providers is predicated upon what the authors contend is a more rapid return to work by patients receiving treatment from physicians. Besides being at odds with the majority of other studies, it is unclear in what relative capacities the patients exhibited in the different groups in their return to work. This turns out to be major concern, for it was previously stated in section IV.B. that the vast majority (76.6%) of lost productive time has been explained by reduced performance while at work and not work absence.[30] Other studies have either indicated that adjustments were made for severity[24] or that patients seeing chirorpactors had either greater or less severity than patients under medical care.

VII.B.7. Cifuentes, 2011[24]

The disability protocol outlined above in section III.B. yielded weekly average costs of medical expenses during both the (a) health maintenance period and (b) the disability episode for patients under the care of medical doctors and/or chiropractors and/or physical therapists. Controlling for demographics and severity, costs were reduced for chiropractic care compared to that administered by physical therapists and medical doctors (Table 26).[24]

Table 26: Costs Encountered by Healthcare Provider during Health Maintenance and Disability Periods

Healthcare Provider(s)	Weekly Average Cost of Medical Expenses During Health Maintenance Period ($)	Weekly Average Cost of Medical Expenses During Disability Period ($)
During health maintenance period		
Only/mostly chiropractor	48 (9-58)	371 (179-471)
Only/mostly physical therapist	129 (13-134)	543 (287-664)
Only/mostly medical doctor	87 (6-84)	470 (245-588)
During disability period		
Only/mostly chiropractor	74 (9-64)	368 (174-473)
Only/motly physical therapist	79 (5-82)	452 (249-581)
Only/mostly medical doctor	121 (17-146)	643 (246-768(
During both periods combined		
Only/mostly chiropractor	45 (8-55)	370 (174-469)
Only/mostly physical therapist	92 (11-104)	486 (272-656)
Only/mostly medical doctor	126 (26-158)	589 (231-798)

Figures shown are mean values followed by interquartile range in parentheses.

VII.B.8. Telles, 2012[93]

For decades the non-profit Workers Compensation Research Institute has provided some of the most rigorous workers' compensation available. In its 12th CompuScope analysis, it collected data from 27 sources, including national and regional insurers, claims administration organizations, state funds, and self-insured employers. Data collected were in the Detailed Benchmark evaluation database, including over 33 million claims deemed to be reasonably representative of the 16 states analysed, including all market segments: self-insurance, residual market, voluntary insurance and state funds. For New Jersey in particular, it included 54% of indemnity claims in

2009/2010. The services used in the price utilization index values generally accounted for 80% of payments overall.

In their analysis over a 12-month period from 2009-2010 of medical payments per claim with greater than 7 days' disability:[93]

1. Only 0.1% of medical payments were received by chiropractors, 10.1% by physical therapists and occupational therapists.
2. Only 0.9% of claims were processed from chiropractors, as opposed to 50.1% by physical and occupational therapists.
3. Average costs per claim for chiropractors were 17.1% of those received by physicians.

For the claims processed, payments per claim from 2008-2009 with greater than 7 days of list time adjusted for injury and industry mix were substantially lower for chiropractors (Table 27):

Table 27: Payments per Claim in New Jersey by Provider, 2008-2009

Provider	Payment
Physicians	$5,273
Chiropractors	$1,236
Physical Therapists/ Osteopaths	$2,474
Hospitals	$7,332

VII.B.9. Telles, 2011[94]

In their analysis over a 12-month period from 2008-2009 of medical payments per claim in New Jersey with greater than 7 days' disability:[94]

1. Only 0.2% of medical payments were received by chiropractors, 10.7% by physical therapists and occupational therapists.
2. Only 1.6% of claims were processed from chiropractors, as opposed to 54.0% by physical and occupational therapists.
3. Average costs per claim for chiropractors were 23.4 of those received by physicians.

VII.B.10. Allen, 2014[95]

This study published in the Journal of Occupational and Environmental Medicine conducted an exhaustive analysis of an integrated database belonging to a large, self-insured Fortune 500 manufacturer covering claims from 2001 to 2009. It identified five patterns of care on the basis of the first 6 weeks of claims, comparing their total costs per epidode with tests that included splits by episode-type and duration, use of guidelines, and propensity-derived adjustments.

The five specific care patterns that were typical of employee experience were:

1. 59% of employees**: Information and Advice ("TalkInto")**: Information gatering, office visit consults, lab tests, imaging (X-ray, ultrasound, CT, or MRI) but no other procedures.
2. 2% of employees: **Complex Medical Management (Complex MM)**: physician visits for nerve blocks, surgeries, or comparable procedures.
3. 11% of employees: **Chiropractic (Chiro)**: More than 1 visit to a DC.

4. 11% of employees**: Physical therapy (PT)**: More than 1 visit to a PT.
5. 17% of employees: **"Dabble"**: Episodes with more than 1 visit for physician, chiropractic, or PT care or at most 1 visit to two or more of these categories.

Back pain groups were broken down into three groups based on episode duration:

1. **Low Back/Neuro**: 44% acute, 18% subacute, 38% chronic.
2. **Low Back/Nonneuro**: 61% acute, 12% subacute, 27% chronic.
3. **Other Back**: 70% acute, 13% subacute, 17% chronic.

Acute LBP indicated LBP that lasts 4 weeks or less; subacute was LBP lasting 4-12 weeks, and chronic LBP persisted longer than 12 weeks.

Of the five approaches, chiropractic was the most cost-effective in all three categories of episode duration, Complex medical care was the most expense care route, followed by physical therapy. (Table 28).

Table 28: Unadjusted Costs of Back Pain Groups

Provider	Low Back/Neuro ($)	Low Back/Nonneuro ($)	Other Back ($)
Medical Management	28.231.50	29,344.25	27,580.39
Physical Therapy	17,193.92	13,448.82	9,361.86
Dable	12,228,67	10,862.93	7,317.55
TalkInfo	11,063.41	8,882.95	8,882.95
Chiropractic	6,983.82	4,927.66	4,927.66

The study also reviewed how closely each group complied with its own clinical guideline for evaluation, diagnosis, screening, care pathways, and treatment algorithms. Compliance with these recommendations significantly lowered the overall cost of care. Chiropractors attained the highest level of guideline compliance of any group, an important response to suspicions or misinformation held by payers or providers that may have excluded or unjustly reduced payments to chiropractors.

VII.B.11. Dagenais, 2015[84]

A comprehensive search strategy was conducted to perform a systematic literature review to compare healthcare costs for patients with any type of spine pain who received chiropractic care or care from other healthcare providers. Only studies in English between 1993 and 2015 were included. Indexed search terms and free text search terms related to chiropractic care were used as an adaptation of the Cochrane Back Review Group search strategy. Sources included the OvidSP interface for the Medline, Embase, NHS Economic Evluation Database, and Health Technology Assesment databases with additional searches conducted in the CEA registry, Index to Chiropractic Literature, and EconLit databases as well as references from previous related reivews and author files. A total of 1276 citations and 25 eligible studies were admitted. Summaries for healthcare costs were summarized for studies examing (i) private health plans, (ii) workers compensation plans, and (iii) clinical outcomes.

Within the 6 studies included in the workers' compensation group, mean costs for chiropractic care were one-third of those recorded by non-chiropractic groups (Table 29). In 5 (83%) of t hose studies, healthcare costs were lower for patients receiving chiropractic care.

Table 29: Cost Comparison of Chiropractic and Non-Chiropractic Care For Low Back Pain within Workers' Compensation Group

Provider	# Members/Claims	Cost ($)
Chiropractic		
Range	54-1007	415-1296
Mean	275	817
SD	362	320
Median	166	777
Comparator (non-chiropractic)		
Range	671-10,930	264-7904
Mean	2988	2565
SD	3966	3127
Median	1605	867

SD = standard deviation

VII.B.12. Wang, 2022[20]

A comprehensive study of chiropractic care and provider patterns of physical medicine treatment for workers across 28 study states was very recently completed by the non-profit Workers Compensation Research Institute (WCRI). Claims studies were reviewed from the WCRI Detailed Benchmark/Evaluation database for injuries occurring from October 1, 2015 through September 30, 2017. Low back pain claims with or without nerve involvement were included, with red flag conditions (tumors, infectious diseases, fractures and dislocations and/or neurological neck conditions) excluded. Also excluded was a small percentage of claims receiving low back surgery and claims that had comorbid conditions with severe complications (diabetes with hypoglycaemia or ketoacidosis, substance abuse with psychotic disorders, and bipolar disorders). A statistical analysis compared utilization and costs of medical services, indemnity payments, and total disability duration between low back pain claims receiving chiropractic exclusive preventive maintenance care and non-chiropractic-only preventive maintenance care.

Out of the 28 states studied, 16 states where more than 5% of LBP claim were received by chirpractors, overall healthcare costs per claim were lower for the two chiropractic exclusive physical medicine (PM) groups compared with claims with non-chorpractic-only PM. The average medical cost per claim at $1366 when chiropractors were the only provider for PM and evaluation and maintenance (EM) services was 61% lower than for the non-chiropractic-only PM group. The average payment per claim for PM services was likely lower for PM services for the chiropractic-only PM/EM group than for the non-chiropractic-only PM group—but to a leser extent since claims with chiropractic-only PM/EM were less likely to have other medical services such as opioid prescriptions, MRI, and pain management injections. The utilization and medical costs were likely reduced for the chiropractic-only PM group for which medical providers were also involved in the EM services; however, the differences were smaller. It was also shown that the chiropractic-only PM/EM group had the lowest indemnity per claim at $492 per medical claim and also the shortest temporary disability duration at 0.7 weeks per claim since fewer workers in the chiropractic-only PM/EM group experienced lost time (Table 30)

Table 30. Descriptive Data: Outcomes for Claims Receiving Chiropractic Esclusive PM Care and Non-Chiropractic PM Care

Measure	Chiropractic-Only PM/EM[a]	Chiropractic-Only PM[b]	Non-Chiropractic – Only PM[c]	Chiropractic-Only PM/EM	Chiropractic-Only PM
Numer of claims	4569	4583	55,616		
Cost and outcomes					
Medical costs	$1366	$3001	$3522	-61%	-15%
Indemnity payments	$492	$2502	$3604	-86%	-31%
Weeks of temporary disability	0.7	3.0	4.9	-86%	-38%
Payments for PM services	$1001	$1126	$1356	-26%	-17%
Payments for non-PM medical services	$365	$1875	$2166	-83%	-13%
% received opioid prescriptions	0.8%	11%	17%	-16	-6
% received MRI	3.0%	17%	25%	-22	-8
% received pain management injections	0.2%	6%	9%	-9	-4

[a]The chiropractic-only PM/EM group includes LBP claims that received PM treatment only byc chiropractors and all the EM services were also provided by and paid for to chiropractors. This is also known as exclusive chiropractic care.
[b]The chiropractic-only PM group includes LBP claims that received PM treatment only by chiropractors, while workers in this group received E&M services by non-chiropractic providers (e.g. medical and osteopathic doctors, nurse practitioners, and physical assitants) and, in most cases, chiropractors also provided and were paid EM services.
[c]The non-chiropractic-only PM group includes LBP claims that received PM treatment only by non-chiropractic PM providers and the patients were also managed by non-chiopractic medical providers. Chiropractors were not involved in the treatmentrs.
EM = evaluation and maintenance; LBP = low back pain; MRI = magnetic resonance imaging; PM = physical medicine

In terms of demographics, workers who received chiropractir care tended to be slightly older female workers with slightly higher wages and longer tenure with their preinjury employers. A higher proportion had clerical and professional jobs or worked in a low-risk injury and less likely to involve attorneys.

Claims with combined or sequential PM care involving chiropractors were understandably more complex and had much higher costs and longer TD duration. Such claims had more diagnoses and more health therapeutic interventions leading to more health care related costs. When PM was provided in a cross-disciplinary setting (i.e. combined PM SBE-1), the average initial cost was $3499, similar to the non-chiropractic-only group ($3522). Indemnity payments and temporary disability duration were 20% lower than for the non-chiropractic-only PM group, and the percentage of those receiving opioid injections was lower (Table 31).

Table 31. Descriptive Data: Outcomes for Claims with Combined or Sequential PM Care

Measue	Combined PM SBE-1[a]	Combined PM SBE-2[a]	Combined PM[b] Non-SBE	Sequential PM[c]	Non-Chiropractic-Only PM[d]
Number of claims	4955	3458	2289	2986	55,616
% of claims	6.3%	4.4%	2.9%	3/8%	70.9%
Cost and outcomes					

Medical costs	$3499	$7519	$9877	$7395	$3522
Indemnity costs	$2867	$9001	$12,434	$8637	$3604
Weeks of temporary disability	3.9	11.6	16.0	11.2	4.9
Payments for PM services	$1143	$2683	$3976	$2487	$1356
Payments for non-PM medical services	$2356	$4836	$5899	$4909	$2166
% received opioid prescriptions	10%	21%	26%	26%	17%
% received MRI	23%	53%	60%	56%	25%
% received pain management injections	8%	21%	31%	23%	9%
Severity and comorbidity					
% with surgery	0%	0%	0%	0%	0%
% with nerve involvement	21%	40%	50%	45%	25%
% with more than 7 days of lost time	28%	51%	61%	53%	35%
% had at least 1 corbidity	2.6%	6.4%	10.l%	7.4%	4.5%
% had ≥2 cormorbidities	0.4%	1.6%	1.9%	2.1%	1.2%

[a]Included in this group are the LBP claims that had combined PM care by both chiropractors and non-chiropractors, and most or all PM services were provided by chiropractors and non-chiropractors who were affiliated with the same tax ID (referred to as same-billing entity PM providers). The subgroup SBE-1 had chiropractors and non-chiropractors providing PM services on day one, and the SBE-2 subgroup had chiropractors and non-chiropractors starting on different dates.
[b]Claims in the combined PM non-SBE group are those that received PM services by chiropractors and non-chiropractors who were affiliated with different billing entities or different health care organizations (i.e., different tax ID).
[c]Claims in the sequential PM group had PM services by chiropractors and non-chiripractors, but there was no overlapping period between chiropractic care and non-chiropractic PM care.
[d]The non-chiropractic-only PM group includes LBP claims that received PM treatment only by non-chiropractic PM providers, and the patients were also managed by non-chiropractic medical providers. Chiropractors were not involved in the treatments.
LBP = low back pain; MRI = magnetic resonance imaging; PM = physical medicine; SBE = same billing entity (for pre-PM office visitgs and initial PM).

In light of these findings, what appers to have been a misconception by employers and insurers to include chirorpactors in the delivery of workers' compensation healthcare is refuted.That hesitation may have sprung from a rapid cost growth of workers' compensation costs in the 1990s coupled with the idea that chiropractic care and physical medicine were part of the cost drivers. This appears to have been a factor in reforms in Oregon and other states that limited the utilization of such services as chiropractic care. Lacking such data as these, the misconception has continued and needs to be corralled. Recognizing these most rigorous recent data across numerous states, these restrictions turn out to be cost encumbering rather than cost-efficient and need to be lifted.

VII.C. Database from clinical studies

VII.C.1. Dagenais, 2015[84]

A comprehensive search strategy was conducted to perform a systematic literature review to compare healthcare costs for patients with any type of spine pain who received chiropractic care or care from other healthcare providers. Only studies in English between 1993 and 2015 were included. Indexed search terms and free text search terms related to chiropractic care were used

as an adaptation of the Cochrane Back Review Group search strategy. Sources included the OvidSP interface for the Medline, Embase, NHS Economic Evluation Database, and Health Technology Assesment databases with additional searches conducted in the CEA registry, Index to Chiropractic Literature, and EconLit databases as well as references from previous related reivews and author files. A total of 1276 citations and 25 eligible studies were admitted. Summaries for healthcare costs were summarized for studies examing (i) private health plans, (ii) workers compensation plans, and (iii) clinical outcomes.

The clinical studies group was comprised of 4 observational designs (comparative cohorts) and 3 randomized controlled trials. Within the 7 studies included in the clinical studies group, mean costs for chiropractic care were comparable to those reported by non-chiropractors (Table 32).

Table 32: Cost Comparison of Chiropractic and Non-Chiropractic Care For Low Back Pain in Clinical Studies

Provider	# Members	Cost ($)
Chiropractic		
Range	7-1855	214-684
Mean	857	411
SD	768	194
Median	606	429
Comparator (non-chiropractic)		
Range	13-1027	123-1285
Mean	568	474
SD	387	401
Median	739	343

SD = standard deviation

VII.C.2. Blanchette, 2016[96]

In a systematic review of the literature of studies published between 1990 and June 4, 2015, a comprehensive search strategy was conducted to identify pragmatic randomized controlled trials and/or full economic evaluations of chiropractic care for low back pain copared to standard care delivered by other healthcare providers. A total of six randomized controlled trials (RCTs) and 3 full economic evaluations were deemed scientifically admissible. Three of the RCTs compared chiropractic care to physical therapy and one apiece comparing chiropractic care to medical care and exercise therapy. Adult patients aged 18 years and older with nonspecific LBP with or without sciatica of any duration were eligible for inclusion. Studies investigating chiropractic care combined with care delivered by other healthcare providers were excluded.

Primary outcomes included:

1. Pain (visual analog scale, numerical rating scale, McGill pain score).
2. Functional status (Roland-Morris questionnaire, Oswestry Disability Index).
3. Global improvement (proportion of patients recovered).

Secondary outcomes included:

1. Health related quality of life (SF-36, EuroQol).
2. Return to work (number of days to return to work, proportion of patients at work).
3. Adverse events.

The economic review entailed an incremental measure of the extra cost needed to improve an additional unit of outcome (e.g. incremental cost-effectiveness ratio [ICER] or an incremental net benefit measure) with the exception of cost-minimizatin studies for which only costs were considered.

Functional status at one month favored chiropractic but were inconclusive at 3 and 12 months. Only three studies were included in the economic analysis with mixed evidence as to which intervention was cost-effective.

VII.C.3. Lin, 2011[97]

A search of clinical and economic electronic databases together with the reference list of relevant systematic review to June 1, 2010 produced a systematic review of general practitioners (MDs) for people with low back pain. Specifically the Cochrane Back Review Group's search strategy was employed to identify randomized controlled trials in LBP with cost analysis developed from search strategies used by the NHS Economic Evaluation Database. The databases earched were Medline, EMBASE, CINAHL, Cochrane Centeral Register of Controlled Trials, PsychINFO, the American Economic Association's electronic bibliography (EconLit), and the European Network of Health Economic Evluation Database. Out of an initial 2945 records retrieved through database searching, 11 studies were included out of 99 full-text articles assessed for eligibility.

From the results shown in Table 33, it was apparent that GP care alone did not appear to be the most cost-effective treatment option for low back pain. Adding spinal manipulation, exercise, or Alexander technique showed a marked improvement in incremental cost-effectiveness.

Table 33: Comparing the Incremental Cost-Effectiveness Ratio in Cost per Quality-Adjusted Life-Year Grained from Healthcare Sector's Perspective

Treatment	ICER in 2005 GBP
Usual GP care + exercise and behavioral counseling	2847
Guideline-based GP care plus spinal manipulation and exercise	4058
Acupuncture	4415
Guideline-based GP care plus spinal manipulation	5125
Exercise and education using a cognitive-behavioral approach	5136
Massage + exercise and behavioral counseling	5304
Alexander technique + exercise and behavioral counseling	5332
Alexander techniqaue	5899
Guideline-based GP + exercise	8863
Massage	-34,473[a]

GP = general practitioner; ICER = incremental cost-effective ratio
[a]More costly and less effective

VII.C.4. UK BEAM Trial Team, 2004[98, 99]

For patients consulting with low back pain, the UK BEAM Team sought to assess the cost-effectiveness of adding (i) spinal manipulation, (ii) exercise classes, or (iii) manipulation followed by exercise ("combined treatment") to (iv) "best care" in general practice. A total of 1287 participants were assessed in 181 general practices and 63 community settings for physical treatments around 14 centers across the United Kingdom.

Participants were randomized between the four interventions previously mentioned. Participants completed questionnaires, including the EQ-5D health status instrument at baseline, 3 months, and 12 months. Use of health care was recorded, including hospital stays, visits to secondary and primary care, and physical therapists both private and within the National Health Service.

Over one year, mean treatment costs relative to "best care" were:
£195 (credibility interval £85,£308) for spinal manipulation
£140 (credibility interval £3, £278 for exercise
£125 (credibility interval £21, £228 for combined treatment

All three active treatments increased participants' quality adjusted life years (QALYs) compared to best care alone. In terms of extra QALYs (incremental cost-effectiveness ratios [ICERs]:
£3800 represented the ICER of combined treatment relative to "best care" alone.
£8300 represented the ICER of exercise relative to "best care" alone.
£8700 represented the ICER of manipulation relative to combined treatment.

The conclusion was that spinal manipulation was a cost-effective addition to "best care" for back pain in general practice.

In terms of outcomes, relative to "best care" in general practice, manipulation followed by exercise achieved a moderate benefit at 3 months and a small benefit at 12 months. Spinal manipulation alone achieved a small to moderate benefit at 3 months and a small benefit at 12 months, while exercise achieved a small benefit at 3 months but not at 12 months (Table 34).[99]

Table 34: Roland-Morris Disability Questionnaire Improvements Relative To "Best Care"

Protocol	RM Improvement at 3 months	RM Improvement at 12 months
Exercise	1.4 (95% CI 0.6,2.1)	0
Manipulation	1.6 (95% CI 0.8,2.3)	1.0 (95% CI 0.2,1.8)
Manipulation followed by exercise	1.9 (95% CI 1.2,2.6)	1.3 (95% CI 0.5,2.1)

CI = confidence interval; RM = Roland-Morris Disability questionnaire

VII.C.5. Korthals-de Bos, 2003[100]

A random allocation of 183 patients with neck pain for at least two weeks was recruited by 42 general practitioners with the intent of evaluating the cost-effectiveness of physiotherapy, manual therapy, and care by a general practitioner. The participants were randomly allocated to:

1. N = 60 to manual therapy: muscular and specific mobilization, provided by 6 manual therapists.

2. N = 59 to physiotherapy: Individualized exercise therapy; additional massage and manual traction was optional, provided by 5 physiotherapists.
3. N = 64 to general practitioner, involving counselling, education, and medication.

A wide net of direct costs was cast, capturing (i) costs of care, (ii) additional visits to other healthcare providers, (iii) medications, (iv) professional home care, (v) hospitalizations, (vi) out of pocket expenses, (vii) costs of paid and unpaid help, and (viii) travel expenses. Indirect costs that were recorded included (i) loss of production owing to absenteeism from work, and (ii) days of inactivity for patients with or without a paid job.

By 26 weeks, the manual therapy group displayed more rapid improvement than the physiotherapy or general practitioner groups, but by 52 weeks the differences were negligible. In terms of cost, however, the total costs of each group were as follows:

1. 447 euros: Manual therapy.
2. 1297 euros: Physiotherapy
3. 1379 euros: General practitioner.

VII.D. Data from Medicare and Medicaid studies

VII.D.1. Davis, 2021[38]

Investigators used Medicare claims data to identify a cohort of 39,278 adult chirpractic users who relocated during 2010-14. Because of this relocation, there was a reduction of access to chiropractic care. Data from two years prior to and after relocation were used to establish baseline and post-relocation values, respectively.

The reduction of access to chiropractic care described above in IV.B produced an additional cost of $8,075 per 1000 beneficiaries on primary care and $106,892 on spine surgeries. If the effect of reduced chiropractic care were extrapolated to the entire Medicare population of 3.4 M chiropractic care users, there would be an additional 110M visits to primary care physicians producing an annual cost of $27.5M and additional 19,000 additional spine surgeries costing $363.4 M.

In this study, each individual served as his or her own control, and the resuction in access to chiropractic care after relocation acted as a proxy for loss of the chiropractic benefit. This study was considered to be among the first to utilize a rigorous methodology to review the indirect effect of access to chiropractic care on medical services use.

VII.D.2. Muse & Associates, 2001[101]

A compilation from the Centers for Medicare and Medicaid Services (CMS) analytical files from 1999 identified all Medicare beneficiaries with primary diagnoses of selected musculoskeletal dislocations and sprains/strains of joints and adjccent muscles. Benficiaries were divided into groups that were treated by chiropractors and those that were not. Out of a total of 5.8M beneficiaires studied, 1.5M (26.8%) received chiropractic care. The beneficiaires who received chiropractic care posted distinct cost savings in multiple categories (Table 35).

Table 35: Average Medicare Payments for Patients Receiving or Not Receiving Chiropractic Care

Benchmark	Receiving chiropractic care	Not receiving chiropractic care
Average Medicare payments per capita for all Medicare services	$4,426	$8,103
Average Medicare payments per capita for treatment of selected conditions	$380	$594
Average Medicare payments per claim for all Medicare services	$133	$210
Average Medicare payments per claim for treatment of selected conditions	$48	$149
Claims per capita	8.0	4.0

In addition, for selected musculoskeleltal conditions, a lower proportion of beneficiaries receving chiropractic care had fewer second encounters with a medical physician (14% vs 34%) as well as fewer third encounters with a medical physician (11% vs 20%). This was true also for the total Medicare population, in which a lower proportion of beneficiaries receiving chiropractic care had fewer second encounters with a medical physician (69% vs 80%) and fewer third encounters with a medical physician (66% vs 73%).

VII.D.3. Weeks, 2016[102]

An observational, retrospective study of Medicare fee-for-service reimbursements from 2006 to 2012 for 72,326 multiply-comorbid patients aged 66 and older with chronic LBP revealed cost savings for chiropractic care. Specifically, patient groups with 1 of 4 treatment groups were compared: (i) chiropractic manipulative treatment (CMT) alone, (ii) CMT followed by conventiaonal medical care (CMT-MED), (iii) CMT preceded by conventional medical care (MED-CMT), and (iv) conventional medical care alone (MED). Propensity score weighing was performed to address selection bias.

Patients using only CMT had the shortest back pain episodes while those who obtained CMT followed by medical care had the longest back pain episodes. Even with propensity score weighting, CMT expenditures were nearly 70% lower than spending for medical care, and if medical care either preceded or followed CMT, CMT expenditures were 60-65% lower (Table 36).

In sum, older multiply-comorbid patients using only CMT during the chronic LBP episodes had lower overall costs of care, shorter episodes, and lower cost of care per episode day than patients in the other treatment groups. In addition, costs of care for the episode and per episode day were reduced for patients who combined CMT with conventional medical care than for patients who did not use any CMT. These findings supported the initial CMT use in the treatment of, and possibly broader chiropractic management of, older multiply-comorbid LBP patients.

Table 36: Unweighted and Propensity Score Weighted Spending and Outcomes for Older Medicare Part A and B Enrolees in 2007-2012 with Chronic Low Back Pain Episodes with Multiple Comorbidities across 4 Treatment Groups

Expenditure Scenario	Data Treatment	Treatment Protocol	N	Mean Days in Episode	Total Eenditures Parts A,B ($)
Entire episode	Un-weighted	CMT	3909	298 (4.9)	3010 (144)
		MED-CMT	3563	367 (5.6)	8277 (251)

		CMT-MED	5235	481 (5.3)	8993 (216)
		MED	59,619	455 (1.5)	11,231 (71)
	Propensity score	CMT	3909	287 (2.1)	3581 (66)
		MED-CMT	3563	369 (2.4)	8721 (105)
		CMT-MED	5235	486 (2.8)	10,271 (113)
		MED	59,619	454 (2.7)	11,039 (117)
Per episode day	Un-weighted	CMT			10.10 (0.50)
		CMT-MED			22.57 (0.70)
		MED-CMT			18.69 (0.46)
		MED			24.69 (0.16)
	Propensity score	CMT			12.50 (0.22)
		CMT-MED			23.64 (0.28)
		MED-CMT			21.13 (0.23)
		MED			24.32 (0.25)

SD= standard deviation; CMT = chiropractic manipulative therapy; CMT-MED = chiropractic manipulative therapy followed by conventional medical treatment; MED-CMT = chiropractic manipulative therapy preceded by conventional medical treatment; MED = conventional medical treatment

VII.D.4. Whedon, 2013[103]

In an analysis of 5.0-5.4M Medicare beneficiaries aged 65-99 who used chiropractic spinal manipulation years from 2002-2008, Whedon determined that annual paymens ranged from $420-$514M. This represented less than one tenth of 1% of overall Medicare expenditures—hardly what one could consider a significant cost burden.

VII.D.5. McGowan, 2019[104]

Researchers applied a dynamic scoring model, incorporating what they believed were the most reliable cost-saving assumptions after a literature review on the efficiency and effectiveness of chiropractic-adelivered care. Avoidance of spinal surgeries and opioid use added reductions to a measure of cost savings from adding chiropractic care as an alternative therapy in the management of neck and back pain.

The static scoring approach to evaluate proposals to cover chiropractic care under Missouri Medicaid was deemed flawed, since it only considered added costs from a legislative change which involves additional costs. Based on the authors' assumptions and the dynamic scoring model, the authors concluded that there would be a cost savings to the state of Missouri from $14.1M to $49.2M once chiiropractors were included as covered providers under Missouri Medicaid. Reduced use and abuse of opioid prescription drugs alone was estimated to produce $25M in savings.

VII.D.6. Whedon, 2021[105]

This study was designed to compare Medicare healthcare expenditures for chronic low back pain patients who received long-term treatment with either opioid analgesic therapy (OAT) or spinal manipulative therapy (SMT). Specifically, Medicare beneficiaries enrolled under Medicare Parts A, B, and D from 2012 through 2016 and alive on December 31, 2016 participated with an episode of chronic low back pain beginning on a date of service in 2013 and defined as occurring with the recording of 2 paid claims with primary diagnosis of LBP at least 90 days but less than 180 days apart.

Long-term management of SMT involved 12 or more office visits for spinal manipulation for LBP in any 12-month period, including at least 1 visit per month. Long-term management by OAT was 6 or more standard 30-day supply prescription fills in a 12-month period. Allowed charges—the dollar amount set by Medicare as payment in full, which typically includes patient cost-sharing) and payments (the amounts reimbursed by Medicare) were analysed. Fee-for-service charges and payment data for outpatient, inpatient, and pharmacy claims were studied. The actual comparisons of costs were done using propensity score methods in combination with multivariable regression, a doubly robust approach.

The overall study sample was 28,160 participants, two-thirds of whom were 74 years or younger. Three-quarters (77%) of these undertook OAT care with the remainder (23%) receiving SMT. A greater proption of participants who received OAT were of lower socioeconomic status with comorbidity scores trender higher.

The adult participants aged 65 to 84 who initiated long-term treatment for chronic LBP with SMT experienced lower long-term overall health care costs under Medicare compared with patients who initiated long-term treatment via OAT. However, the reverse was true for long-term costs specifically for clinical care of chronic low back pain (Table 37). It was proposed that the long-term *overall* cost increase of OAT treatment may have been associated with complications associated with opioid use. Relatively few patients crossed over (3% from OAT to SMT, 5% from SMT to OAT). Although these data may appear to have conflicted with the per-episode data of the Weeks study,[102] the comparison was restricted to opioid prescription costs only, such that when the larger perspective of total health care costs was taken into consideration, a much more costly path lay in store for those patients in the OAT cohort.

Table 37: Average Cost per Beneficiary ($), 2013-2016

	----------TOTAL----------			----------ANNUAL----------			
Cost Measure	**SMT**	**OAT**	**OAT-SMT**	**SMT**	**OAT**	**OAT-SMT**	**OAT-SMT (%)**
LOW BACK PAIN							
Allowed charges	11,133	4627	-6506	2783	1157	-1626	-58
Medicare payment	8155	3462	-4693	2039	866	-1173	-58
OVERALL							
Allowed charges Part A	46,704	117,827	+71,123	11,676	29,457	+17,781	+152
Allowed charges Part B	47,030	71,243	+24,213	11,758	17,811	+6053	+51
Beneficiary cost Share D	2494	2864	+370	624	716	+92	+15
Payments Part A	12,337	28.054	+15,717	3084	7014	+3930	+127

Payments Part B	36,812	57,740	+20,928	9203	14,435	+5232	+57
Payments Part D	6386	14,263	+7877	1597	3566	+1969	+123

OAT = participants who initiated OAT in 2013 for long-term management; SMT = participants who initiated SMT in 2013 for long-term management

VII.E. Economist's projection of cost-effectiveness of chiropractic expansion[106]

Pran Manga, a leading economist and Professor emeritus in Health Economics at the University of Ottawa, described what was a state of high user fees for chiropractic care in the province of Ontario in 1998. He proposed improved access to chiropractic services through enhanced coverge under the Ontario Health Insurance Plan (OHIP); essentially, that OHIP would cover 75% of the fee per visit and 100% for the elderly and poor. The sum required for this initiative was projected to be $200M by the third year of its implementation in 2000.

The reform would result in the doubling of the public utilization of chiropractic services from 10% to 20% and that patients would report to chiropractors earlier with their problems. Because of the high user fee in 1998, 4 out of 5 chiropractic patients were on record as having had their disorders for over 6 months, already having had extensive medical diagnosis and treatment.

The expenditure to improve access to chiropractic services and changed utilization patterns that it would produce was projected to save $548M ($380M-$770M) in direct costs. Corresponding savings in indirect costs made up of the short and long term costs of disability were projected to range from $1.225M to $3.775B. Reasons for expecting such substantial savings included:

1. Approximately 95% of chiropractic practice in Ontario involved the management of patients with neuromusculoskeleltal disorders and injuries.
2. Musculskeletal disorders and injuries were the second and third most costly categories of health problems in economic burden of illness studies. Muscuoskeleltal disorders were also among the primary reasons for activity limitations and short-term disability, ranking first in chronic health problems and first as a cause of long-term disability.
3. Musculoskeletal disorders ranked first as a reason for consultation with a health professional in Ontario and second as a reason for the use of prescription and non-prescription drugs.
4. Poor and lower middle-income groups and the elderly were low users of chirorpatic mainly due to the deterrent effect of high copayments and user fees. Yet the prevalence of neuromusculoskeletal conditions was highest among these socioeconomic groups.
5. Considerable empirical support existed for the cost-effectiveness and safety of chiropractic management of musculoskeleltal disorders. Indeed, Manga had already concluded 5 years previously that:[107]

> There is an overwhelming body of evidence indicating that chiropractic management of low-back pain is more cost-effective than medical management…The lack of any convincing argument or evidence to the contrary must be noted and is significant to us in forming our conclusions and recommendations. The evidence includes studies showing lower cdhiropractic costs for the same diagnosis and episodic need for care.

IX. Refutation:

A study by Carey et al reported significantly higher healthcare costs for patients receiving chiropractic or orthopaedic care for back pain (secondary to a greater number of visits) compared to patients receving back pain care from a primary care physician in a health maintenance organizsation. Patients who received care from chiropractorsd (DCs) paid more per episode than patients who received care from primary care physicains, the excesses being 69% in u ran settings and 3% in rural settings.[15] However:

1. The costs reported were just outpatient costs rather than total costs.
2. The costs were estimated using average statewide charges for a large insurance carrier; actual payments were not tabulated with the fact that payments are often significantly less than charges, and the discounting is typically larger for chiropractors rather than medical doctors. [26]
3. Despite adjustments for sciatica and duration of pain, the study did not specifically adjust for comorbidities, severity, and type of diagnosis.
4. The data were actually drawn from a localized area in North Carolina with a very small sample.[26]

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