

Cost of Care for Ambulatory Patients with Low Back Pain

Arthur C. Liu, MD, and Eileen Byrne, MD

Los Altos and Palo Alto, California

Background. Low back pain is a common presenting complaint in primary care, and the rate of utilization of resources among physicians treating this condition varies. Charges associated with the care of patients with low back pain were analyzed for a series of patients in a multispecialty group practice setting.

Methods. One hundred seventy managed care patients were selected for review. Use of laboratory, plain radiography, magnetic resonance imaging (MRI), subspecialty referrals, and physical therapy was examined based on patient characteristics and physician specialty. Appropriateness of MRI and lumbar spine radiography according to published criteria was also studied.

Results. Overall utilization was higher for patients who were referred to a subspecialist, and costs for visits to subspecialists were higher. Charges for physician services and MRI accounted for a majority of the total charges. Patients who were referred for subspecialty care or MRI but did not meet criteria for utilization of these resources comprised 6% of the study population but ac-

counted for 27% of the total charges. Five of 14 patients undergoing MRI did not meet the published clinical criteria determining need for MRI, and 10 of 17 patients referred to subspecialists did not meet referral criteria. Other patients who met criteria for MRI or subspecialty consultation did not receive these services. Seventeen percent of the patients referred for physical therapy had a symptom duration of 2 weeks or less at the time of referral and accounted for 17% of all physical therapy charges.

Conclusions. The majority of costs associated with care for low back pain in this study were attributable to physician charges and the use of MRI. Charges for subspecialty physician services, lumbar spine radiographs, and MRI in patients not meeting appropriate criteria accounted for 19% of all costs.

Key words. Back pain; low back pain; health care costs; health services; utilization; lumbar vertebrae; primary health care. (*J Fam Pract* 1995; 40:449-455)

Low back pain is the second most common presenting complaint in office visits to all physicians, following only upper respiratory tract infections.¹ Defined as pain involving the area from the lower rib cage to the gluteal folds,² low back pain has been estimated to have a lifetime prevalence of 60% to 90%. Most patients with low back pain experience rapid resolution of their symptoms, however, with only 14% of the population suffering an episode of low back pain that lasts 2 or more weeks. Only 1% to 2% of all patients will ever undergo lumbar spine surgery.²⁻⁴

Submitted, revised, December 28, 1994.

From the Palo Alto Medical Foundation in Los Altos (A.C.L.) and Palo Alto (E.B.), and the Department of Medicine, Stanford University School of Medicine (A.C.L.) in Stanford, California. Requests for reprints should be addressed to Arthur C. Liu, MD, Palo Alto Medical Foundation, Los Altos Center, 370 Distel Circle, Los Altos, CA 94022.

Despite this generally favorable prognosis, direct annual costs of medical care for low back pain in the United States have been estimated at \$24.3 billion in 1990 dollars, with substantial additional indirect costs related to disability.³ The tremendous costs of providing medical care for patients with low back pain are related not only to the high prevalence of this condition, but also to the high utilization of resources, such as radiographic imaging, in treating low back pain. The frequency of diagnostic and therapeutic procedure utilization in the care of low back pain on a per-case basis has been compared with that for several other common complaints, with low back pain-related utilization ranking second behind diabetes.⁵

As health care providers in the current managed care environment attempt to care for patients with low back pain in a more cost-effective manner, it is becoming increasingly important to identify which diagnostic and

therapeutic resources have the greatest impact on the cost of caring for patients with low back pain, and to reduce inappropriate use of these procedures. The present study was undertaken to examine the costs of providing care for low back pain to managed care patients in an ambulatory care facility, including relative use of resources based on patient characteristics and physician specialty. Actual utilization of lumbosacral spine radiography, magnetic resonance imaging (MRI), and subspecialty consultation was compared with previously published guidelines for use of these resources.

Methods

The study site, Palo Alto Medical Clinic in Palo Alto, California, is a multispecialty group practice serving a mixture of capitated health maintenance organization (HMO) patients and fee-for-service, Medicaid, and Medicare patients. Consecutive HMO patients were selected for study based on billing data indicating that an index visit for low back pain had occurred in the primary care departments of family practice or general internal medicine during the period beginning March 1, 1992, and ending December 31, 1992. These billing data in turn were derived from charge slips completed by the treating physician for each office visit. Physicians completing the diagnosis section of the charge slip may either use a checkbox to indicate one of the listed diagnoses or write in a diagnosis by hand. In most cases, physicians use one of the diagnosis checkboxes already available.

After review of the charge slips used by family physicians and general internists, the following diagnoses and ICD-9 codes were selected for review: 722.2, herniated disc, back; 722.9, disc disease, intervertebral; 724.5, back pain; 729.2, radiculopathy; 847.2, lumbar strain; 847.9, back strain; and 922.3, back contusion. A list was compiled of 244 patients for whom one of these diagnoses had been indicated by a primary care physician at the index visit. Charts for each of these patients were obtained and reviewed for a period extending from the index visit to 90 days thereafter. Patients were excluded if it was apparent that an ongoing evaluation for an episode of low back pain was already in progress at the time of the index visit, or if the index visit proved to be entirely unrelated to low back pain. There was no requirement that the back pain addressed at the index visit be acute in nature or that it be the chief presenting complaint. Seventy-four patients were excluded from the study because the index visit proved to be related to problems other than low back pain, such as upper back or neck pain, genitourinary problems, or neurologic disorders other than low back pain or sciatica.

Evaluation, treatment, and billing data were then reviewed independently by the authors for the remaining 170 patients. In all cases, the treating physician at the initial visit was a primary care internist or family physician, but subsequent visits included both primary care and subspecialty physicians. For each visit, the following history and examination data were recorded by each reviewer: patient age; duration of low back pain; presence of lower extremity pain; presence of objective neurologic deficits, eg, lower extremity weakness, sensory deficit, or reflex loss consistent with lumbosacral radiculopathy; presence of a positive straight leg raising test; signs and symptoms suggestive of cauda equina syndrome, ie, saddle anesthesia, or bowel or bladder symptoms; history of cancer, other than skin cancer; fever; morning stiffness or other evidence of ankylosing spondylitis; unexpected weight loss; history of corticosteroid therapy or substance abuse; and history of trauma. Duration of symptoms was recorded in weeks. If the duration was not reflected in the medical record, none was recorded. If symptoms were described as chronic or present for more than 3 months, duration was recorded as chronic. Symptoms and signs were assumed to be absent if not documented in the medical record. Provider, provider specialty, referrals to subspecialists, and referrals to physical therapy were also recorded, as were charges for laboratory services, imaging, and physician services.

Physical therapy is provided at a separate facility from the study site and is often provided on a "subcapitated" basis, in which the physical therapist contracts with the study site to provide physical therapy services for members of certain health plans by capitation and for which no bill is generated. Thus, only limited physical therapy billing data were available for review. Charges were estimated for the remaining patients who received physical therapy by multiplying the number of physical therapy visits by the average charge per visit for fee-for-service patients. Chiropractic treatment is neither available at the study site nor covered by the majority of the managed care plans that contract with the study site. Hospital charges other than professional services also were not available for review.

For visits in which problems other than low back pain were also addressed, an estimate was made of the percentage of charges in each category that were attributable to a complaint of low back pain. For instance, if a patient was seen for both low back pain and bronchitis at the same visit, and the medical record appeared to indicate that an equal proportion of the physician's time was devoted to each problem, only 50% of the physician's charge for that visit was considered back pain-related, and any laboratory or imaging charges related to the respiratory illness were excluded from the charge data related to back pain. Such

charges, however, were included in the calculation of "all-cause" charges.

Results

One hundred seventy patients with a mean age of 42 years were reviewed. Of these, 83 reported a history of at least one previous episode of low back pain, and 7 patients had undergone previous lumbar spine surgery. Eighty-nine were seen exclusively for low back pain at all appointments. Appointments for the other 81 patients seen for low back pain also included evaluation for additional, unrelated complaints. One hundred nineteen patients were seen for only one visit, and 51 patients were seen for two or more visits, for an overall mean number of visits of 1.5 visits per patient. Excluding the 10 patients whose pain was described as chronic at the index visit, the average duration of symptoms at the index visit was 3 weeks. Interreviewer reliability for history and examination findings was assessed by calculation of kappa values, which ranged from 0.48 to 0.88, with a mean of 0.72.

Seventeen patients were referred to subspecialists in the fields of neurosurgery, neurology, orthopedics, rheumatology, and psychiatry. Of these, seven were referred by the consultant to another subspecialist. In all, 24 subspecialty referrals were made to a total of nine different consultants. Four invasive procedures were performed in the study group: one patient had lumbar laminectomy and three were treated with injection, eg, facet joint. The 54 patients who were referred for physical therapy had an average symptom duration of 4 weeks at the time physical therapy was prescribed, not including the 11 patients whose pain was described as chronic at the time of referral for physical therapy. Nine patients were referred to physical therapy with symptoms that were present for 2 weeks or less. Of the 54 patients referred to physical therapy, only 31 actually received treatment: a total of 143 physical therapy visits, for an average of 4.6 visits per patient.

Only one of 170 patients underwent lumbar spine surgery. Physician charges associated with the care of this surgical patient were \$9991. Because this study focused on ambulatory care, the remainder of this discussion excludes charges for the single patient who underwent inpatient surgery.

The total charges accumulated for evaluation and treatment of all complaints for patients in this study were \$69,768, of which \$54,683 was related to the care of patients with low back pain. Charges for MRI totaled \$18,028. Radiology charges, which totaled \$5364, represent those for all other imaging studies, including a radionuclide bone scan on one patient. None of the patients in this study underwent myelography or computed

Table 1. Charges for Care of Patients with Low Back Pain, by Provider Specialty

Variable	Primary Care Physicians	Subspecialty Physicians	P Value
No. of patients	169	17	
No. of visits	219	34	
Average charge* per visit, by category, \$			
Physicians	56	185	<.05
Laboratory	4	41	<.05
Imaging studies†	21	23	NS
MRI	69	100	NS
Physical therapy	44	62	NS
Total	195	411	<.05

*Amounts rounded.

†Imaging studies include plain radiography, bone scan and other imaging techniques, excluding MRI.

MRI denotes magnetic resonance imaging.

tomography. Laboratory charges totaled \$2148; physician charges related to the care of outpatients with low back pain, \$17,731; and physical therapy charges, \$11,413.

Charges incurred by the study patients for problems other than low back pain were excluded from the analyses.

Comparison of Charges Based on Provider Specialty

Average charges were analyzed according to the specialty of the provider seeing the patient at each visit (Table 1). As might be expected, charges incurred by specialists tended to be higher than those incurred by primary care physicians. There were no significant differences between the charges incurred by general internists and those incurred by family physicians. Average physician charges were \$185 for specialists, significantly higher than the \$56 average charge per visit for primary care physicians. Laboratory utilization was also higher for specialists; however, laboratory charges accounted for a relatively small proportion (4%) of total charges in the study. Although average charges for radiography, MRI, and physical therapy were higher for specialists than for primary care physicians, the differences were not statistically significant. The average total charge per visit was significantly higher for specialists.

Comparison of Charges Based on Patient Characteristics

Indications for surgical referral of patients with low back pain or sciatic pain consistent with herniated intervertebral disc have been outlined by Deyo et al.⁶ These are (1) cauda equina syndrome, (2) progressive or severe neuro-

logic deficit, (3) persistent neuromotor deficit after 4 to 6 weeks of conservative therapy, and (4) persistent sciatica, sensory deficit, or reflex loss after 4 to 6 weeks of conservative therapy in a patient with positive straight leg raising sign, consistent clinical findings, and favorable psychosocial circumstances, eg, realistic expectations and no evidence of depression, substance abuse, or excessive somatization.

Surgical referral criteria for conditions such as spinal stenosis are not as clearly established. Suggested indications for surgery in this disorder, whether it is related to osteoarthritis, spondylolisthesis, or other causes, include persistent neurogenic claudication unresponsive to conservative treatment, progressive neurologic deficit, or bowel and bladder symptoms.^{7,8} As the presence of lower extremity pain was recorded for all patients in the study and was not limited to sciatic pain, patients with persistent neurogenic claudication or sciatic pain secondary to spinal stenosis would meet the referral criteria used in this analysis. Only one patient was referred for a clinical diagnosis of spinal stenosis with sciatica, however, and one other for spondylolisthesis without lower extremity symptoms. Suspected disc herniation was the reason for referral in a majority of cases.

Criteria for referral to nonsurgical subspecialties, such as neurology, psychiatry, or rheumatology, are not well defined. Of the seven patients in this study who saw a nonsurgical subspecialist, three were first referred to a surgeon, who subsequently referred them to a physiatrist or rheumatologist. For the purposes of this analysis, the criteria used for referral to surgical specialists due to a diagnosis of lumbar disc disease were also used for nonsurgical subspecialists. Referral was also considered appropriate if systemic illness was suspected to be the source of a patient's symptoms. Only one such patient was referred for this reason. The consultant subsequently concluded that the patient was suffering from mechanical low back pain.

Imaging with computed tomography, MRI, radionuclide bone scan, or myelography is advocated primarily for patients who are considered surgical candidates,⁶ or those whose symptoms are suspected to be related to serious systemic illness, such as infection or neoplasm.⁹ The referral criteria for subspecialty consultation, therefore, were applied to MRI use as well.

For criteria 3 and 4 set forth by Deyo and associates, symptom duration of at least 2 weeks was used. Sixteen of the 169 outpatients studied met one or more criteria for obtaining MRI, subspecialty consultation, or both. Table 2 presents data comparing the charges incurred by the group of patients meeting these referral criteria with the charges submitted for patients not meeting these criteria.

From these data, it is evident that the use of subspe-

Table 2. Charges for Care of Patients with Low Back Pain Who Did and Did Not Meet Criteria for Referral to Subspecialist

Variables	Met Criteria for Referral	Did Not Meet Criteria for Referral
No. of patients (% of total)	16 (9.5)*	153 (90.5)
Charges, \$ (% of total)		
Physician		
Primary care	2336 (4)	10,085 (18)
Subspecialty	2433 (4)	2877 (5)
Laboratory	584 (1)	1564 (3)
Imaging studies†	840 (2)	4524 (8)
MRI	11,153 (20)	6875 (13)
Physical therapy	2560 (5)	8853 (16)
Total	19,906 (36)	34,777 (64)

*One referred patient underwent surgery and was therefore excluded from the cost analysis.

†Includes plain radiography, bone scan, and other imaging techniques, excluding MRI.

MRI denotes magnetic resonance imaging.

NOTE: Percentages may not add to 100 because of rounding.

cialty referrals and MRI did not always correspond with the presence of appropriate history and examination findings. In considering this discordance, the study subjects can be further divided into four subgroups: group A, the 9 patients who met clinical criteria and were then referred for subspecialty care or MRI, who accounted for only 5% of all patients but 32% of the total charges; group B, the 10 patients who did not meet clinical criteria but still received MRI or subspecialty referral, representing only 6% of all patients but 27% of total charges in the study; group C, the 7 patients who met clinical criteria but received neither MRI nor subspecialty referral, who comprise 4% of all patients and 4% of the total charges; and group D, the remaining 143 patients (85% of the total) who did not meet clinical criteria and received neither MRI nor subspecialty care and incurred only 36% of the total charges related to low back pain.

The average age, duration of symptoms, number of symptoms suggestive of either lumbar radiculopathy or systemic disease, and the number of significant positive physical examination findings were compared for each of these subgroups. Patients whose symptoms and examination findings met clinical criteria for obtaining either subspecialty consultation or MRI and received one or both of these services (group A) were not significantly different in duration of symptoms, number of symptoms, or number of positive examination findings when compared with patients in group C, who underwent neither consultation with a subspecialist nor MRI. The patients in group A were significantly younger than those in group C (mean age 35 and 46 years, respectively). Patients whose findings did not meet clinical criteria established for utilizing sub-

Table 3. Use of Magnetic Resonance Imaging (MRI) for Patients Meeting at Least One of the Clinical Criteria for the Procedure

	No. of Patients		Total
	Who Had MRI	Who Did Not Have MRI	
Published Criteria for MRI			
Suspected systemic disease	0	1	1
Cauda equina syndrome	0	0	0
Progressive neurological deficit	0	0	0
Back pain ≥ 2 wk, with			
Motor deficit	1	4	5
Leg pain	8	6	14
Reflex loss	2	1	3
Sensory deficit	4	2	6
Positive straight leg raising test	8	5	13
Total	8	8	16

NOTE: Totals shown do not equal the sum of numbers in each column because individual patients may have met more than one of the criteria listed.

specialty services or MRI and also received neither of these services (group D) and those in group B, who received consultation or MRI, or both, despite the lack of appropriate findings, were similar with respect to age, number of symptoms, and number of positive examination findings. The mean duration of symptoms was shorter for patients in group B than for those in group D.

Appropriateness of Imaging Technique Use

MAGNETIC RESONANCE IMAGING

Of 169 patients, 14 underwent MRI. Four of these studies were ordered by family physicians, seven by general internists, and only three by subspecialists. Five of the 14 MRIs were obtained for patients whose clinical findings did not meet the criteria for surgical referral or MRI; one of these MRIs was obtained by a family physician, three by general internists, and one by a subspecialist. Sixteen of 169 patients met at least one of the criteria for MRI or surgical referral, yet eight of these patients (50%) did not receive MRI (Table 3).

RADIOGRAPHY

Radiography of the lumbosacral spine was performed for 34 patients. Twenty-three patients also underwent radiography of other areas (eg, hip or pelvis) that was considered at least partially related to evaluation for low back pain or lower extremity pain consistent with sciatica. Criteria for imaging of these areas in the evaluation of low back pain are less well established; therefore, the following discussion of radiography use is confined to lumbosa-

Table 4. Use of Lumbosacral Spine Radiography for Patients with at Least One Clinical Indication for This Imaging Study

Clinical Indication	No. of Patients		Total
	Who Had Radiograph	Who Did Not Have Radiograph	
Age >50 y	9	39	48
Symptom duration >6 wk	19	21	40
History of cancer*	1	3	4
Fever	0	0	0
Evidence suggesting ankylosing spondylitis†	3	1	4
Unexplained weight loss	0	1	1
Substance abuse	0	1	1
Corticosteroid therapy	0	0	0
Neurologic deficits	5	13	18
History of trauma	7	18	25
Total	25	75	100

*Excluding skin cancer.

†Morning stiffness, for example.

NOTE: Totals shown do not equal the sum of numbers in each column because individual patients may have met more than one of the criteria listed.

cral spine imaging. Previously described indications for lumbosacral spine films include patient age over 50 years, failure to improve after 4 to 6 weeks, history of cancer other than skin cancer, fever, evidence suggestive of ankylosing spondylitis (eg, morning stiffness), unexpected weight loss, history of corticosteroid therapy or substance abuse, neurologic deficits, or history of trauma.^{9,10}

Eighteen of the 34 radiographs of the lumbosacral spine obtained in the study population were ordered by family physicians, 13 by general internists, and 3 by subspecialists. Using the criteria listed above, only 4 patients did not have at least one indication for radiography, although trauma was defined liberally to include even seemingly minor falls; heavy lifting alone was not considered trauma. One hundred of the 169 patients met at least one criterion for obtaining radiography, but only 25% of these patients actually underwent imaging (Table 4). The numbers of patients categorized as "criteria met" and "criteria not met" in Table 2 do not correspond to those reported in Table 4 because different clinical criteria were used.

Appropriateness of Referral to Subspecialists

A total of 26 patients either met the criteria for referral or were referred to a subspecialist, or both. Seven patients met the referral criteria and were seen by a subspecialist. Ten were referred for subspecialty consultation, even though they did not meet criteria for referral, whereas nine patients met the history and examination criteria for referral but were not referred to a consultant.

Relative Contribution of Inappropriate Utilization to Total Costs

The cost of unnecessary surgery is often a major concern in discussions of the costs of caring for patients with low back pain. Only one of 170 patients in this study, however, underwent treatment, and this patient fulfilled the criteria for surgical consultation. The present study focused on the costs associated with outpatient care, as measured by charges submitted.

In all, 5 of the 14 MRIs, 4 of the 34 lumbosacral spine radiographs, and 10 of the 17 subspecialty consultations were not warranted by published clinical criteria. These interventions accounted for 38% of all MRI costs, 8% of all non-MRI radiology costs, and 54% of all subspecialty physician charges, respectively. In aggregate, these charges accounted for 19% of all outpatient charges related to low back pain in the study, that is, \$10,256 of \$54,683.

Discussion

The data gathered here applied only to managed care patients in a single multispecialty group practice, and may not be representative of resource use in other settings or in the care of noncapitated patients at the study site. An additional limitation of the study is that patients were selected on the basis of diagnoses listed in billing data; claims data have been shown to correlate poorly with clinical information.¹¹ Because this study was not designed to examine outcomes of therapy, it is difficult to comment on the cost-effectiveness of the interventions observed. Further, it is impossible to determine from these data whether the patients who met clinical criteria for MRI, subspecialty referral, or lumbar spine films but did not receive them were adversely affected as a result. Given the natural history of mechanical low back disorders, however, this seems unlikely.^{2,6,12-14}

Based on the intended purpose of the study to encompass the full spectrum of patients presenting to primary physicians with low back pain, no attempt was made to restrict the study population to patients with acute pain, or to patients whose only presenting complaint was low back pain. As a result, the patients studied may have been less symptomatic and had fewer objective abnormalities than patients in other studies of low back pain.

This study attempted to address several questions related to the use of resources in the evaluation and treatment of low back pain. Were the differences in resource use based solely on patient characteristics, ie, were some patients more expensive to treat simply because they were more ill? It is not surprising that utilization of resources

was higher for patients with history and physical examination findings that met criteria for subspecialty referral. Similarly, one would expect that charges would be higher for patients who were referred for subspecialty care than for those cared for exclusively at the primary care level. It is important to note that patient characteristics such as age, number and duration of symptoms, and number of positive examination findings did not correlate better with actual referral status or use of MRI.

How appropriate was the use of imaging and consultation in general? Our findings can be compared with those of a similar study of low back pain care. Schroth et al⁵ examined the use of lumbar spine radiographs, MRI or CT, and subspecialty referral compared with clinical criteria similar to those used in the present report. Schroth and colleagues found that 10 of 38 patients receiving lumbar spine radiographs did not meet the criteria for this type of imaging, compared with 4 of 34 patients in this series. Twelve of 18 patients in the Schroth study who underwent CT or MRI failed to meet criteria for these examinations. A similar number of patients were referred to subspecialists, and 15 of the 19 referrals made after 4 weeks of conservative therapy were determined to be inappropriate, compared with 10 of 17 referrals in our series. Finally, 12 of the 18 MRI or CT scans obtained as reported by Schroth and co-workers had been ordered by the primary care physician, compared with 11 of 14 in this study. While the data obtained in these two series differ in some respects, the similarities between the two studies are more striking than the differences. As noted by Schroth et al, these data do not support the notion that overuse of expensive imaging and interventions is driven by subspecialists. Rather, in both reports, most of the inappropriate use was initiated at the primary care level in the form of imaging or referrals to subspecialists that were not warranted by clinical criteria.

What were the services that contributed most to the total cost of providing care for these patients? Physician charges accounted for 33% of total costs: primary care physicians, 23%; and outpatient subspecialty care, 10%. Thirty-three percent of the total charges were attributed to MRIs, most of which were ordered by primary care physicians. Physical therapy accounted for 21% of the total charges. One of the major limitations in this study is that it was impossible to assess what proportion of physical therapy utilization was appropriate. Appropriateness of physical therapy could not be determined because there is no clear consensus regarding which patients should receive physical therapy or how much they should receive.^{2,5,6} It was possible, however, to determine that the majority of physical therapy costs were incurred by patients who did not meet clinical criteria for subspecialty referral (Table 2), and that 9 of the 54 patients who were

referred for physical therapy had a symptom duration of 2 weeks or less at the time physical therapy was prescribed. Charges for these 9 patients accounted for 17% of all physical therapy charges.

How much could the cost of providing outpatient care for patients with low back pain be reduced by eliminating inappropriate use of resources? Again, this question cannot be answered definitively until outcomes-based data regarding the efficacy and appropriate use of physical therapy become available. As we attempt to reduce the costs associated with treating patients with low back pain, however, it should be noted that an 19% reduction in charges related to low back pain in this study population might have been achieved with more appropriate use of resources. The bulk of this reduction (13%) might have been achieved by eliminating inappropriate use of MRI. Subspecialty physician charges resulting from inappropriate referrals accounted for a 5% potential reduction, while lumbrosacral radiography obtained in the absence of an appropriate clinical medication accounted for 1%.

Additional studies are needed to examine the outcomes and costs associated with differing management strategies. In particular, the role of clinical guidelines deserves further consideration: should we interpret criteria such as the ones used in this study to mean that all patients meeting given criteria should receive a costly intervention? If this were done, costs would probably increase rather than decrease. In this study, for instance, eight patients who met the clinical criteria for obtaining MRI or surgical consultation did not receive an MRI. If each of these patients had undergone MRI, the cost would have exceeded the savings achieved by not performing the five MRIs that were considered inappropriate based on the clinical criteria used in the study. Practicing physicians need more data about whether patient outcomes are adversely affected by avoiding the use of subspecialists or sophisticated imaging in the care of patients who may meet published criteria for these services. More specific information regarding the efficacy and appropriate use of physical therapy also is needed.

Acknowledgments

The authors would like to thank the medical records department and health plans office of the Palo Alto Medical Foundation, as well as the staff of Richard Carr Physical Therapy, for their administrative support.

References

1. Deyo RA, Rainville J, Kent DL. What can the history and physical examination tell us about low back pain? *JAMA* 1992; 268:760-5.
2. Frymoyer JW. Medical progress: back pain and sciatica. *N Engl J Med* 1988; 318:291-300.
3. Frymoyer JW, Cats-Baril WL. An overview of the incidences and costs of low back pain. *Orthop Clin North Am* 1991; 22:263-71.
4. Deyo RA, Cherkin D, Conrad D, Volinn E. Cost, controversy, crisis: low back pain and the health of the public. *Ann Rev Public Health* 1991; 12:141-55.
5. Schroth WS, Scheckman JM, Elinsky EG, Panagides JC. Utilization of medical services for the treatment of acute low back pain: conformance with clinical guidelines. *J Gen Intern Med* 1992; 7:486-91.
6. Deyo RA, Loeser JD, Bigos SJ. Diagnosis and treatment: herniated lumbar intervertebral disk. *Ann Intern Med* 1990; 112:598-603.
7. Cailliet R. *Low back pain syndrome*. 3rd ed. Philadelphia, Pa: FA Davis Co, 1981.
8. Grabias S. Current concepts review: the treatment of spinal stenosis. *J Bone Joint Surg* 1980; 62-A:308-12.
9. McCowin PR, Borenstein D, Wiesel SW. The current approach to the medical diagnosis of low back pain. *Orthop Clin North Am* 1991; 22:315-25.
10. Deyo RA. Lumbar spine films in primary care: current use and the effects of selective ordering criteria. *J Gen Intern Med* 1986; 1:20-5.
11. Jollis JG, Ancukiewicz M, DeLong ER, Pryor DB, Muhlbaier LH, Mark DB. Discordance of databases designed for claims payment versus clinical information systems. *Ann Intern Med* 1993; 119: 844-50.
12. Onel D, Sari H, Donmez C. Lumbar spinal stenosis: clinical/radiologic therapeutic evaluation in 145 patients. Conservative treatment or surgical intervention? *Spine* 1993; 18:291-8.
13. Saal JA, Saal JS. Nonoperative treatment of herniated lumbar intervertebral disc with radiculopathy. An outcome study. *Spine* 1989; 14:431-7.
14. Bush K, Cowan N, Katz DE, Gishen P. The natural history of sciatica associated with disc pathology: a prospective study with clinical and independent radiologic follow-up. *Spine* 1992; 17: 1205-12.