Relative Costs and Effectiveness of Specialist and General Internist Ambulatory Care for Patients with 2 Chronic Musculoskeletal Conditions

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ABSTRACT. ***Objective.*** To evaluate costs and effectiveness of ambulatory care provided by specialists, nonspecialists (general internists), and both specialists and nonspecialists (co-care) to patients with knee osteoarthritis (OA) and/or chronic low back pain (LBP).

Methods. We studied Veterans Health Administration (VHA) outpatients from the Veterans Health Study with LBP and/or OA followed for at least 6 months between August 1993 and December 1995, who completed the Medical Outcomes Study Short Form 36-item (SF-36) functional status questionnaires at both baseline and followup. We obtained costs of VHA outpatient utilization and medications for these patients during the followup period. We compared costs and effectiveness of the ambulatory care provided by specialists, nonspecialists, and co-care. We also compared specialty care with nonspecialty care using an incremental cost effectiveness ratio (ICER) of annualized cost difference divided by annualized SF-36 based Physical Component Summary (PCS) improvement difference. ICER stability was assessed using bootstrap sampling.

Results. Among 398 patients, followed an average of 14 months, 155 received only nonspecialty care, 49 specialty-only care, and 192 co-care. After regression analysis, adjusted for age, disease characteristics, and baseline health status, PCS improvements per year were 1.66 (SD 8.22) for nonspecialty care, 3.48 (SD 7.91) for specialty care, and 0.65 (SD 8.08) for co-care; while costs of care per year were $1099 (SD $1681), $1376 (SD $1503), and $2517 (SD $1644), respectively (all data US dollars). A standardized ICER of $152 per PCS unit indicated specialty care to be cost effective compared with nonspecialty care.

Conclusion. Specialist-only ambulatory care for OA or LBP was associated with improvement in functional status at slightly higher costs compared with nonspecialty care. Co-care, however, was substantially more costly and was associated with little improvement in functional status. (J Rheumatol 2002;29:1488–95)

Key Indexing Terms:
MARGINAL COST EFFECTIVENESS RATIO KNEE OSTEOARTHRITIS
CHRONIC LOW BACK PAIN VETERANS ADMINISTRATION SF-36

Managed care organizations often limit access to specialty care because it is assumed to be expensive. It is possible, however, that routine specialist care for specific conditions, either as primary care or as co-care when combined with internist care, could be less costly if clinical expertise enables a specialist to make a diagnosis with fewer tests and to treat without costly medication that might have been ordered by a physician less familiar with the condition[1]. Another major concern especially for policy makers and consumers is that if access to specialty care is limited, costs will be contained at the expense of quality. Some studies suggest that specialist care may be cost effective[2,3], but this may not be true for all specialists nor for all conditions.

Evaluating the cost effectiveness of specialist care for osteoarthritis (OA) and chronic low back pain (LBP) is important because these are common chronic musculoskeletal conditions accounting for substantial utilization and costs. For example, care costs for a single chronic condition were estimated at $1829 in the 1987 National Medical Care Expenditure Survey[4], while in a 1991 to 1993 managed care study, charges attributable to OA were estimated at $2827 per year for patients under 65 and $1964 for those 65 years or older[5] (all data are US dollars). The effective medical management of OA and chronic LBP is a matter of considerable economic and societal significance.

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Supported by a grant from the American College of Rheumatology.

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Submitted September 18, 2001; revision accepted January 15, 2002.

If specialist care favorably affects functional status, then even if it is more costly it may be cost effective.

Some cost effectiveness studies in OA and in rheumatoid arthritis (RA) are summarized by Ruchlin, *et al*[6]. The focus of these 6 studies was not on specialist versus nonspecialist care, but on the comparison of alternative treatment strategies, i.e., different drug regimens in the 2 RA studies and different surgical strategies in 3 of the OA studies. The sixth study, by Weinberger, *et al*[7], examined costs and effectiveness in reducing functional status decline of a telephone contact intervention in patients with OA. Two recent studies compare specialist and nonspecialist care but focus on costs and utilization only, not outcomes. Mazzuca, *et al*[8] examine the effects of self-care education on utilization and primary care visit costs for patients with knee OA, while Gabriel, *et al*[9] compare costs of care provided by rheumatologists and generalists in patients with RA.

We assessed both costs and effectiveness of routine care provided by specialists, nonspecialists (general internists), and both types of providers to patients with either or both of knee OA and chronic LBP. The cost effectiveness perspective of this study is the health care payor's, and therefore only direct cost estimates of care are included.

We chose knee OA and chronic LBP because they are common ambulatory care problems that may be managed both by internists (nonspecialists) and by specialists, including rheumatologists, neurologists, and orthopedic surgeons. The ambulatory care setting of our study consists of several Veterans Health Administration (VHA) outpatient clinics. The VHA medical system is a favorable setting for this research because it is an example of a large managed care environment, its physicians are salaried, with no financial interest in the utilization of medical services received by their patients, and there are few financial barriers to access for its patients. During the period of this study, VA patients could themselves choose to have specialty care. It is to be expected that those with more severe disease would be more likely to choose this care, and so our analyses account for possible health care disparities by including covariates in multiple regression analysis and by stratifying by indicators of disease severity.

The development, in recent years, of patient based health status measures for chronic conditions [e.g., the Health Assessment Questionnaire (HAQ)[10] and the Arthritis Impact Measurement Scales (AIMS)[11] in arthritis, and the 36 item Medical Outcomes Study Short Form (SF-36)[12], appropriate in many musculoskeletal conditions[13]] makes it possible to evaluate effectiveness of care for conditions characterized largely by symptoms. We used the Physical Component Summary (PCS) of the SF-36 to measure functional status as an outcome, and both physical and mental component summaries (MCS) in forming health status based severity strata[14].

MATERIALS AND METHODS

Study population and setting. A total of 614 veterans with either or both of self-reported OA and LBP, who were enrolled in the Veterans Health Study (VHS) prior to July 1995, were eligible for this study. The VHS was a longitudinal study evaluating the health status of male veterans using ambulatory care at Boston-area VHA centers[15]. VHS patients were a random sample of patients who came to one of 4 VHA sites for an ambulatory care medical visit between August 1993 and December 1995. Disease status of patients in the VHS was determined using a screening questionnaire evaluated for consistency and reliability[16]. The patients with LBP satisfied 3 screening criteria: (1) report of ever having had LBP, (2) a health care provider visit for LBP in the previous year, and (3) LBP that began more than 3 months previously. Patients with OA had answered yes to 2 questions: Do you have pain, aching or stiffness in one or both knees on most days? and, Has a doctor ever told you that your symptoms are due to osteoarthritis or arthritis in your knee?

Inclusion criteria for the study required a VHS baseline interview with administration of the SF-36 between August 1993 and June 1995, at least one subsequent OA or LBP related visit to a VHA internist, rheumatologist, orthopedic surgeon or neurologist, and a subsequent quarterly SF-36 administration as part of the VHS with followup time of at least 6 months between the baseline interview and December 1995. We chose this cutoff for all patients to maximize data acquisition per patient. A total of 398 patients (65% of the 614) met these criteria; most excluded patients had not had subsequent visits to the VHA in the time frame of the study.

Utilization and costs. We obtained VHA utilization data for each patient from the Decentralized Hospital Computer Program (DHCP). The DHCP supports all clinical work at each VHA medical center, including information on all patient visits, laboratory tests, other tests and procedures, and pharmacy. We identified the physicians visited and outpatient utilization relevant for the study conditions, and estimated the utilization costs. *Physicians*. We identified all general internal medicine, rheumatology, orthopedics, neurology, or rehabilitation medicine physicians visited by the study patients between each patient's baseline date and December 31, 1995. The specialty of each physician visited was ascertained by independent persons from each health facility who were familiar with the physicians.

Utilization. Resource utilization specific for OA and LBP was identified from the full VA lists of radiology and laboratory procedures, and medications were identified by 2 rheumatologists (DTF, MJP). Physician visits and consultations, supportive services (physical therapy, occupational therapy, and nutrition, prosthetic and brace consultations), diagnostic and monitoring procedures [specific radiology, laboratory, and electromyogram (EMG) procedures], and relevant drug prescriptions were included. We identified all physician encounters occurring between baseline interview date and outcome assessment date for which procedures, services, or medications relevant to OA or LBP treatment were coded.

We included the relevant nonvisit utilization (diagnostic and monitoring procedures and pharmacy) from 2 weeks before baseline interview up to the outcome assessment date, assuming that any utilization within 2 weeks of the baseline visit could have an influence on subsequent health status. If the name of the physician responsible for the nonvisit utilization was missing, it was identified using an algorithm, based on the timing of the service relative to the index visit, and its usefulness for diagnosis or toxicity monitoring if done within a specified time interval around the suspected index visit, as well as likely patterns of procedure and test ordering. (This occurred in < 5% of nonvisit utilization.)

We tested the validity of the algorithm on all utilization data for a sample of 18 patients by matching physician names present in the patient chart with those attributed by the algorithm plus those found in the DHCP. Each physician visit was counted as relevant only if the assessment and plan section of the physician note mentioned OA or LBP and/or knee OA or LBP complaints. We also checked whether providers excluded from the study on the basis of their specialty were appropriately excluded. For 496 units of utilization by 18 patients, the kappa statistic for correct identifica-

tion of the provider of each unit and inclusion or exclusion of the unit using the algorithm versus the chart was 0.92, with corresponding sensitivity of 98% and specificity of 93%.

Costs. For each type of outpatient utilization except medication, we estimated costs in 1995 US dollars based on Boston University Medical Center 1995 costs (personal communication, Boston University Medical Center Financial Services). For medication costs we used average wholesale costs from the 1995 *Drug Topics Red Book*[17].

Functional status outcome. We used change in the PCS score as the measure of effectiveness of care. The PCS and MCS were generated from responses to the SF-36V, an SF-36 modification developed by Kazis, *et al*[15]. The PCS and the MCS are uncorrelated composite measures based on 8 components derived from the SF-36, namely physical function, role physical, body pain, vitality, general health, social function, role emotional, and mental health. The PCS and MCS are standardized so that a score of 50 corresponds to the average for the US population (SD = 10). A change of 2 to 3 units, i.e., 20 to 30% of the SD, is a small but appreciable change comparable to 10-year age cohort differences. For example, in the general US population, PCS norms in the successive age decades of 45–54, 55–64, and 65–74 are 49.5, 46.1, and 43.5, respectively, so that those who are 20 years older have a score that is 6.0 units lower, a difference of 3.0 per decade of age[18]. The PCS and MCS were obtained from the VHS baseline questionnaire and at the subsequent scheduled VHS quarterly assessment date closest to December 31, 1995.

Analysis. We identified 3 groups of patients: those who visited specialists only for their LBP or knee OA care, those who received a mixture of specialist and nonspecialist care (the co-care group), and those with only nonspecialist care for those conditions. We used one-way analysis of variance for continuous variables and chi-square tests for categorical variables to compare the 3 care groups with respect to disease grouping, and the following demographic variables: age, education and income, employment status, service-connectedness of disability, marital status, and race. Service-connectedness is a VA-assessed measure of the extent to which a patient's disability is related to military service. The VA is required to furnish outpatient care without limitation to veterans with 50% or more service-connected disability. We used analysis of variance also for comparisons of baseline health status, including PCS, MCS, illness duration, pain level, and disease burden index. Pain in knee OA was based on the Western Ontario-McMaster University (WOMAC) questionnaire relating to pain[19], scaled to range from 0 to 10, as was the LBP pain measure. If a patient had both OA and LBP, we used the larger of his 2 disease-specific measures of disease duration and of pain severity. The VHS disease burden index is an unweighted count of medical conditions indicated to be present from a list of diagnoses signifying 40 distinct disease conditions[20].

We calculated annualized costs per person, in total and for each of visits, laboratory tests, radiology procedures, medication, and support services, by specialty care group. We compared the 3 groups on means per year of followup of visits, radiology procedures, and laboratory, medication and other support services by analysis of variance. Annualized change in PCS for each patient was obtained by subtracting the outcome measure from the corresponding baseline measure and dividing by duration of followup. We calculated per-group means of annualized costs and PCS change, and also least-squares means, adjusted for age and baseline disease, pain, and health status measures in a linear model. We calculated these same means for the disease subgroups (OA, LBP, and both OA and LBP) and for subjects with up to one year versus those with more than one year of followup.

We computed an unadjusted incremental cost effectiveness ratio (ICER) for specialist-only versus internist-only care using PCS change as the measure of effectiveness. We also derived an adjusted ICER with stratification by terciles of baseline MCS crossed with baseline PCS median (6 strata). The numerator and denominator of the adjusted cost effectiveness ratio were differences between standardized means of cost/year and PCS change/year computed using the 6 strata. We assessed the stability of each ICER by bootstrap sampling, a repeated sampling technique used to provide a nonparametric estimate of the distribution of an ICER[21]. The resulting nonparametric estimates of location and variability have an advantage over parametric choices of reduced susceptibility to effects of possible outliers.

RESULTS

We subdivided the 398 subjects (all male) in this study into 3 groups: 155 (39%) received treatment, including visits and other services, from nonspecialists only; 49 (12%) visited specialists only; and the remaining 194 (49%) received co-care, i.e., from both specialists and nonspecialists. Because of the randomness of selection of patients included in the VHS, the patients in our study obtained care from a wide range of different individual providers in the Boston-area VHA centers. Fairly similar numbers of visits were made to each of 3 types of specialists by patients in both the specialist-only and the co-care groups, with 35% of all such visits being to rheumatologists, 28% to orthopedists, and 37% to neurologists. (The nature of practice at the VA sites in the study was such that rehabilitation specialists did not provide care for patients with OA or LBP.) Of the 398 patients, 162 had OA only, 149 had LBP only, and 87 had both conditions. Among patients with both conditions 23% obtained nonspecialist-only care compared with 42% of those with OA alone and 45% of those with LBP alone.

Patient ages ranged from 22 to 90 years (mean 63.4 yrs). The 3 care groups differed in age and education, with the patients receiving nonspecialist-only care being older (59.3 yrs for specialty care only, 62.3 years for co-care, and 66.1 for nonspecialist care) and having less education on average (13.3 yrs for specialty care, 12.5 yrs for co-care, and 12.2 yrs for nonspecialty care) than those who received specialist or co-care (Table 1). The 3 groups did not differ significantly with respect to other demographic variables: household income, race, marital status, employment, and service-connected disability status. The patients in the 3 care groups differed with respect to disease characteristics at baseline. Patients in the nonspecialist care only group were less likely to have both OA and LBP: 29% of the specialist care group had both conditions, as did 27% of the co-care group, versus 13% of the nonspecialist-only care group. All 3 groups had similarly long but varied disease duration (mean 22.5 yrs, but 10% had been diagnosed ≤ 2.5 yrs before baseline, and the maximum was 60 yrs). Patients in the 2 groups with specialty care had greater pain at baseline and also had higher mean disease burden index. The specialist-only and co-care groups of patients had worse PCS at baseline (mean 29.4 for specialty care only, mean 29.8 for co-care, versus 32.5 for the nonspecialty care group) and also worse baseline MCS (mean 42.7 for specialty care and 44.3 for co-care, versus 48.9 for the nonspecialty care group).

The patients in the co-care group received more care with correspondingly greater costs than did patients in either of

Table 1. Demographic and baseline disease characteristics by type of care.

	Nonspecialty Only, n = 155, mean (SD)/ %	Specialty Only, n = 49, mean (SD)/ %	Co-care, n = 194, mean (SD)/ %	p*
Demographic characteristics				
Age, yrs	66.1 (10.0)	59.3 (14.2)	62.3 (12.4)	0.001
Education, yrs	12.2 (2.4)	13.3 (2.2)	12.5 (2.5)	0.024
Income	$ 22,323 ($17,141)	$21,944 ($12,646)	$22,747 ($17,043)	0.948
Employed, %	25.7	26.5	23.8	0.888
> 50% service connected, %	30.0	39.0	33.5	0.543
Married, %	61.3	51.0	57.7	0.435
White, %	92.9	89.8	89.2	0.478
Disease characteristics				
OA only, %	44	29	41	
LBP only, %	43	43	31	
OA and LBP, %	13	29	27	0.004
Disease duration, yrs	22.5 (17.8)	23.5 (17.9)	22.3 (16.7)	0.915
Pain score, 0–10	4.4 (2.2)	5.4 (2.2)	5.3 (2.3)	0.001
Disease burden index	7.4 (3.7)	8.3 (4.5)	8.5 (3.9)	0.038
PCS	32.5 (10.3)	29.4 (9.3)	29.8 (9.5)	0.020
MCS	48.9 (12.8)	42.7 (14.4)	44.3 (14.2)	0.002

* Overall comparison of the 3 groups. LBP: low back pain, PCS/MCS: Physical/ Mental component summary of the SF-36.

the other 2 groups, both overall and in each of the separate categories of MD visits, medications, and radiologic procedures (Table 2). Only for laboratory tests did the differences not reach statistical significance (although they followed the same pattern). It would appear that there was some duplication of care in the co-care group: of the 6.7 MD visits per year in which OA or LBP was addressed, 3.4 (51.5%) were to specialists, so that this group had roughly twice as many MD visits as either of the other 2 groups. Just over half of all co-care group visits of any type (53%) were to specialists, but specialists provided less than half of the other types of care in the co-care group: 11% of laboratory tests and 28.5% and 21% of medications and radiology procedures, respectively. The total cost of care averaged $2588 per year for the co-care group, versus $1469 per year for the specialist care-only group and $965 per year for the internist-only care group. The major portion of the difference in cost of care was due to additional MD visits, which were also more expensive per visit if they were to specialists. The cost per nonspecialist visit was $129.66, while specialist visits had costs of $247.66 per visit to rheumatologists or neurologists, and $236.10 per visit to orthopedists. Differences in medication costs also contributed to the cost of care differences, but to a lesser extent, with more costly medications prescribed to patients in the specialist-only and co-care groups.

Table 2. Utilization of services per year of followup, by type of care.

	Nonspecialty Only, n = 155	Specialty Only, n = 49	Co-care, n = 194	p*
MD visits				
No. per year	3.5	3.6	6.7	< 0.001
$/year	483	792	1355	< 0.001
PT/OT visits				
No./year	1.2	1.3	3.5	0.016
$/year	134	191	435	0.011
Nutrition/EMG visits†				
No./year	0.42	0.41	1.09	0.006
$/year	48	125	194	< 0.001
Laboratory tests				
No./year	3.8	3.1	5.7	0.050
$/year	61	47	84	0.096
Medications				
No./year	3.7	4.1	6.3	< 0.001
$/year	101	195	229	< 0.001
Radiology procedures				
No./year	0.67	0.61	1.42	< 0.001
$/year	138	119	292	< 0.001
Total services				
No./year	13.2	13.1	25.0	< 0.001
$/year	965	1469	2588	< 0.001

*Overall comparison of the 3 groups. † Nutrition and EMG visits combined here because of small numbers of each type of visit.

As Table 3 shows, there was a marginally significant difference between the groups with respect to duration of followup, with individual patients having 6 to 24 months of followup in each care group, while mean followup duration ranged from 12.6 to 14.8 months for the 3 groups (p = 0.069 overall). The groups differed in change in PCS. Patients in the nonspecialist-only and the specialist-only care groups experienced some improvement in PCS per year of followup (1.7 and 3.6 units), while those in the co-care group had less improvement (0.4 units; p = 0.043). There were substantial

Table 3. Health status and cost outcomes by type of care.

	Nonspecialty Only, n = 155, mean (SD)	Specialty Only, n = 49 mean (SD)	Co-care, n = 194, mean (SD)	p*
Followup, (months)	13.8 (6.2)	12.7 (5.4)	14.8 (6.0)	0.069
PCS improvement	1.09 (7.15)	2.50 (6.98)	0.23 (7.59)	0.134
PCS improvement/year	1.67 (8.35)	3.59 (10.06)	0.36 (8.06)	0.043
Adjusted PCS improvement/year†	1.66 (8.22)	3.48 (7.91)	0.65 (8.08)	0.072
Cost of care, $	1059 (1308)	1514 (1449)	3195 (3041)	0.001
Cost of care/year, $	965 (1027)	1469 (1275)	2588 (2039)	0.001
Adjusted cost of care/year†, $	1099 (1681)	1376 (1503)	2517 (1644)	0.001

*Overall comparison of the 3 groups. †Adjusted for patient age, disease duration, pain score, disease burden index, baseline PCS and MCS, and specific musculoskeletal condition (OA alone, OA and LBP versus LBP alone). LBP: low back pain, PCS/MCS: Physical/Mental Component Summary of SF-36.

differences between the groups, both in total costs and in costs per year of followup. Adjusted means for PCS improvement per year and for cost per year were similar to the unadjusted means.

We also compared the care groups for subgroups of patients with OA only, with LBP only, and for patients with both conditions. We identified very similar patterns for costs but not for PCS improvement, as seen in the full study population. Table 4 shows the consistently higher adjusted costs/year for co-care patients compared with the 2 other care groups, for each of OA only, LBP only, and both conditions; and the greater adjusted annualized PCS improvement in the specialist-only care group, but only for those patients with both conditions. Table 4 also shows adjusted means and standard deviations per care group for the patients followed for up to 12 months (n = 226) and between 12 and 24 months (n = 172). For the 57% of patients followed ≤ 1 year the cost and PCS improvement differences are similar to those seen overall and by disease. For patients followed for > 1 year, the cost patterns are unchanged, but the PCS improvements are low in each care group and there are no significant differences between the 3 care groups.

Because of the considerably lower amount of PCS improvement in the patients with co-care and its higher costs, we confined further cost effectiveness comparisons to the specialty-only versus the nonspecialty care groups. The unadjusted ICER is $263 per additional unit of improvement in PCS, while the point estimate for the adjusted ICER is $152. The variability in each ICER is considerable, however. Most of the bootstrap distribution for both the unadjusted and the adjusted ICER has both numerator and denominator > 0, corresponding to a trade-off, i.e., specialty

Table 4. Adjusted health status and cost outcomes: by disease and by length of followup.

	Nonspecialty Only, mean (SD)	Specialty Only, mean (SD)	Co-care, mean (SD)	p*
OA only**	n = 68	n = 14	n = 80	
PCS improvement/year	2.17 (8.62)	2.47 (8.25)	–0.30 (8.57)	0.397
Cost of care/year, $	1175 (1727)	1305 (1652)	2383 (1717)	0.001
LBP only **	n = 67	n = 21	n = 61	
PCS improvement/year	1.75 (7.89)	1.69 (7.50)	2.34 (7.74)	0.898
Cost of care/year, $	1134 (1444)	971 (1372)	2349 (1416)	0.001
Both OA and LBP**	n = 20	n = 14	n = 53	
PCS improvement/year	–0.84 (7.80)	7.67 (7.57)	0.12 (7.64)	0.003
Cost of care/year, $	916 (1926)	1835 (1869)	3034 (1888)	0.001
Followup ≤ 12 mo†	n = 93	n = 34	n = 99	
PCS improvement/year	2.25 (9.62)	4.72 (9.39)	0.89 (9.56)	0.030
Cost of care/year, $	1132 (1651)	1494 (1613)	2561 (1641)	0.001
Followup > 12 mo†	n = 62	n = 15	n = 95	
PCS improvement/year	0.22 (4.71)	0.52 (4.31)	0.72 (4.48)	0.818
Cost of care/year, $	1068 (1773)	979 (1622)	2477 (1687)	0.001

* Overall comparison of the 3 groups.
** Adjusted for patient age, disease duration, pain score, disease burden index, baseline PCS and MCS. † Adjusted for patient age, disease duration, pain score, disease burden index, baseline PCS and MCS, and specific musculoskeletal condition (OA alone, OA and LBP versus LBP alone).

care is both more costly and more effective than nonspecialty care. But nonspecialty care dominates for a small portion of the values, with greater improvement in PCS and less cost per year than for specialty care. This proportion is 11.4% for the unadjusted ICER (median $275) and 7.9% for the adjusted ratio (median $188).

DISCUSSION

In this analysis of costs and effectiveness of care for 2 chronic conditions in the context of VHA outpatient care, the hypothesized cost effectiveness of co-care was not confirmed. Co-care was consistently much more expensive than either of the other patterns of care without evidence of superior effectiveness. On the other hand, we did find some indication that specialists, as the only providers of OA and LBP care for patients, especially for those with both of these chronic conditions, are cost effective compared with nonspecialists (internists). The specialist-only care was as effective or more effective than internist care, with an SF-36 derived PCS improvement 1.82 units greater than that experienced by similar patients cared for by internists only. At just under 20% of the PCS standard deviation, this is a small, but clinically meaningful effect. In the adjusted marginal cost effectiveness ratio, there is an additional yearly cost of $152 per additional unit improvement in PCS.

It might be expected that conditions such as OA and LBP that are commonly seen in internists' practices would be well managed there, but that patients with more complex multisystem disorders that are rarely treated by generalists, such as systemic lupus erythematosis or RA, would fare better if cared for by rheumatologists. Yelin, *et al*[3] found that patients with RA treated by rheumatologists over a time period of up to 11 years reported significantly better functional status (using the HAQ) than patients whose main physician was a nonrheumatologist. On the other hand, a recent study by Katz, *et al*[22] of shorter term (3 month) outcomes of patients with acute knee or shoulder disorders found no differences between internists, rheumatologists, and orthopedic surgeons in pain relief or functional improvement during followup. In addition, a study comparing the ongoing management of OA by family medicine practitioners, general internists, and rheumatologists[23] found no differences between these 3 physician groups in the extent of improvement in pain of physical function over 6 months.

From our study it appears that when there was co-care, the specialist care was generally an add-on to internist care, essentially doubling the use of each type of service, thus adding costs, but not resulting in health status gains in this group of patients. The patients in the specialist-only care group were both younger and better educated than the patients in the other 2 groups, and may have had better outcomes because of early self-referral to specialists. The specialist care provided to patients who also received care from nonspecialists was largely in the form of additional visits. The specialists did not order tests, medications, or procedures at a higher rate than the internists when they were in the role of primary care providers, and generally ordered few additional services when they were in a co-care role. In a context in which specialty and nonspecialty care is coordinated to avoid excessive numbers of visits and duplication of services, this type of co-care could possibly be cost-effective.

The similarities in utilization by specialists and by internists, not only overall but with respect to most components of utilization, is noteworthy. In the context of ongoing care, these 2 types of providers provided very similar care. This contrasts with costs of components of care for acute LBP reviewed by Solomon, *et al*[24], where different types of provider had different utilization patterns. For example, using data from National Ambulatory Medical Care Surveys, Hart, *et al*[25] found that, compared with other providers, internists wrote more prescriptions and orthopedic surgeons and neurologists ordered more radiographs when caring for LBP. Similarly, in a community study of outcomes and costs of care for episodes of acute LBP, Carey, *et al*[26] found differences between care provided by primary care physicians, chiropractors, and orthopedic surgeons — orthopedic surgeons' and chiropractors' frequency of ordering radiographs and total costs were twice those of primary care physicians. In an academic medical center setting over 3 months, Katz, *et al*[22] found greater use of radiographs and magnetic resonance imaging by orthopedic surgeons, and of injection procedures by rheumatologists, compared with general internists caring for patients with new episodes of knee or shoulder pain. In the Mazzuca, *et al* study[23] there were substantial differences in management practices, rheumatologists being more likely than family medicine practitioners or general internists to prescribe exercise or thermal modalities, and to give joint protection advice. The general internists had a different pattern of drug presciption, prescribing lower doses of nonsteroidal antiinflammatory drugs and being more likely to utilize acetaminophen and nonacetylated salicylates than physicians in the other 2 groups.

This was not a randomized study, and it is clear that the patients who received specialist care typically had more severe disease than those who received nonspecialist care only. In particular, they had worse PCS and MCS scores at baseline. To adjust for the disparity we stratified on these factors to calculate an adjusted marginal cost effectiveness ratio. This resulted in improved cost effectiveness, from an additional $263 in yearly costs per unit improvement in PCS for specialty care versus internist care in the unadjusted ICER, to $152 after the adjustment. A possible concern with our adjustment process might be that it did not fully account for bias in care group membership. To assess this we estimated the propensity of patients to be in the specialty care-

only group rather than the internist-only care group, via a stepwise logistic regression in which all baseline variables of Table 1 were eligible for inclusion[27]. Of these variables, only PCS, MCS, age, and years of education contributed to the propensity score. Recalculation of the ICER, adjusting for propensity quintiles, gave a value of $159 per unit PCS improvement, compared with $152 based on PCS and MCS stratification. So we are confident that our health status severity based adjustment was sufficient for the purpose.

The condition-specific and followup duration subgroup analyses of Table 4 suggest that the health status improvement advantages described in the full set of 49 specialist care-only patients (Table 3) with OA and/or LBP and followed between 6 and 24 months apply only if the patient has both OA and LBP, or has been followed for not more than a year. Effects are strong in these subgroups. A person with more than one musculoskeletal condition, here both OA and LBP, could be expected to fare better in the care of specialists. Also, a short term rate of improvement in health status is likely to be greater than a longer term rate, as treatment-based gains in chronic conditions may level off. But the subgroup results are based on small numbers, only 14 and 15 patients in the smaller sets of specialist-only care patients within each subgrouping, so that the results for the full study population should not be summarily discarded.

Many cost effectiveness studies are based on published data for groups, with components of each of the numerator and denominator of the marginal cost effectiveness ratio constructed as ratios of total costs for a treated group divided by total patients or patient-years, and total life-years or quality adjusted life-years (QALY) gained divided by the number of patients in the group. In such circumstances it is essential to assess the stability of the ICER using sensitivity analysis, in which the components are modified in accord with hypothesized variations. Our study differs in two ways from this model.

First, we have individual patient data on the costs and effectiveness measure as well as on possible confounders of choice of treatment. We stratified on disease severity factors to obtain a risk adjusted cost effectiveness estimate. The lack of an exact theoretical confidence interval for an ICER led to the use of bootstrap sampling for the estimation of variability of the ratio. Second, life-years or QALY may not be appropriate for assessment of effectiveness of chronic disease care in the short term because they do not fully capture disease related dysfunction[28]. These measures tend to discriminate against chronic diseases compared with acute adult conditions. We used the SF-36, which has been found to be both reliable and responsive for subjects with musculoskeletal disorders[13]. As the SF-36 is used in future studies, a reference set of effects expressed in terms of changes in SF-36 summary measures may be developed that would aid the interpretation and comparison of effectiveness assessments for a variety of treatments and conditions. One such reference comes from the VHA 1998 National Survey[29], in which PCS for a sample of veterans who were VHA users in 1996 declined by an average of 0.39 points over the 18 months between the 1996 and 1998 surveys.

By design, this study is limited to the VHA outpatient setting. A strength is that, at the time of this study, this was an environment in which patients with chronic conditions could readily choose to receive routine care from specialists. Limitations include the fact that not all care provided to these veterans for OA or LBP was included in our study. We did not include inpatient care, either within or outside the VHA, and some veterans may also have received outpatient care for the conditions outside the VHA (through Medicare eligibility, for example). If inpatient care had been included it would not have changed the direction of the results, although it would have changed the dollar amount of the ICER. During the time of the study, 20 OA/LBP VHA hospitalizations were experienced by 17 of the 398 patients, totaling 224 days of care: 0.15 per patient with ambulatory care provided by nonspecialists only, 0.24 per patient in the specialty-only care group, and 0.97 per patient in the co-care group. When the relevant days of inpatient care are priced according to Diagnosis Related Group-specific VA reasonable charges[30] for room and board and ancillaries for the specific types of hospitalization adjusted to 1995, we estimate additional costs of $271 per patient per year for the internist-only group and $469 per year for the specialist-only group. This reduces the cost effectiveness of specialty care to some extent, increasing the unadjusted ICER by 39%, from $263 to $366 per unit improvement in PCS.

Another possible limitation of this study is the use of patient self-report of OA/LBP. Among the patients classified by self-report as having OA, there were 2 who in later rescreening denied having OA, and a further 2 of 92 who were rescreened for another study who were found to have a different musculoskeletal condition (personal communication, D. Felson). Regardless of the exact diagnosis in each case, all patients in this study received ambulatory care consistent with diagnosis 0f OA/LBP.

It is difficult to accurately estimate costs of care in the VHA. We used outpatient costs from a Boston area medical center. Our results would still be generally applicable in any system in which the relative costs of various types of visits, test procedures, and medications are similar to those we used. However, a major component of the difference in costs between specialty-only care and nonspecialty-only care was the difference in the cost of specialist versus internist visits. If the differential between costs for these 2 types of visits did not exist, i.e., the specialist and internist visits had the same cost, that of an internist visit, the cost effectiveness of specialist versus nonspecialist care would have been improved, with a reduction of the unadjusted ICER from $263 to $93 per unit improvement in the PCS. This 64%

reduction in cost difference would translate into an adjusted ICER of only $54 per unit improvement in PCS.

We found that in VHA outpatient care in some Boston area clinics in 1994-95, specialist-only care resulted in improved functional status outcomes for patients with OA or LBP, at an increased cost, compared with internist-only care, primarily because of the greater cost of specialist visits. Co-care by specialists and internists, however, was not cost effective in this context, with apparent duplication of most types of services and a markedly increased total cost of care per patient-year. It would appear that in a context in which duplication of services by internists and specialists can be avoided, specialists can provide cost effective ongoing care for patients with these chronic conditions.

ACKNOWLEDGMENT

Programming support by L. Curran, L. Ma, X. Cao, and S. Loveland is gratefully acknowledged.

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