An Evaluation of Medical and Chiropractic Provider Utilization and Costs: Treating Injured Workers in North Carolina

Shawn P. Phelan, DC,[a] Richard C. Armstrong, DC,[b] David G. Knox, DC,[c] Michael J. Hubka, DC,[d] and Dennis A. Ainbinder, MD[e]

Abstract

Objective: To examine utilization, treatment costs, lost workdays, and compensation paid workers with musculoskeletal injuries treated by medical doctors (MDs) and doctors of chiropractic (DCs).

Design: Retrospective review of 96,627 claims between 1975 and 1994.

Results: Average cost of treatment, hospitalization, and compensation payments were higher for patients treated by MDs than for patients treated by DCs. Average number of lost workdays for patients treated by MDs was higher than for those treated by DCs. Combined care patients generated higher costs than patients treated by MDs or DCs alone.

Conclusion: These data, with the acknowledged limitations of an insurance database, indicate lower treatment costs, less workdays lost, lower compensation payments, and lower utilization of ancillary medical services for patients treated by DCs. Despite the lower cost of chiropractic management, the use of chiropractic services in North Carolina appears very low. (J Manipulative Physiol Ther 2004;27:442-8)

Key Indexing Terms: *Workers' Compensation; Rate Setting; Chiropractic; Cost; Cost Effectiveness*

Introduction

The high cost of work-related injury is well known. Exceeding the treatment costs are the costs of work-related disability.[1,2] In 1991, $25.3 billion was spent on wage loss compensation and $16.8 billion was paid for medical treatment of disabled or deceased workers.[3] Sixty percent of disability payments were attributed to only 20% of injured workers who were disabled 4 months or longer.[1] Seventy percent of treatment costs and compensation costs were attributed to 7% to 10% of the cases.[1,4] However, several authors have reported recent trends toward lower treatment and disability costs.[2,5] They attributed this decrease to an increase in high deductible self-insurance and an increase in the use of injury prevention and managed care programs.[5]

A number of attempts have been made to clarify cost-effectiveness and methods of treatment for medical doctors (MDs) and doctors of chiropractic (DCs) in the general patient population and work injury population.[6-9] These studies have varied somewhat in their conclusions. A study based in Iowa found that patients treated by MDs had more temporary total disability (TTD) and higher compensation payments compared with patients treated by DCs. However, the same study found that patients treated by DCs had higher treatment costs.[10] A study based in Utah found that patients treated by MDs had more lost workdays, higher treatment costs, and higher compensation costs, but patients treated by DCs tended to be treated for a longer period of time.[8]

A study based in Oregon found there was no significant difference in TTD for acute low back pain patients treated by MDs or DCs. However, for patients with chronic low back problems, there was a significant difference. Medical doctors' patients averaged 34.5 days TTD, whereas chiropractors' patients averaged 9.0 days TTD.[11] A follow-up study using the same Oregon database found patients treated by DCs received more treatment over a longer duration and

[a]Private practice of chiropractic, Wake Forest, NC.
[b]Private practice of chiropractic, Cary, NC.
[c]Private practice of chiropractic, Fuquay-Varina, NC.
[d]Associate Professor, Southern California University of Health Sciences, and Private practice of chiropractic, Pasadena, Calif.
[e]Private practice of chiropractic, Los Angeles, Calif.

This work was funded by a grant from the North Carolina Board of Chiropractic Examiners.

Submit requests for reprints to: Shawn Phelan, DC, 123 South White Street, Wake Forest, NC 27587 (e-mail: *spdc@aol.com*).

Paper submitted February 12, 2003; in revised form May 8, 2003.
0161-4754/$30.00

doi:10.1016/j.jmpt.2004.06.002

Table I. *Claims, lost workdays, and cost by provider utilization*

Provider use (number of claims)		Lost workdays per patient	Costs per patient ($)						
			MD	DC	Hospital inpatient	Hospital outpatient	Total medical cost	Compensation	Total claim
MD Only	Mean	176	3519	–	2438	2217	8175	17,673	25,848
(37,290)	SD	356	4978	–	7650	3993	13,623	40,495	48,840
DC Only	Mean	33	–	663	43	51	756	3318	4074
(370)	SD	85	–	433	593	284	817	9932	10,250
MD and DC	Mean	240	4425	748	2920	2401	10,494	23,106	33,600
(2155)	SD	390	5704	643	7537	3891	14,676	38,210	47,909
None	Mean	133	–	–	3892	763	4655	17,086	21,741
(3835)	SD	282	–	–	8934	1911	9219	39,893	42,841
Total	Mean	174	3225	43	2570	2080	7917	17,768	25,685
(43,650)	SD	351	4891	227	7748	3860	13,357	40,210	48,183

n = 43,650.
Claims with compensation costs only purged.
MD, Medical doctor; *DC,* doctor of chiropractic.

at greater cost than those treated by MDs.[12] In contrast, still another study based in Oregon found the duration of chiropractic treatment was less than medical treatment.[6]

Chiropractic treatment costs were higher than medical doctors' treatment costs in a study from West Virginia. There was no mention of TTD or compensation payments in the West Virginia study.[13] A previous study from North Carolina found costs of care were the highest for orthopedists and DCs and lowest for primary care MDs, with no difference in outcome.[9] In a study from California, treatment costs of MDs and DCs were equal, while patients managed by DCs had less TTD.[14]

Several studies comparing medical and chiropractic care evaluated patient satisfaction, which appears to be greater for patients treated by DCs.[9,15-17] Although it is difficult to attach a monetary value on patient satisfaction, a discussion of patient satisfaction impacts perceived health care value. The perception of health care value has been described as the change in patient status plus patient satisfaction divided by the price.[18] Value continues to play a significant role in decision making by employers, carriers, policymakers, and providers. Additionally, it may be reflected in a patient's illness behavior, rate of return to work, index of disability, and tendency to litigate.

$$\frac{\text{Change in Patient Status} + \text{Patient Satisfaction}}{\text{Price}} = \text{Value}$$

The purpose of this study was to evaluate the total cost of medical and chiropractic management of injured workers in North Carolina. By design, this was a comparison study. In such studies, significant cost variation can be introduced through inclusion or exclusion of ancillary costs.[8,9,12,13] Examples of ancillary costs are surgical procedures, physical therapy, medications, supports, and hospital inpatient or outpatient care. In this study, surgical procedures were included under the category of hospital costs. All other ancillary costs have been assumed under the treatment costs and were differentiated by provider type.

Methods

Between the years 1975 and 1994, 96,627 closed injury claims were archived by the North Carolina Industrial Commission (NCIC). Before 1975, claim records were not stored on computers at the NCIC. After 1994, individual insurance carriers assumed responsibility for storing claims. The Office of Technology Services of the North Carolina Department of Commerce extracted the data. This was done by using "nature of injury" and "body part" codes from the patient's first report of injury. International Classification for Disease (ICD) codes were not included in the archives and therefore could not be used. Additional variables included lost workdays, MD treatment cost, DC cost, hospital inpatient cost, hospital outpatient cost, total medical care cost, compensation paid, and total cost of claim (Tables 1 and 2). The claim data did not show the method of provider selection by the injured worker. The data were not stratified for utilization rates; therefore, utilization trends were not identified.

Of the 96,627 total claims, 43,650 claims had values for each variable (Table 3) and thus met the selection criteria and comprised the primary study population. The remaining 52,977 claims had nature of injury or body part data but did not contain the variables in Table 3 necessary for inclusion in the study. Averages and standard deviations were calculated for all continuous variables (TTD, MD cost, DC cost, hospital inpatient cost, hospital outpatient cost, total medical cost, compensation paid, and total cost of claim) for the 43,650 claims. Frequencies and proportions

Table 2. *Lumbar/lumbosacral strains: claims, lost workdays, and cost by provider utilization*

Provider use (number of claims)		Lost workdays	Costs ($)						
			MD	DC	Hospital inpatient	Hospital outpatient	Total medical cost	Compensation	Total claim
MD Only	Mean	175	3425	–	2312	2006	7743	15,819	23,562
(9073)	SD	320	4918	–	6725	3510	12,831	30,394	38,943
DC Only	Mean	25	–	634	0	50	685	1912	2597
(181)	SD	56	–	393	0	298	503	4682	4776
MD and DC	Mean	223	4112	752	2845	2141	9850	19,596	29,446
(958)	SD	328	5370	679	7500	3185	14,146	8518	39,237
None	Mean	171	3151	75	2350	1873	7450	15,399	22,849
(899)	SD	319	4831	303	6853	3372	12,660	29,605	37,889
Total	Mean	101	–	–	2683	609	3292	9407	12,699
(11,111)	SD	311	–	–	7919	1700	8518	21,975	23,618

n = 11,111.
Claims with compensation costs only purged.
MD, Medical doctor; *DC,* doctor of chiropractic.

were calculated for all categorical variables (nature of injury and injured body part) for all 96,627 claims.

Claims were classified into 4 mutually exclusive categories: (1) users of MD services only, (2) users of DC services only, (3) users of MD and DC services, and (4) claims reflecting no use of either MD or DC services. Using these utilization categories, descriptive statistics were computed for all continuous variables by provider use. Examination of the nature of injury and part of body variables suggested investigation of a further subset of the data—lumbar spine and/or lumbosacral spine strains. Frequencies and proportions were then calculated for these data.

The findings were analyzed for statistical significance by using an Independent-Samples T Test procedure and comparing the averages or mean values for both provider groups. With regard to the Table mean values, a reader may notice standard deviations consistently higher than the mean values. This occurs because health care utilization does not usually provide data with a normal or bell shaped curve. A relatively small patient population will often use a majority of the services.[1,4] Visit rates and cost variables for these individuals are much greater than for the majority of patients. Therefore, this creates very high values for some claims over each variable.

Results

From the total number of work-related injuries (n = 96,627), 43,650 claims met the selection criteria. Of these claims, 85.4% were patients treated by MDs, whereas only 0.8% were patients treated by DCs. Patients seen by both MDs and DCs (crossovers) amounted to 4.9%. Patients treated in a hospital setting accounted for 8.8% (Table 4).

Of the 96,627 closed injury claims administered by the North Carolina Industrial Commission during the time period 1975 to1994, 49.5% were reported as strain injuries (Table 5). Of those claims with cost data that included body part injured data (40,140), 37.7% involved injuries to the low back (Table 6). This can be compared with the patient population without cost data but whose claims did include data for the body part injured (48,642). The group without cost data reported a similar rate of low back injury (35.1%) to that of the claims with cost data (Table 7). The remaining 7,845 claims included for analysis contained nature of injury reports only and did not define a body part.

The costs associated with the 43,650 claims that contained cost data were as follows: total cost of care was $1.1 billion between 1974 and 1994. Dollar values are not stratified or adjusted to current values but reflect the dollar value for the year the claim was closed. Total medical cost (both providers minus compensation payment) was $346 million and compensation (lost wages) paid to patients was $775 million. Total cumulative days lost was 7.6 million workdays (Table 1).

The average treatment cost for patients treated by MDs was $3519, whereas the average treatment cost for chiropractic patients was $663. For patients treated by both MDs and DCs, the average costs of treatment were $4425 and $748, respectively, and $5173 cumulatively. Compensation paid was $17,673 for patients treated by MDs, $3318 for patients treated by DCs, and $23,106 for patients treated by both. Hospital inpatient care and outpatient care costs for MDs were $2438 and $2217, respectively, and $4655 cumulatively. Hospital inpatient care and outpatient care costs for patients treated by DCs were $43 and $51, respectively, and $94 cumulatively. Average TTD for patients treated by MDs was 176 days, whereas for patients treated by DCs it was 33 days. For patients treated by both, the average TTD was 240 days. The average total cost of claims (including compensation) managed by MDs was $25,848; for claims managed by DCs it was $4,074; and for

Table 3. *Variable definitions*

Variable	Definition
Lost workdays	Days the injured worker spent on Total Temporary Disability
MD cost	Cost of treatment provided by medical doctors
DC cost	Cost of treatment provided by doctors of chiropractic
Hospital inpatient	Hospital admissions
Hospital outpatient	Patients treated in hospitals on an outpatient basis
Total medical	Sum of all treatment costs, including hospital
Compensation paid	Compensation paid to patients for lost work, pain, and suffering
Total cost of claim	The sum of all costs of the claim
Nature of injury	Type of injury, ie, sprain/strain
Body part	Part of body reported as injured by the worker

MD, Medical doctor; *DC,* doctor of chiropractic.

Table 4. *Utilization rates by provider type*

MD	37,290	85.4%
DC	370	0.8%
MD and DC	2155	4.9%
Managed in a hospital setting	3835	8.8%

n = 43,650.
MD, Medical doctor; *DC,* doctor of chiropractic.

Table 5. *Most prevalent presentations by nature of injury*

Nature of injury	Frequency	Percentage*
Strain	47,846	49.5
All other cumulative injuries	22,883	23.7
Dislocation	10,817	11.2
Multiple physical injuries only	6498	6.7
Inflammation	2053	2.1
Contusion	1634	1.7
Fracture	1339	1.4
Nature of injury presentations of less than 1% of n	3557	—

n = 96,627.
*Out of all 96,627 claims (no missing values).

combined cases it was $33,600 (Table 1). When restricting the analysis to low back injuries alone (Table 2), we find average values very similar to those found when analyzing the injuries in general (Table 1).

Under the low back injury category, the average costs of care were $3425 for MDs and $634 for DCs. Patients that were seen by both MDs and DCs generated average costs of $4112 and $752, respectively, and $4864 cumulatively. Compensation payments averaged $15,819 for patients treated by MDs, $1912 for patients treated by DCs, and $19,596 for patients treated by both. Hospital inpatient and outpatient costs for MDs averaged $2312 and $2006 respectively, and $4318 cumulatively. For DCs, hospital inpatient and outpatient care were $0 and $50, respectively. Average lost workdays for patients treated by MDs was 175, while for patients treated by DCs it was 25; patients treated by both yielded 223 lost days. The average total cost of claims (including compensation) managed by MDs was $23,562; for claims managed by DCs it was $2597; and for combined care it was $29,446 (Table 2).

Prevalences of presentation of 18 musculoskeletal injuries by body part were extracted from the data. These data showed the highest presentation rates for lumbar and lumbosacral injuries regardless of provider type. Comparatively, the prevalence rate for these injuries for the MDs was 35.9% and for the DCs it was 68.5% (Table 6). Prevalences of presentation of 7 musculoskeletal injuries by nature of injury were extracted from the data. Again, regardless of provider type, these data showed the highest presentation rates for strain injuries (Table 8).

When reviewing the tables, a reader may become confused by the n values, which differ from table to table. This occurs because the large number of claims (96,627) was divided into multiple subsets to explore injury prevalence and provider access patterns. The largest *set* of data is injured workers in general. This is Table 5 with an n of 96,627, titled "Most prevalent presentations by nature of injury." To be in this group, the worker filed a report of injury with the North Carolina Industrial Commission and identified a "nature of injury."

The *subsets* are composed of individuals that filed with the Industrial Commission and identified a nature of injury, but they may not have noted a specific "body part" and may not have incurred health care costs. Of course, for the purposes of this study, the most significant subsets are those with provider costs associated with them. Those without provider costs are included in tables to show injury demography.

Table 1, titled "Claims, lost workdays, and cost by provider utilization," contains the subset files with the provider costs and has an n of 43,650. Another subset is found in Table 6, titled "Most prevalent presentations for part of body involved by provider utilization." This subset contains the claims that had body part and nature of injury codes, but they may or may not have had provider cost data. The table has an n of 40,140.

Workers with a lumbar injury and provider cost data identified were further analyzed in an additional subset with an n of 11,111 in Table 2, titled "Lumbar/lumbosacral strains, claims, lost workdays, and cost by provider utilization." Finally, in Table 7, titled "Most prevalent presentations by part of body for claims without cost data," we have a subset of those claims identifying a body

Table 6. *Most prevalent presentations for part of body involved by provider utilization*

Provider use (number of claims)	Part of body	Frequency	Percent
MD (34,594)	Lower back area (lumbar and lumbosacral)	12,406	35.9
	Multiple body parts	4934	14.3
	Knee	2459	7.1
	Shoulder(s)	2382	6.9
	Hip	1865	5.4
	Wrist	1477	4.3
	Upper arm	928	2.7
	Insufficient information	869	2.5
	Elbow	826	2.4
	Neck	768	2.2
	Buttocks	738	2.1
	Upper leg	557	1.6
	Upper arm	516	1.5
	Ankle	466	1.3
	Fingers	452	1.3
	Upper extremities	393	1.1
	Trunk	384	1.1
	Hand	381	1.1
DC (356)	Lower back area (lumbar and lumbosacral)	244	68.5
	Multiple body parts	38	10.7
	Neck	15	4.2
	Shoulder(s)	13	3.7
	Trunk	8	2.2
	Upper leg	6	1.7
	Wrist	4	1.1
MD and DC (2058)	Lower back area (lumbar and lumbosacral)	1319	64.1
	Multiple body parts	344	16.7
	Neck	82	4.0
	Shoulder(s)	62	3.0
	Insufficient information	48	2.3
	Buttocks	29	1.4
	Hip	28	1.4
	Trunk	24	1.2
	Knee	22	1.1
	Upper arm	21	1.0
None (3132)	Lower back area (lumbar and lumbosacral)	1164	37.2
	Multiple body parts	454	14.5
	Hip	212	6.8
	Shoulder(s)	209	6.7
	Knee	174	5.6
	Wrist	127	4.1
	Upper arm	92	2.9
	Insufficient information	81	2.6
	Elbow	77	2.5
	Upper leg	73	2.3
	Buttocks	66	2.1
	Neck	56	1.8
	Lower arm	48	1.5
	Trunk	36	1.1
	Disk	29	0.9

n = 40,140.

Claims with compensation costs only were purged; some missing values for body part variable.

MD, Medical doctor; *DC,* doctor of chiropractic.

part injured but without any reported health care costs. The table has an n of 48,642. Table 8 contains the most prevalent presentations for nature of injury by provider utilization with an *n* of 43,650 claims. The overall analysis yielded a *P* value significant at less than .000.

Discussion

This study captures a data set from a large population of injured workers (96,627) over a relatively long period of time (19 years). The inclusion criteria retained 43,650 claims and encompassed all cost aspects of treatment. In addition to the variables discussed in the Methods section, information was captured on injury type, prevalence, and frequency of presentation for both nature of injury and body part. Additionally, the study defines specific provider utilization for the 18 separate categories of musculoskeletal conditions analyzed. The information was extracted by information technology (IT) specialists for the State of North Carolina under the auspices of the Department of Commerce. The IT specialist who designed the original archival system in 1974 designed and conducted the data extraction for this study. Biostatisticians jointly at the University of California (UCLA) and the Southern California University of Health Sciences (SCUHS) performed the analysis. The authors did not assist with either the extraction or the analysis of the data.

Although these data contain all reported injuries archived during the available 19-year time frame, there is variability to the information contained in the individual files. This may be because of changes in data entry policy, technology, or even staff. Additionally, the data captured may not contain all treated work-related injuries that occurred during this time. Treatments can be rendered without a report of injury to the North Carolina Industrial Commission. It is not the responsibility of the MD or the DC to report the injury. It is instead the responsibility of the employer and/or carrier. This eliminates the possibility of provider reporting bias for the purposes of this study. Without a report to the North Carolina Industrial Commission, the injury would not appear in the study data. Also, there were 52,997 closed claims that contained only compensation payments, because provider type had been purged. These claims were dropped from the study but would have contained additional patients for both provider types. These additional claims may have impacted the findings.

Inherent inaccuracies in insurance databases present challenges of methodology. These challenges include lack or inaccuracy of diagnostic and procedural codes, lack of control for acuity and chronicity, incomparability of groups, absence of information on prognostic indicators, insufficient outcome measures, lack of information on comorbidity, and missing data.[7,11,19-21] However, these databases are representative of defined populations treated within a defined fee

Table 7. *Most prevalent presentations by part of body involved for claims without cost data*

Part of body	Frequency	Percentage*
Lower back area (lumbar area and lumbosacral)	17,082	35.1
Multiple body parts	6751	13.9
Knee	3049	6.3
Shoulder(s)	2854	5.9
Hip	2755	5.7
Wrist	2001	4.1
Insufficient information	1894	3.9
Upper leg	1258	2.6
Upper arm	1146	2.4
Neck	1086	2.2
Buttocks	978	2.0
Elbow	968	2.0
Ankle	695	1.4
Fingers	692	1.4
Trunk	644	1.3
Lower arm	633	1.3
Disk	499	1.0
Upper extremities	435	0.9
Insufficient information	3222	6.6

n = 48,642.
*Claims identifying a body part but without costs.

Table 8. *Most prevalent presentations for nature of injury by provider utilization*

Provider use (number of claims)	Nature of injury	Frequency	Percent
MD (37,290)	Strain	19,037	51.1
	All other cumulative injuries	8334	22.3
	Dislocation	3670	9.8
	Multiple physical injuries only	2752	7.4
	Inflammation	972	2.6
	Contusion	696	1.9
	Fracture	694	1.9
DC (370)	Strain	226	61.1
	All other cumulative injuries	75	20.3
	Dislocation	34	9.2
	Multiple physical injuries only	19	5.1
	Contusion	7	1.9
	Inflammation	3	0.8
MD and DC (2155)	Strain	1264	58.7
	All other cumulative injuries	412	19.1
	Dislocation	221	10.3
	Multiple physical injuries only	164	7.6
	Contusion	39	1.8
	Fracture	15	0.7
	Inflammation	14	0.6
None (3835)	Strain	1766	46.0
	All other cumulative injuries	1100	28.7
	Dislocation	472	12.3
	Multiple physical injuries only	229	6.0
	Inflammation	62	1.6
	Contusion	47	1.2

n = 43,650.
Claims with compensation costs only purged.
MD, Medical doctor; *DC,* doctor of chiropractic.

schedule without provider bias. This results in having an excellent ability to generalize the results to a wider population. Despite the limitations, insurance databases provide a stable frame of events and remain a legitimate source for the study of utilization.[22,23]

Conclusion

This study did not elude the methodologic difficulties of previous studies. The most notable limitations are the lack of data on severity of injury and comorbidity. Management costs of injured workers in North Carolina during the years 1975 to 1994 were defined with this study. However, we cannot determine if either provider group treated the more severe or chronic musculoskeletal injuries. If inpatient and outpatient hospital costs are an indicator, then the MDs would seem to have treated the more severe and, hence, the more costly injuries. Unfortunately, this cannot be determined with the available data. Accessing the physical files of this database and manually extracting the information could show additional diagnostic information. Severity, comorbidity, acuity and chronicity, as well as patient's age and sex could then be differentiated. Prospective studies and randomized trials are needed to continue the investigation as well.[21]

The data in the state of North Carolina provide a picture, though incomplete, of utilization rates and management costs of injured workers. Given the results of this study, utilization of DCs for the treatment of injured workers is very low. There are no legislative impediments to injured workers wishing to access DCs, and the North Carolina Industrial Commission Medical Fee Schedule allows for full scope of practice reimbursement for DCs. A survey of North Carolina patients in the general population suffering acute, severe low back pain found 13% of study respondents initially sought care with a chiropractor.[17] Although a comparison of this population's utilization rates to workers' compensation rates may be inappropriate, it raises questions. A review of a Liberty Mutual Insurance nationwide workers' compensation databank showed a chiropractic utilization rate of 3%.[23] Comparing these rates with the 0.8% utilization rate of chiropractors in our North Carolina data may suggest that barriers to injured worker access to chiropractors exist in North Carolina.

The differences in provider management costs, independent of critical issues such as severity and comorbidity,

suggested by these results indicate lower treatment costs, fewer lost workdays, reduced utilization of ancillary medical services, and reduced compensation payments for patients treated by DCs. Recognizing the study limitations, if indeed the provider subsets are comparable, it seems likely that substantial savings to the workers' compensation system would be possible if chiropractic services were increased in North Carolina.

Combined care patients tended to have significantly higher costs across all categories. Unfortunately, these data do not allow us to determine why their costs were so much higher. It is possible that factors such as symptom chronicity, initial provider selection, potential litigation, or patient satisfaction caused these cost increases.

Acknowledgment

The authors thank the North Carolina Industrial Commission Chairman Mr. Buck Lattimore for arranging access to the archives and the North Carolina Board of Chiropractic Examiners for grant funding. Additionally, the authors would like to acknowledge doctors Reed Phillips and Alan Adams of the Southern California University of Health Sciences, doctors Eric Hurwitz and Frank Kohlbeck of UCLA, and Dr Marc Gottlieb, private practitioner in Raleigh, North Carolina, for their reviews and contributions.

References

1. Williams DA, Feuerstein M, Durbin D, Pezzullo J. Health care and indemnity costs across the natural history of disability in occupational low back pain. Spine 1998;23:2329-36.
2. Webster BS, Snook SH. The cost of compensable low back pain. J Occup Med 1990;32:13-5.
3. Nelson WJ. Workers' compensation: coverage, benefits and costs, 1990-91. Soc Secur Bull 1993;56:68-74.
4. Spitzer WO, Le Blank FE, Dupis M. Scientific approach to the assessment and management of activity related spinal disorders. A monograph for MDs: report of the Quebec Task Force on Spinal Disorders. Spine 1987;12:1-9.
5. Hashemi L, Webster BS, Clancy E. Trends in disability duration and cost of workers' compensation low back claims (1988-1996). J Occup Environ Med 1998;40:110-9.
6. Bergemann BW, Chichoke AJ. Cost effectiveness of MDs vs. chiropractic treatment of low-back injuries. J Manipulative Physiol Ther 1980;3:1143-7.
7. Assendelft WJ, Bouter LM. Does the goose really lay golden eggs? A metholodigical review of workmen's compensation studies. J Manipulative Physiol Ther 1993;16:161-8.
8. Jarvis KB, Phillips RB, Morris EK. Cost per case comparison of back injury claims of chiropractic versus MDs management for conditions with identical diagnostic codes. J Occup Med 1991;33:847-52.
9. Carey TS, Garrett J, Jackman A, McLaughlin C, Fryer J, Smucker DR. The outcomes and costs of care for acute low back pain among patients seen by primary care practitioners, DCs and orthopedic surgeons. N Engl J Med 1995;333:913-7.
10. Johnson MR, Schultz MK, Ferguson AC. A comparison of chiropractic, MDs and osteopathic care for work-related sprains and strains. J Manipulative Physiol Ther 1989;12:335-44.
11. Nyiendo J. Disabling low back Oregon workers' compensation claims. Part II: time loss. J Manipulative Physiol Ther 1991;14:231-9.
12. Nyiendo J. Disabling low back Oregon workers' compensation claims Part III: diagnostic and treatment procedures and associated costs. J Manipulative Physiol Ther 1991;14:287-97.
13. Greenwood JG. Work-related back and neck injury cases in West Virginia. Orthop Rev 1985;XIV:51-63.
14. Johnson WG, Baldwin ML, Butler RJ. The costs and outcomes of chiropractic and physician care for workers' compensation back claims. J Risk Insur 1999;66:185-205.
15. Deyo RA, Cherkin D, Conrad D. Cost, controversy, crisis: low back pain and the health of the public. Annu Rev Public Health 1991;12:141-56.
16. Smith M, Stano M. Costs and recurrences of chiropractic and MDs episodes of low-back care. J Manipulative Physiol Ther 1997;20:5-12.
17. Carey TS, Evans AT, Hadler NM. Acute severe low back pain. A population-based study of prevalence and care seeking. Spine 1996;21:339-44.
18. Triano JJ, Hansen DT. Chiropractic and quality care, are they mutually exclusive? J Neuromusculo Sys 1999;7:25-33.
19. Faciszewski T, Broste SK, Fardon D. Quality of data diagnoses of spinal disorders in administrative databases. A multicenter study. J Bone Joint Surg Am 1997;79:1481-8.
20. Jarvis KB, Phillips RB, Danielson D. Managed care preapproval and its effect on the cost of Utah worker compensation claims. J Manipulative Physiol Ther 1997;20:372-6.
21. Deyo RA, Taylor VM, Diehr P, Conrad D, Cherkin DC, Ciol M, et al. Analysis of automated administrative and survey databases to study patterns and outcomes of care. Spine 1994;15(Suppl 18):2083S-91S.
22. Faciszewski T. Spine update. Administrative databases in spine research. Spine 1997;22:1270-5.
23. Tacci JA, Webster BS, Hashemi L, Christiani DC. Health care utilization and referral patterns in the initial management of new-onset, uncomplicated, low back workers' compensation disability claims. J Occup Environ Med 1998;40:958-63.