Paying Doctors More: Use of Musculoskeletal Specialists and Increased Physician Pay to Decrease Workers' Compensation Costs

Steven G. Atcheson, MD
Robert L. Brunner, PhD
E. James Greenwald, MD
VaDonna G. Rivera, DC
Jacqueline C. Cox, MPA
Stanley J. Bigos, MD

Previous studies evaluating workers' compensation care systems used retrospective controls. We performed a concurrent effectiveness study comparing a WC system that used visiting musculoskeletal specialists to assist primary care physicians with a typical discounted-fee, WC, managed-care system. In the new specialist-direct system, physicians could not profit from self-referral, but were paid 35% to 69% more per patient visit than doctors in the discounted-fee clinics. All claims filed by all employees of two hotels for 2 years were examined. Patients had self-selected either a specialist-direct or a discounted-fee clinic, and the entire cost of the claim was assigned to either system of care. Claim costs were 63% lower in the specialist-direct system ($P < 0.001$). Medical costs were 45% less ($P < 0.014$), and indemnity 85% less ($P < 0.001$), in this system. Claims were closed nearly 6 months faster in the specialist-direct system ($P < 0.0001$). Indemnity claims were more common in the discounted-fee system ($P < 0.0001$). Claimant and injury characteristics were not significantly different between the systems. This new care model is a cost-effective alternative to discounted WC managed care. Discounting the services of the primary treating physician may result only in cost-shifting, not cost-saving. (J Occup Environ Med. *2001;43:672–679*)

All who seek care for a work-related injury automatically fall within the reach of one of more than 50 state and federal workers' compensation (WC) jurisdictions. The costs of occupational illnesses and injuries are very high, estimated at $171 billion in 1992.[1] This was about equal to the amounts spent treating cancer. Once in the system, employees become both patients and claimants in a contest over causation, indemnification, and final disability determination.[2] Too often, there results a protracted and expensive struggle with little discernible benefit to the injured worker.

Unlike private medical insurance, WC insurance pays all costs associated with a work-related injury or illness. The insurer provides first-dollar coverage for all medical treatments, hospitalization, drugs and therapy—the medical costs of the claim. This insurance also pays for lost work time, vocational retraining, and residual disability settlements—the indemnity costs. The indemnification process is thought to consume about 60% of total claims expenditures, far exceeding direct medical payments.[1] Nevertheless, the medical costs alone to treat an injury under WC are more than those in a non-WC setting.[3–6]

Vast pools of data that detail claim rates and costs are widely available from state and national agencies, such as the Bureau of Labor Statistics, and private organizations, such as the National Council on Compensation Insurance. Despite this wealth

From Arthritis Specialists of Northern Nevada, Reno, Nevada (Dr Atcheson); the University of Nevada School of Medicine, Reno (Dr Brunner); Reno Orthopaedic Clinic (Dr Greenwald); SpecialtyHealth Clinic, Reno (Dr Atcheson, Dr Greenwald, Dr Rivera, Ms Cox); and the University of Washington School of Medicine, Seattle (Dr Bigos).

Address correspondence to: Steven G. Atcheson, MD, Arthritis Specialists of Northern Nevada, 93 Bell Street, Reno, NV 89503.

of information, it is still unlikely that a local insurer will know what a particular claim, such as uncomplicated low back pain, *should* cost to bring to closure, given ideal circumstances.[7] Reliable benchmarks for small geographical areas do not exist because the large numbers of variables that contribute to the total claims cost are not regularly analyzed. Expenditures can be affected by changing regulations concerning compensability, the style of claims administration, the current economic climate, the degree of medical specialization, and the application of new medical technologies and procedures. A multivariate analysis by Volinn et al[8] was unable to account for most of the 15-fold variation in surgery rates for low back pain among counties in Washington state. Dembe[9] discussed how the prevailing social and political climate determines whether such illnesses as back pain and carpal tunnel syndrome are compensated through accident insurance systems. What may be compensable in one state may be deemed not work-related in another state, or even in the same jurisdiction at another time.[9]

WC claim rates and types of injury fluctuate widely from year to year.[10] For example, occupational low back pain claim rates in the United States declined by 34% between 1987 and 1995,[11] whereas disorders associated with repeated trauma tripled during the same period.[10] Since 1996, there has been a steady decline in the incidence of both workplace injuries and lost workday cases.[12,13] However, a recent survey of WC consultants reported nearly unanimous agreement that both claim rates and costs once again are on an upward cycle.[14]

Managed care involvement in WC has not been the panacea many had expected. Discounting physicians' fees has not uniformly been associated with decreased claim costs. In fact, during a time of steadily decreasing claim rates, some programs managed to increase costs.[7]

Often lost in this complex data stream is the simple truth that the treating physician has by far the most influence in determining the ultimate cost of a work-related injury. Clearly, a claim cannot even exist without a doctor's certification, and the physician must authorize all lost work time or restricted duty. Also, tests, treatments, and requests for consultation must originate with the treating doctor. Care systems that compensate physicians for referring patients for testing to facilities in which the same doctors hold a financial interest will see increased usage of those services and higher costs.[15]

A different approach to managing a WC system would restrict physician self-referral but at the same time increase the pay of the treating physicians. In 1997,[13] at least 80% of lost-work-time illnesses and injuries were musculoskeletal in nature. Because the vast majority of WC claims involve the musculoskeletal system, patients using this new system would have rapid access to musculoskeletal consultations. Our hypothesis was that such a system would decrease the costs of treating work-related injuries and illnesses.

We tested a primary care access system for WC patients that (1) substantially increased reimbursement of the treating primary care physicians, (2) provided those doctors with automatic on-site consultation by musculoskeletal specialists at no extra cost to the primary care facility, and (3) did not allow any of the physicians involved to profit from self-referral for tests and treatments. We participated in a demonstration project that compared the costs of this unique "specialist-direct" system with a discounted-fee managed care system during a 2-year test period. Other factors that would contribute to the cost and duration of a compensation claim were comparable or identical between the two primary care access systems.

Methods

Patients and Claims

All WC claims filed by the employees of two large hotel-casinos for calendar years 1995–1996 inclusive were examined. The workforce averaged 4000, with no major seasonal fluctuations. A single benefits administrator processed all claims, all of which were closed and paid in full by January 1999.

The benefits administrator provided a claim report that included patient demographics, employment history, occupational injury history, a narrative description of the injury, formal coding of the injury, and a detailed record of claims expenses. Expenses were divided among three categories: (1) medical expenses included all medical services, drugs, and devices prescribed by a physician or chiropractor; (2) indemnity expenses included all payments for lost work time and disability settlements at the time the claim was closed; and (3) administrative expenses included all legal, investigative, and related costs. Detailed payment information, including dates of service and itemized amounts for every payment and payee, was also furnished. The injury coding system categorized all injuries and illnesses three ways: (1) by type of incident (eg, slip/trip/fall, pushing/pulling); (2) by nature of injury (eg, burn/scald, laceration); and (3) by part of body (eg, back-low, hand/wrist).

Treatment Systems

The employers were self-insured, and under Nevada law were allowed to direct all injured employees to a specified panel of medical care providers. Employees were required to report all work-related illnesses and injuries to security personnel, who administered first aid and supplied the employee with a list of approved facilities at which to obtain initial medical treatment. The security officers were forbidden from recommending one treatment facility over another. The options included three

local hospital emergency departments, one general practice clinic, three chiropractors (for spine problems only), and three occupational medicine clinics. One of these clinics was staffed by primary care physicians who were assisted by two musculoskeletal specialists (Dr Greenwald, an orthopedic surgeon, and Dr Atcheson, a rheumatologist). Each specialist attended the clinic one-half day a week and could see patients with musculoskeletal problems within 3 days of the first clinic visit. We termed this the "specialist-direct" care system, which comprised the study group. The other initial treatment facilities (control group), which we termed the "discounted-fee" system, did not have musculoskeletal specialists as in-house consultants. When specialty care was required, patients were referred to an outside specialist. All referrals for any tests, treatments, or consultations outside the primary care facilities, specialist-direct or discounted-fee, had to be made to a single panel of specialists, therapists, and imaging facilities preselected by the benefits administrator. The patient flow process is diagrammed in Figure 1.

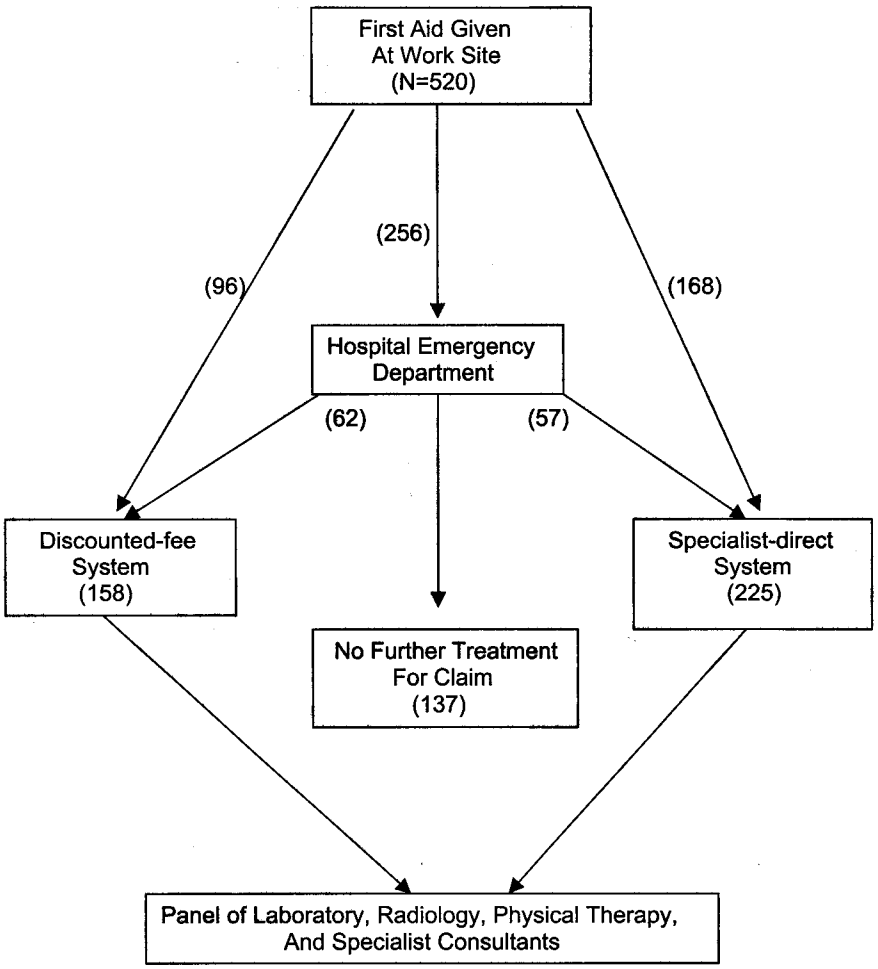

Fig. 1. Flow of patients through the treatment systems. If patients in the discounted-fee or specialist-direct system need additional tests or treatments outside a primary care clinic, they must be obtained through the same small panel of providers preselected by the claims administrator.

Assignment of Patients and Costs

Of the 549 claims that were filed, 27 closed without expenses incurred and without a record of medical treatment provided. Two more cases were excluded because the system of care was unable to be determined (total cost, $750). The 520 remaining claims were assigned to systems as shown in Figure 1. Patients received an initial medical evaluation and treatment plan in either a discounted-fee fee primary care setting or in the specialist-direct clinic system. All costs incurred for the claim—medical, indemnity and administrative—were charged to that system. At times, patients in either system were referred to musculoskeletal or other specialists for additional treatments not available in the primary care clinics. These costs were also charged to the initially assigned system. Some patients were first treated in a hospital emergency department and then sent for follow-up care. The primary care facility (discounted-fee or specialist-direct) that assumed follow-up treatment was assigned the costs of the emergency claim, as well as all further costs for the claim until closure. For 137 claims, the entire cost resulted from a single visit to a hospital emergency department, with no disability expenses accrued. These were regarded as simple first-aid–only claims and were not assigned to either of the treatment systems.

Imputed Specialist Expenses

Because the consultants attending the specialist-direct clinic were not paid during the 2-year study period, we decided to model the increased cost of their services. A fair market value was determined from our subsequent experience with this system. Each specialist was assigned a cost of $36,000 per year for one-half day attending, 50 weeks per year, which we have found to be the level of effort needed for each specialist to assist in the care of 6000 employees ($6 per employee per year or $12 per employee for the 2 years of the study). Two specialists would have met the demands of an employee

pool of 12,000. However, because the hotels studied here had 4000 employees, and the specialist-direct system was referred 58.7% of the cases seen in a primary care facility, we assumed that the specialist-direct system drew from a pool of 2350 employees.

Financial Incentives

All of the primary care practitioners in the discounted-fee clinics were paid a 15% to 20% discount from the prevailing fee schedule published by the Nevada Division of Insurance, as were all other physicians on the managed care panel. Some of these primary care facilities had in-house radiology, laboratory, and/or physical therapy suites. One clinic owned its own pharmacy service. The specific methods that may have compensated physicians for self-referral to these ancillary services were not available to us.

The primary care physicians in the specialist-direct clinic were paid on a fee-for-service basis, at 100% of the same fee schedule. In addition, the doctors were encouraged to spend more time with patients and were paid a higher fee for doing so. For example, a doctor in the discounted-fee system was paid a range of $48 to $60 for a typical new patient visit, whereas a physician in the specialist-direct system would receive $81 for the same level of service and $115 if the physician determined that a higher service level was justified. A follow-up office visit would merit $32 to $48 in the discounted-fee system, and $52 to $77 using the specialist-direct model. As a result, these physicians were paid considerably more per patient visit than their counterparts in the occupational medicine clinics that contracted with the administrator's "preferred provider" panel. However, none of the physicians in the specialist-direct clinic was allowed to receive any compensation from ordering any tests or treatments such as x-ray or physical therapy.

TABLE 1
Personal Characteristics of Claimants, and Results of Special Claim Determinations*

	System	
	Discounted-Fee (n = 158)	Specialist-Direct (n = 225)
Mean age (years)	41.3	40.3
Mean years employed at claim date	5.8	6.1
Proportion of women	55.7%	48.4%
Denied claims	21 (13.3%)	25 (11.1)
Reopened claims	9 (5.7%)	15 (6.7)

* There were no significant differences between the systems in any of these variables.

TABLE 2
Counts of the Most Common Injuries and Illnesses Reported*

	System			
	Discounted-Fee (N = 158)		Specialist-Direct (N = 225)	
Injury Category	n	%	n	%
Nature of injury				
Strain/sprain	69	43.7	80	35.6
Contusion/abrasion	36	22.8	58	25.8
Injury type				
Slip/trip/fall	49	31.0	52	23.1
Pushing/pulling	22	13.9	33	14.7
Lifting/carrying	21	13.3	37	16.4
Struck by/against	30	19.0	42	18.7
Body part				
Low back	31	19.6	40	17.8
Hand/wrist	26	16.4	26	11.6
Knee, shoulder	22	13.9	39	17.3

* There were no significant differences between the systems for any of these categories. Percentages exceed 100 because every claim was coded three separate ways (see text).

Length of Claim

In Nevada, a WC claim remains open until the claimant has achieved "maximum medical improvement," and has been declared "permanent and stationary." The length of time a claim remains open is another measure of efficiency that is affected by the medical system used. We compared the average claim duration in months for all claims and for those incurring indemnity expenses.

Statistical Analyses

Cost variables, claim length, and other continuous dependent variables were compared by one-way analysis of variance. Categorical variables (eg, injury type) were examined in cross-tabulations that generated chi-squared test statistics and odds ratios. All analyses used the Statistical Package for the Social Sciences software (Statistical Products and Service Solutions, Chicago, IL).

Results

Claimants and Claims

Table 1 details personal attributes of the claimants. There were no significant differences in the demographics between patients assigned to the specialist-direct or discounted-fee systems. The same table also shows proportions of denied claims, and those that were reopened after having been closed once. These are potentially more costly because they often incur additional legal and in-

TABLE 3
Claim Types, Proportions, and Costs

Claim Type and Component	System: Discounted-Fee (n = 158)	System: Specialist-Direct (n = 225)	p Value
All assigned claims			*
Total cost	$2,898†	$1,062	<0.001
Medical component	$1,229	$685	<0.014
Indemnity component	$1,298	$184	<0.001
Administrative component	$370	$193	*
Indemnity percentage of total cost	44.8%	17.3%	<0.001
Mean claim length	14.3 months	8.4 months	<0.0001
Medical-only claims	113 (71.5%)	199 (88.4%)	<0.0001
Total cost	$707	$550	*
Medical component	$361	$431	*
Administrative component	$346	$119	<0.06
Indemnity claims	45 (28.5%)	26 (11.6%)	<0.0001
Total cost	$8,302	$4,987	*
Medical component	$3,372	$2,635	*
Indemnity component	$4,499	$1,594	≤0.08
Administrative component	$431	$758	*
Indemnity percentage of total cost	$54.2	32.0%	≤0.05
Mean claim length	23.2 months	13.8 months	≤0.023
Total 2-year expenditures	$457,884	$238,950	NA‡
Cost per employee per year	$138.75	$56.84	

* $p \geq 0.10$.
† Dollar values are means.
‡ NA, not applicable.

vestigative expenses. The numbers of these claims did not significantly differ between the two systems.

Severity of Injury

There were no significant differences between the systems for any of the injury variables. Given the large number of possibilities (68 among the 3 categories), some were entered just a few times or not at all. Table 2 lists the most common problems encountered.

All soft-tissue claims with no major external force applied to the body (ie, those that would be commonly called "cumulative trauma," "repetitive strain," or "overuse" injuries, typically involving the spine or upper extremities) were analyzed. There were 41 (25.9%) in the discounted-fee system and 52 (23.1%) in the specialist-direct system (not a significant difference).

Overall Claim Costs

Table 3 details the mean claim costs of all 383 patients assigned to the two systems. There were statistically significant differences in total medical, indemnity, and combined costs, with the specialist-direct system nearly two-thirds less costly overall than the discounted-fee. For the calendar year immediately before the addition of the specialist-direct system, there were 264 claims opened, or 6.6 per 100 employees, compared with 6.9 per 100 during the 2 study years reported here. The 264 claims cost $648,120, or an average of $2455 per claim, using the same discounted fee model. This was not markedly different from the average discounted-fee system amount ($2898) during the 2-year study period reported here.

Medical-Only Claims

These are claims with no disability expenses incurred; the majority of all claims were medical only. By definition, the claimants received no pay for lost work time or residual disability; thus, claim costs were generally low. The specialist-direct system cost more for medical services, but less for administrative services, resulting in no significant difference between the systems.

Indemnity (Lost-Time) Claims

These made up a minority of claims in both systems but were by far the most expensive. A higher proportion of claims in the discounted-fee system incurred indemnity expenses, with an odds ratio of having an indemnity claim in this system of 1.75 (95% confidence interval, 1.39 to 2.20; $P < 0.0001$) compared with the specialist-direct system. An indemnity claim, on average, was more than $3300 more expensive in the discounted-fee system, and indemnity costs consumed 54.2% of overall lost-time claim expenditures, compared with the 32% spent using the specialist-direct model ($P < 0.05$).

Charged Specialist Expenses

At a specialist cost of $12 per employee for the 2 years of the study, we added $28,200 in administrative fees to the costs of the specialist-direct system. This increased the average claim cost by $125, bringing the total to $1187—still significantly less than the $2898 average cost using the discounted-fee system ($F = 9.87$, $P < 0.002$). These calculated costs are shown graphically in Figure 2.

We also calculated the total cost to the employer for use of these two systems of access to care. The specialist-direct clinic was responsible for 2350 employees, the other facilities for the remaining 1650 employees. The specialist-direct system cost $267,150, including the $28,200 in modeled specialist fees, or $56.84 per employee per year. The discounted-fee clinics cost $457,884 during the same period, or $138.75 per employee per year, nearly 2.5 times more expensive.

Length of Claim

The average length of time to closure for all claims was nearly 6

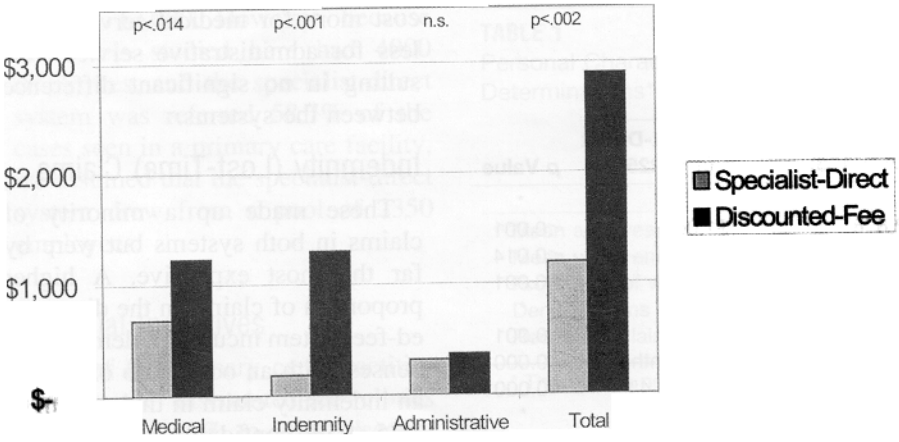

Fig. 2. Mean claim costs for all claimants assigned to the two care systems. Administrative and total claim costs for the specialist-direct system include an additional $125 per claim for musculoskeletal consulting services (see text for details).

months less in the specialist-direct system ($P < 0.0001$). Indemnity claims, always the most difficult to close, remained open a for a mean of 23.2 months in the discounted-fee system. The specialist-direct system had an average claim length of 13.8 months before closure, more than 9 months less, and also a significant difference ($P = 0.023$).

Discussion

What distinguishes this study from other published evaluations of WC costs and care is that this was a truly concurrent investigation, comparing the effectiveness of two care models applied simultaneously to the same workforce and functioning under identical regulations. Many studies have focused on cost differences between WC cases and those treated through group medical insurance.[3] Others have looked at cost differences before and after the replacement of one form of WC care with another.[16,17] Neither of these designs adequately measures or adjusts for the effects of the many factors influencing the ultimate cost of a work injury. A randomized study by Vierhaut et al[18] in the Netherlands is more relevant and cogent. It compared monthly joint consultation sessions between an orthopedist and groups of general practitioners with the usual care practices in the region. After 1 year, referrals and diagnostic interventions were significantly lower and more patients were symptom-free in the joint consultation group.

We argue that the striking differences in claim costs and length of claim mainly reflect the differences in the primary care access systems employed, and not other factors, for the following reasons: (1) all patients using either system were drawn from the same employment pool and did not differ with respect to demographic or injury variables; (2) all claims were processed and adjudicated by the same administrator, without significant differences between the systems with respect to administrative fees or rates of claim reopening and denial; (3) the 2-year study period did not differ from the prior year with respect to number of claims opened or average cost per claim within the same discounted-fee managed care model that was in effect before and during the study; and (4) both the discounted-fee and specialist-direct systems were required to use the same outside facilities for radiology, laboratory, durable medical goods, and pharmacy services (in-house facilities owned by some of the discounted-fee clinics were exempted). Specialist consultations, as well, had to be obtained from a single short list of physicians; the only difference was that twice-weekly musculoskeletal consults were available in-house to the primary care physicians only in the specialist-direct system.

We conclude that there were three variables that contributed to the outcome differences: (1) the primary care physicians in the specialist-direct system were paid much more than those in the discounted-fee system; (2) musculoskeletal specialists regularly participated in one clinic, advised the primary care physicians, and jointly treated patients; and (3) self-referral for tests or physical therapy was not allowed in the specialist-direct system. We cannot measure the portion of the variance in claim cost contributed by each factor. However, the question is not answerable because the primary care physicians would not have been paid at the higher rate without the specialists attending the clinic.

The nearly 50% difference in medical costs incurred in the specialist-direct system resulted from a reduced volume of services provided. In a comprehensive review of economic outcomes in WC, Margoshes and Webster[3] concluded that medical expenses were uniformly higher for WC cases than for similar medical problems treated under other insurance systems, and that the difference was due to increased utilization of services rather than price discrimination. In a study of referral patterns among WC physicians in California, Swedlow et al[15] found that physical therapy was initiated 2.3 times more often by physicians profiting from these services. Also, MRI scans were more likely to be medically inappropriate when ordered by a doctor with financial ties to the imaging facility.

Any reduction in indemnity costs can only result from less paid lost work time or reduced permanent disability awards at claim closure. It seems that both factors were involved in producing the 85% reduction of indemnity costs in the specialist-direct system. The proportion of indemnity claims was much

smaller in the specialist system (11.6 vs 28.5%), and indemnity costs, when they occurred, were considerably less as well ($1594 per claim versus $4499). We believe that the rapid access to musculoskeletal consultations enjoyed by the physicians in the specialist-direct clinic was a major contributor to these differences. Patients were rarely taken off work, because the specialists strongly encouraged that patients remain at work with safe restrictions. Orthopedic problems requiring more aggressive intervention than was apparent to a nonspecialist could be identified less than a week after the first patient visit to the clinic, rather than the 3- to 6-week delay to obtain a consultation that is typical for a managed care system.

The indemnity cost difference may also be explained by the treatment of soft-tissue problems involving the back and upper extremities in the specialist-direct system. Here it was emphasized to both patients and the primary care physicians that the natural history of these ailments is largely benign and there are risks associated with too much rest of the symptomatic areas. "Red flags" indicating an urgent or comorbid condition were taught in the specialist-direct clinic, modeled after approaches described for the spine, shoulder, and upper extremities.[19–24] So-called cumulative trauma disorders and overuse injuries are known to account for a markedly disproportionate share of lost work time and indemnity costs.[25–26] Soft-tissue problems usually cost much more to treat under WC than under group medical coverage, whereas straightforward injuries have much more equivalent costs.[3] We believe that this approach to managing soft-tissue injuries contributed to the reduction in both medical and indemnity costs seen in the specialist-direct system.

Some might argue that merely supplying the treating primary care physicians with appropriate musculoskeletal guidelines might be an adequate substitute for attending specialists. We disagree. First, there is scant evidence that published guidelines have resulted in important changes in either physician behavior or patient outcome.[27] Second, there is simply not enough good scientific evidence available to guide the physician in most clinical decisions.[28] We believe that the hands-on, one-on-one consultations available in the specialist-direct system provide the treating physician with an efficient source of both experience and expertise.[29]

This study fulfills almost all of the requirements[30] for an effectiveness study of disease management systems. Effectiveness studies measure performance during typical practice conditions. The sole missing criterion is that patient entry was not consecutively randomized. Here, patients were free to choose their primary care treatment clinic. Randomized allocation of patients to the different care systems would have been a violation of state regulations. Although our data indicate that there was no apparent selection bias, that is still a possibility. A second concern involves severity of injury. Others have demonstrated the difficulty of ascertaining a true clinical picture of a given injury from administrative coding data.[31–32] Our data showed no significant differences in types of injury managed by the two care systems, but there may have been important variables we could not measure.

The management system we tested was highly successful in controlling utilization and costs but is very much a population-dependent operation. Small employers cannot afford to pay what amounts to a retainer for specialists' services. Even the employers in this study, with 4000 employees, would not pay $72,000 a year for the exclusive use of two musculoskeletal specialists 1 day a week, although our data show that these clients still would have saved a considerable sum. Large WC insurers may not want to use this type of system because they already have their own in-house case management and utilization review programs. Our subsequent experience with the specialist-direct program, now in its seventh year, indicates that a single clinic requires a minimum of 12,000 contracted employees for this system to be financially viable. This is a very large number that is simply not attainable in many parts of the United States.

The high pay received by the primary care doctors in the specialist-direct clinic was ultimately insignificant in overall claim costs, which illustrates an important point: primary care physician fees are a relatively small portion of the total expenses paid for an employee's illness or injury, given that the final bill includes all tests, treatments, consultations, and indemnity payments. Yet this doctor, with nearly total control of resource utilization, is more responsible than anyone else for determining the ultimate cost of the claim. It seems irrational to mandate punitive fee discounts, which, based on our data, seem to result only in cost-shifting, not cost-saving. The system we tested demonstrated that higher fees, combined with appropriate expertise, no treatment delays, and no self-referral for profit, results in dramatic reductions in costs and unnecessary care.

Acknowledgment

We owe special thanks to Linda Atcheson, RN, BSN, for her critical review and for providing many helpful suggestions which clarified the results of this investigation.

References

1. Leigh JP, Markowitz SB, Fahs M, Shin C, Landrigan PJ. Occupational injury and illness in the United States. *Arch Intern Med.* 1997;157:1557–1568.
2. Hadler NM. Workers' compensation schemes and regional back and leg pain. In: Hadler NM. *Occupational Musculoskeletal Disorders.* 2nd ed. Philadelphia, PA: Lippincott Williams and Wilkins; 1999:249–278.
3. Margoshes BG, Webster BS. Why do occupational injuries have different health outcomes? In: Mayer TG, Gatchel RJ, Palatin PB, eds. *Occupational Mus-*

culoskeletal Disorders. Function, Outcomes, and Evidence. Philadelphia, PA: Lippincott Williams and Wilkins: 2000: 47–61.
4. Spengler DM, Bigos SJ, Martin NA, Zeh J, Fisher L, Nachemson A. Back injuries in industry: a retrospective study. I. Overview and cost analysis. *Spine.* 1986;11: 241256.
5. Higgs PE, Edwards D, Martin DS, Weeks PM. Carpal tunnel surgery outcomes in workers: effect of workers' compensation status. *J Hand Surg (Am).* 1995;20:354–360.
6. Bednar JM, Baesher-Griffith P, Osterman AL. Workers compensation: effect of state law on treatment cost and work status. *Clin Orthop Rel Res.* 1998;351: 74–77.
7. Rousmaniere PF, Fox CD. Managed care at adolescence. *J Workers Comp.* 1998; 7:39–51.
8. Volinn E, Mayer J, Diehr P, Van Koevering D, Connell FA, Loeser JD. Small area analysis of surgery for low-back pain. *Spine.* 1992;17:575–579.
9. Dembe AE. *Occupation and Disease.* New Haven, CT: Yale University Press: 1996:229–271.
10. Bureau of Labor Statistics. *1998 OSH Summary Estimates. Supplemental Charts.* Washington, DC: BLS; 1999. US Dept of Labor publication 99–358.
11. Murphy PL, Volinn E. Is occupational low back pain on the rise? *Spine.* 1999; 24:691–697.
12. Bureau of Labor Statistics. *Workplace Injuries and Illnesses in 1998.* Washington, DC: BLS; 1999. US Dept of Labor publication 99–358.
13. Bureau of Labor Statistics. *Lost-Worktime Injuries and Illnesses: Characteristics and Resulting Time Away From Work, 1997.* Washington, DC: BLS; 1999. US Dept of Labor publication 99–102.
14. Anonymous. Actuaries agree comp crisis coming; urge benchmarking. *Workers' Comp Managed Care.* 2000;8:1–2.
15. Swedlow A, Johnson G, Smithline N, Milstein A. Increased costs and rates of use in the California workers' compensation system as a result of self-referral by physicians. *N Engl J Med.* 1992;327:1502–1506.
16. Wiesel SW, Boden SD, Feffer HL. A quality-based protocol for management of musculoskeletal injuries. *Clin Orthop Rel Res.* 1994;301:164–176.
17. Green-McKenzie J, Parkerson J, Bernacki E. Comparison of workers' compensation costs for two cohorts of injured workers before and after the introduction of managed care. *J Occup Environ Med.* 1998;40:568–572.
18. Vierhout WPM, Knottnerus JA, van Ooij A, et al. Effectiveness of joint consultation sessions of general practitioners and orthopedic surgeons for locomotor-system disorders. *Lancet.* 1995;346:990–994.
19. Malmivaara A, Hakkinen U, Aro T, et al. The treatment of acute low back pain: bed rest, exercises, or ordinary activity? *N Engl J Med.* 1995;332:351–355.
20. Bigos SJ, Andary MT. The practitioner's guide to the industrial back problem: part I. Helping the patients with the symptoms and pathology. *Semin Spine Surg.* 1992; 4:42–54.
21. Bigos SJ. The practitioner's guide to the industrial back problem: part II. Helping the patient with the return to work predicament. *Semin Spine Surg.* 1992;4:55–63.
22. Neer CS. Impingement lesions. *Clin Orthop.* 1983;173:70–77.
23. Atcheson SG, Ward JR, Lowe W. Concurrent medical disease in work-related carpal tunnel syndrome. *Arch Intern Med.* 1998;158:1506–1512.
24. Atcheson SG. Carpal tunnel syndrome: is it work-related? *Hosp Pract (Off Ed).* 1999;34:49–56.
25. Hashemi L, Webster BS, Clancy EA, Volinn E. Length of disability and cost of workers' compensation low back claims. *J Occup Environ Med.* 1997;39: 937–945.
26. Hashemi L, Webster BS, Clancy EA, Courtney TK. Length of disability and cost of work-related musculoskeletal disorders of the upper extremity. *J Occup Environ Med.* 1998;40:261–269.
27. Gundersen L. The effect of clinical practice guidelines on variations in care. *Ann Intern Med.* 2000;133:317–318.
28. Feinstein AR, Horwitz RI. Problems in the "evidence" of "evidence-based medicine". *Am J Med.* 1997;103:529–535.
29. McDonald CJ. Medical heuristics: the silent adjudicators of clinical practice. *Ann Intern Med.* 1996;124:56–62.
30. Epstein RS, Sherwood LM. From outcomes research to disease management: a guide for the perplexed. *Ann Intern Med.* 1996;124:832–837.
31. Oleinick A, Gluck JV, Guire KE. Concordance between ANSI occupational back injury codes and claim form diagnoses and a lower bound estimate of the fraction associated with disc displacement/herniation. *Am J Ind Med.* 1996;30: 556–568.
32. Gabriel SE, Amadio PC, Ilstrup D. The feasibility and validity of studies comparing orthopedists and non-orthopedists caring for musculoskeletal injuries: results of a pilot study. *Arthritis Care Res.* 1997;10:163–168.