Hospital, Pharmacy, and Outpatient Costs for Osteoarthritis and Chronic Back Pain

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ABSTRACT. ***Objective.*** We examined the direct medical costs for patients with osteoarthritis (OA) and chronic back pain (CBP) in comparison to similar patients not treated for these conditions.

Methods. All persons age 18 years and over enrolled in the Lovelace Health Plan (LHP) who had at least 2 outpatient or one inpatient visits during the study period (June 30, 2000 to July 1, 2001) for OA or CBP were identified using discharge billing records. Each patient with OA or CBP was matched to 3 persons of the same age group, sex, and ethnicity, and then utilization and pharmacy records for each study subject were abstracted for comparison.

Results. The prevalence of OA and CBP increased with age (11.0% and 7.2% of persons in the 75–79 age group, respectively), although more than two-thirds of OA and CBP patients in the LHP were below age 65. Patients with OA or CBP were more than 3 times more likely than controls to be admitted to hospital, and their average length of stay, costs per hospital day, and readmission rate were all significantly higher ($p < 0.01$). However, only 58.8% of the excess admissions in the OA group and 48.8% of the excess admissions in the CBP group were attributed to musculoskeletal disease. Outpatient costs were more than doubled among both OA and CBP cases (mean annual outpatient costs of $4684 and $4350, respectively), with increased costs seen in all service areas. Prescription drug costs for OA patients (mean average wholesale price, AWP, $1184) were increased by 102%, with the greatest increases seen in the use of nonsteroidal antiinflammatory drugs (NSAID), gastric acid secretion reducers, and antidepressants. Prescription drug costs for CBP patients were increased by 107% (mean AWP $1331), with the greatest increases seen in the use of antidepressants, NSAID, narcotics, and gastric acid secretion reducers.

Conclusion. Health services and prescription medication costs for patients with OA and CBP were more than double those of matched controls. Much of the increased utilization occurred in areas not commonly associated with musculoskeletal conditions. (J Rheumatol 2004;31:573–83)

Key Indexing Terms:
OSTEOARTHRITIS CHRONIC BACK PAIN COST
ECONOMIC EVALUATION UTILIZATION

Osteoarthritis (OA) and chronic back pain (CBP) are among the most common debilitating conditions reported by patients and represent a substantial burden on the healthcare system[1]. Roughly half of all men and women over age 65 years report having OA[2], and OA and CBP are the 2 leading causes of disability in the United States[3]. Back symptoms are the tenth most common chief complaint for outpatient office visits, and arthropathies including OA are the fifth most common office visit diagnosis[4]. Remarkably, despite the very high prevalence of these conditions, there are few studies on their direct costs for care[5,6], and these do not provide detailed comparison data from similar reference populations that help identify the specific ways these conditions affect utilization. Such data are needed to identify opportunities to improve the cost-effectiveness of care and to facilitate the design of disease management programs.

To examine the direct medical costs of care for OA and CBP, we conducted a population-based case-control analysis of the inpatient, outpatient, and prescription pharmacy utilization of patients with OA and CBP compared to patients of the same age, sex, and ethnicity who were not treated for these conditions.

MATERIALS AND METHODS

This study was conducted among members of Lovelace Health Plan (LHP), a group and network model health maintenance organization (HMO) serving most of New Mexico. The LHP served about 240,000 health plan members in 2001, including members of the commercial plan (roughly 700 employer groups) and managed Medicare and Medicaid plans. Lovelace clients, as ascertained by self-report on annual surveys, are 55.8% non-Hispanic white, 38.7% Hispanic, 2.1% Native American, and 3.4% other racial designations.

The LHP is the HMO product of Lovelace Health Systems, Inc. (LHS), which was owned by Cigna Corporation during the study period. LHS also serves roughly 80,000 fee-for-service clients each year. Lovelace owns and operates a 210 bed acute care hospital on the main Lovelace Medical Center campus in Albuquerque, and 8 primary care plus 2 multispecialty medical centers located in Albuquerque and Santa Fe. LHS employs 285

From the Lovelace Clinic Foundation, Albuquerque, New Mexico, USA.

Supported by a grant from Pharmacia, New York, New York, USA.

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Submitted March 17, 2003; revision accepted August 8, 2003.

physicians. In addition, there are about 2000 contracted network physicians around the state associated with LHP.

Subjects. To identify persons with clinically significant OA and CBP, we reviewed all LHP patients age 18 years and older who had at least 2 outpatient visits on separate days, or one inpatient admission, for OA or CBP during the 12 month study period (July 1, 2000 to June 30, 2001). The International Classification of Disease-9 discharge diagnosis codes used to define OA are listed in Appendix 1. Joint conditions that are usually treated with surgery (e.g., arthrophytes), arthritis that is commonly treated with immune suppressants (e.g., rheumatoid arthritis), inflammatory rheumatic conditions highly likely to involve other organs (e.g., polymyalgia rheumatica), joint complications of systemic diseases (e.g., hemarthrosis and Charcot's arthropathy), and arthropathy associated with infections were excluded. Visits that had an OA code as a primary diagnosis or one of the first 3 secondary diagnoses were included. These codes were validated in this database as part of a separate study on the incidence and prevalence of arthritis in New Mexico[7].

The ICD-9 discharge diagnosis codes used to define CBP are listed in Appendix 2. Visits that had a CBP code as a primary diagnosis or one of the first 3 secondary diagnoses were included. Back conditions related to malignancy, infections, and inflammatory diseases (e.g., ankylosing spondylitis) were excluded. These codes were validated as part of a project designed to improve the evaluation and management of back pain in this system[8].

We excluded patients who withdrew from the LHP at any time during the study period to avoid any biases that might be introduced by patients switching into and out of fee-for-service plans. We also excluded patients who did not have complete utilization data available, which included 45,608 New Mexico Medicaid-HMO patients for whom we did not have complete claims information.

Controls were selected from the LHP population age 18 and over who did not have an OA or CBP diagnosis during the study period. Control patients also had to meet the continuous enrollment criterion. Ethnicity was assigned using a locally developed computer program that identifies Hispanic and non-Hispanic ethnicity based on surname with an accuracy of 90%[9]. Comorbid illnesses were categorized using the Deyo modification of the Charlson Index[10,11].

Data collection and cost estimates. Data for all inpatient and outpatient encounters and prescription drug fulfillment were abstracted from the LHP administrative database. Data elements extracted from outpatient records included the date and location of service, billing area, principal diagnosis and up to 3 additional diagnoses for each encounter, total charges (or claim billed amount), providing and referring physicians, and plan type. For inpatient records, data elements also included date of admission and discharge, length of stay, diagnosis related group, attending physician, and principal surgical procedure, if any. Data extracted from pharmacy records included fulfillment date, drug, amount, strength, average wholesale price, and therapeutic classification. If a patient had a prescription filled by a pharmacy not included in the LHP network, those data would not be available.

Inpatient and outpatient costs were estimated using the charges appearing on claims. The LHP generates claims for all services provided by its staff physicians (internal claims) and processes claims submitted by contracted providers (external claims). For external claims, which represented 30% of patient encounters and 27% of all dollars associated with patient care, the amount requested by the provider was used. Pharmacy costs were based on the average wholesale price of each prescription drug filfillment.

Analysis. Proportional differences between groups were compared using the Mantel-Haenszel test[12]. Differences in utilization and costs, as well as lengths of inpatient stays, between case and control groups were tested using the Mann-Whitney rank-sum test[13]. Differences in the likelihood of hospitalization were compared overall and by Major Diagnostic Category using odds ratios and the Mantel-Haenszel test.

RESULTS

We identified 5129 patients (3123 women, 2006 men) who met eligibility criteria for the OA case group, and 3864 patients (2366 women, 1498 men) who met eligibility for the CBP case group. The prevalence of OA increased steadily with age (Figure 1), while the prevalence of CBP peaked in the 75–79 age group in women and the 80–84 age group in men (Figure 2). However, the majority of all patients treated for either OA or CBP by the LHP were below age 65 (68.6% and 76.7%, respectively; Figure 3). Hispanic patients made up 32.2% of the OA group and 34.6% of the CBP group, which is only slightly lower than expected based on LHP's overall demographic data. A significantly higher prevalence of serious comorbid illnesses (Charlson score ≥ 1) was found among the patients with OA (36.2% vs 25.0% of controls) and CBP (32.9% vs 23.3% of controls) ($p < 0.001$). Non-Hispanic white patients with OA had significantly higher costs than Hispanic OA patients in all utilization categories (inpatient \$2207 vs \$1667; outpatient \$4843 vs \$4408; pharmacy \$1313 vs \$998; $p < 0.001$ in each). Non-Hispanic white patients with CBP also had higher costs than Hispanic CBP patients (inpatient \$1596 vs \$1132; outpatient \$4588 vs \$3908; pharmacy \$1443 vs \$1110; $p < 0.001$ in each). Some of this difference may be because Hispanic patients in the LHP tend to be younger than those who are non-Hispanic white.

Hospital inpatient utilization. Patients with OA were almost 4 times more likely (OR 3.83, 95% CI 3.42–4.29), and patients with CBP 3 times more likely (OR 3.08, 95% CI 2.70–3.53), to be admitted to hospital than their matched controls. Those who were hospitalized were also more likely to have repeat hospitalizations (average number of admissions per hospitalized patient, Table 1). The average length of stay was nearly a full day longer for patients with OA, and more than a half day longer for CBP, than for their controls (Table 1). The average charge per day was also substantially greater in the case groups, and persons below age 65 in all groups had higher costs per hospital day (Table 2).

We classified the primary discharge diagnoses by major system categories to identify the areas of increased utilization, and found that only about half the hospitalizations in either the OA or CBP groups were attributable to musculoskeletal disease (Tables 3A, 3B). There were significantly increased hospitalizations for cardiovascular, respiratory, digestive, and central nervous system conditions, as well as for factors influencing health status ("V codes"). The incidence of childbirth was significantly lower in the OA group and slightly reduced in the CBP group, and was the only category of admission that was reduced in either group.

Outpatient services utilization. Outpatient visits (Table 4) and costs (Table 5) were significantly increased in most service areas for OA and CBP patients compared to controls. Primary care, medical specialty, surgical specialty, and outpatient rehabilitation centers had the greatest absolute

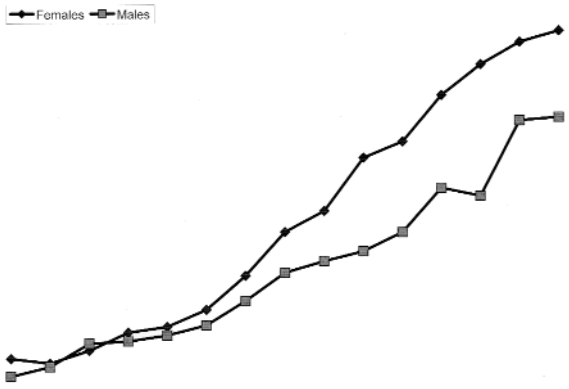

Figure 1. Prevalence of osteoarthritis by age group.

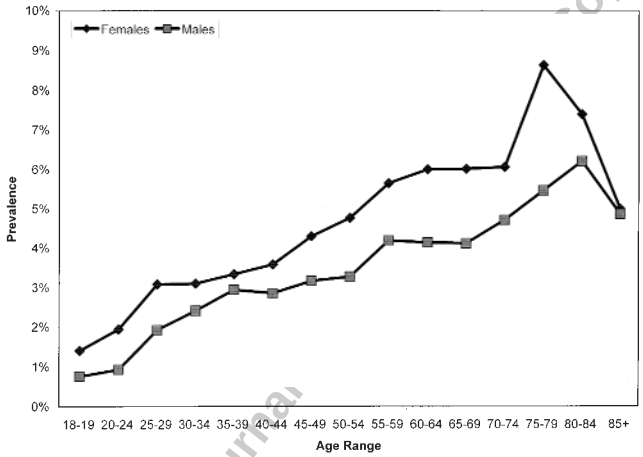

Figure 2. Prevalence of chronic back pain by age group.

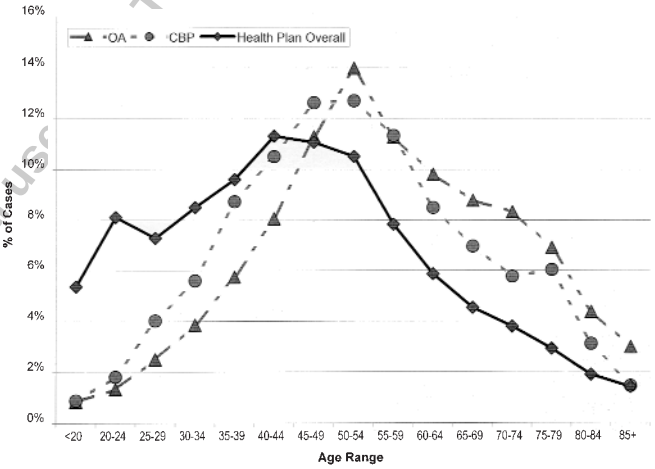

Figure 3. Age distributions of patients with OA and chronic back pain (CBP) compared with all Lovelace Health Plan members.

Table 1. Hospital admissions.

	Osteoarthritis		Chronic Back Pain	
	Study	Control	Study	Control
Total patients in group, n	5129	15,357	3864	11,557
Patients admitted	698	607	451	475
Total admissions	1044	774	635	573
Average no. of admissions per hospitalized patient	1.50	1.28	1.41	1.21
Patients admitted per 1000 patients in group	136.1	39.5	116.7	41.1
Total admissions per 1000 patients in group	203.5	50.4	164.3	49.6
Total discharges	1044	744	635	573
Total days	3909	2196	2077	1563
Average length of stay	3.74	2.84	3.27	2.73
Z score	7.601		3.423	
p	< 0.00001		0.001	

Statistical significance by Mann-Whitney rank-sum test.

Table 2. Hospital days and charges by diagnosis, study group, and age group.

	Total Days	Total Admissions	Average length of Stay, days	Total Charges, $	Charge/Admission, $	Charge/Day,$
Low Back Pain						
Cases						
Age ≥ 65 yrs	1041	242	4.3	1,359,172.19	5,616.41	1,305.64
< 65	1036	393	2.6	2,250,978.09	5,727.68	2,172.76
Subtotals	2077	635	3.3	3,610,150.28	5,685.28	1,738.16
Controls						
≥ 65 yrs	664	203	3.3	774,516.43	3,815.35	1,166.44
< 65	899	370	2.4	1,404,066.97	3,794.78	1,561.81
Subtotals	1563	573	2.7	2,178,583.40	3,802.07	1,393.85
Arthritis Cases						
≥ 65 yrs	2406	558	4.3	3,705,193.80	6,640.13	1,539.98
< 65	1503	486	3.1	3,171,061.74	6,524.82	2,109.82
Subtotals	3909	1044	3.7	6,876,255.54	6,586.45	1,759.08
Controls						
≥ 65 yrs	1213	371	3.3	1,428,135.81	3,849.42	1,177.36
< 65	983	403	2.4	1,706,432.61	4,234.32	1,735.94
Subtotals	2196	774	2.8	3,134,568.42	4,049.83	1,427.40

differences in the average number of visits per patient. However, utilization in several service areas that might not be commonly associated with chronic musculoskeletal conditions, such as neurology, gastroenterology, and mental health, was more than doubled. Thirty-one percent of CBP patients were seen in the pain clinic at least one time during the study period, compared to only 9% of OA patients. The CBP cases also had higher average radiology costs than OA cases. Nearly all of this difference can be accounted for by claims submitted by contract physicians (physicians who are not part of the LHP group practice) for magnetic resonance scans of the spine (54.2% of difference in claims for radiology per case), computer tomography scan/body (5.7%), and diagnostic radiographs (4.7%). Costs for surgical specialty clinics and outpatient surgery were substantially higher for OA patients compared to CBP patients, but in most other outpatient service areas their costs were similar.

Prescription pharmacy utilization. Prescription fulfillments were categorized by therapeutic area. Among OA patients, NSAID (mostly the COX-2 inhibitors) had the greatest increases in both utilization and costs (Tables 6A, 7A). The next greatest increases in costs were seen in the gastric acid secretion reducer and antidepressant categories, which is attributable to the relatively high costs of proton pump inhibitors and serotonin reuptake inhibitors. Increased utilization was found among OA patients in all therapeutic areas, including a 25% increase in utilization of antihypertensive and cardiac medications and greater than 50%

Table 3a. Likelihood of admission by major diagnostic category (MDC) for OA.

MDC	Description	Cases Hospitalized, N = 5129	Controls Hospitalized, N = 15,357	Mantel-Haenszel Common OR Estimate	95% CI Lower	95% CI Upper
8	Diseases and disorders of the musculoskeletal system and connective tissue	493	79	18.87	14.31	24.90*
23	Factors influencing health status and other contracts with health services	23	10	5.64	2.62	12.14*
18	Infections and parasitic diseases	10	5	6.06	1.82	20.19*
6	Diseases and disorders of the digestive system	77	90	2.46	1.74	3.49*
4	Diseases and disorders of the respiratory system	61	80	2.35	1.60	3.45*
19	Mental diseases and disorders	6	6	2.40	0.64	8.93
5	Diseases and disorders of the circulatory system	126	129	2.69	2.02	3.58*
7	Diseases and disorders of the hepatobiliary system and pancreas	27	29	2.49	1.38	4.52*
11	Diseases and disorders of the kidney and urinary tract	21	28	2.10	1.11	3.97*
99	Other DRGs associated with all MDC	11	10	2.67	1.03	6.91*
3	Diseases and disorders of the ear, nose, mouth and throat	6	10	2.12	0.68	6.67
1	Diseases and disorders of the nervous system	41	59	1.84	1.11	3.07*
13	Diseases and disorders of the female reproductive system	62	69	2.56	1.79	3.66*
9	Diseases and disorders of the skin, subcutaneous tissue, and breast	18	15	3.77	1.76	8.08*
14	Pregnancy, childbirth, and the puerperium	10	95	0.25	0.12	0.55
21	Injury, poisoning, and toxic effects of drugs	7	10	1.87	0.61	5.71
10	Endocrine, nutritional, and metabolic diseases and disorders	16	26	1.43	0.70	2.93
12	Diseases and disorders of the male reproductive system	14	10	4.32	1.85	10.11*
20	Alcohol/drug use and alcohol/drug-induced organic mental disorders	4	3	2.96	0.42	21.02

* Significance at 0.05 level.

increase in use of antibiotics. Medications directly related to OA treatment (NSAID and narcotics/analgesics) accounted for only 27.1% of the excess pharmacy cost in the OA group.

Among CBP patients, use of antidepressants was remarkably increased and accounted for the greatest cost differential between CBP and control groups (Tables 6B, 7B). The anticonvulsant category, which includes the commonly prescribed neuroleptic agent neurontin, was also notably increased. Narcotics were more commonly used in CBP patients compared to OA patients, and the average cost per narcotic prescription was higher ($34 vs $26 per prescription, respectively). As expected, use of muscle relaxants was increased in CBP patients compared to controls (difference of 0.7 prescriptions per member), but the difference in their use of antihypertensive and cardiac medications was even greater (difference of 0.9 prescriptions per member).

DISCUSSION

As expected, the prevalence of OA and CBP in the LHP increased with age, although the majority of all patients with OA and CBP in this cohort were below age 65, and younger patients had higher average costs. We found that the annual direct healthcare costs for patients with OA and CBP in this population based cohort were more than double those of age, sex, and ethnicity matched controls that did not have these conditions. Hospital, outpatient, and outpatient pharmacy costs accounted for 16.4%, 68.9%, and 14.7% of total costs for OA patients, and 13.1%, 68.2%, and 18.6% of total costs for CBP patients, respectively. The greatest proportional increase in costs was for hospitalizations: mean inpatient costs for OA patients were $2021 versus $316 for controls, and mean inpatient costs for CBP patients were $1423 versus $317 for controls. However, the greatest absolute increase in cost was for outpatient services, with an average difference of $2950 ($4684 vs $1734) for OA and $2706 ($4349 vs $1643) for CBP. Pharmacy utilization was also substantially increased, but less than half of the difference was for pain relievers or muscle relaxants. We conclude that in this managed care system, OA and CBP affect a much younger population than one would anticipate, that the direct medical costs associated with caring for persons with OA and CBP are as high as or higher than other chronic medical conditions, and that much of the increased

Table 3b. Likelihood of admission by major diagnostic category (MDC) for chronic back pain.

MDC	Description	Cases Hospitalized, N = 3864	Controls Hospitalized, N = 11,557	Mantel-Haenszel Common OR Estimate	95% CI Lower	95% CI Upper
8	Diseases and disorders of the musculoskeletal system and connective tissue	234	48	13.49	9.59	18.97*
23	Factors influencing health status and other contacts with health services	26	8	7.67	3.20	18.31*
18	Infections and parasitic diseases	12	2	13.59	2.92	63.25*
6	Diseases and disorders of the digestive system	60	53	3.32	2.21	5.00*
4	Diseases and disorders of the respiratory system	59	45	3.14	1.98	4.97*
19	Mental diseases and disorders	11	7	4.76	1.56	14.55*
5	Diseases and disorders of the circulatory system	63	90	2.16	1.51	3.09*
7	Diseases and disorders of the hepatobiliary system and pancreas	16	15	2.54	1.18	5.49*
11	Diseases and disorders of the kidney and urinary tract	14	15	2.48	1.11	5.52*
99	Other DRG associated with all MDC	6	6	3.54	1.08	11.66*
3	Diseases and disorders of the ear, nose, mouth and throat	10	7	3.48	1.06	11.47*
1	Diseases and disorders of the nervous system	26	40	1.68	0.96	2.96
13	Diseases and disorders of the female reproductive system	27	54	1.52	0.95	2.44
9	Diseases and disorders of the skin, subcutaneous tissue and breast	9	11	2.37	0.93	6.00
14	Pregnancy, childbirth, and the puerperium	37	125	0.84	0.55	1.27
10	Endocrine, nutritional and metabolic diseases and disorders	10	26	1.13	0.50	2.56
12	Diseases and disorders of the male reproductive system	3	2	2.97	0.42	21.19
20	Alcohol/drug use and alcohol/drug-induced organic mental disorders	2	4	1.47	0.13	16.62

* Significance at 0.05 level.

Table 4. Outpatient visit differences by service area.

	Osteoarthritis			Chronic Back Pain		
	Cases, N = 5129 Visits/Patient	Controls, N = 15,357 Visit/Patient		Cases, N = 3864 Visits/Patient	Controls, N = 11,557 Visit/Patient	
Primary care	7.2	4.0	3.2	8.3	3.8	4.5
Cardiology	0.5	0.3	0.2	0.5	0.2	0.3
Neurology	0.2	0.1	0.1	0.3	0.1	0.2
OB/GYN	0.3	0.2	0.1	0.4	0.3	0.1
Gastroenterology	0.2	0.1	0.1	0.2	0.1	0.1
Mental health clinic	0.4	0.2	0.2	0.5	0.2	0.3
Ophthalmology/optometry	0.9	0.6	0.3	0.8	0.5	0.3
Pain clinic	0.2	0.0	0.2	0.8	0.0	0.8
Other medical specialties	8.1	3.8	4.3	7.2	3.5	3.7
Laboratory	0.6	0.3	0.3	0.7	0.4	0.3
Radiology	0.5	0.2	0.3	0.6	0.2	0.4
Surgical specialties	3.7	0.8	2.9	1.9	0.8	1.1
Outpatient surgery	0.6	0.2	0.4	0.4	0.2	0.2
Outpatient rehabilitation	3.1	0.4	2.7	4.5	0.3	4.2
Emergency department	0.7	0.3	0.4	0.8	0.3	0.5
Home health	0.5	0.3	0.2	0.3	0.2	0.1
Ambulance	0.1	0.0	0.1	0.1	0.0	0.1
Other outpatient services	1.1	0.6	0.5	1.2	0.5	0.7
	28.8	12.5	16.3	29.3	11.7	17.6

Table 5. Outpatient visit cost differences by service area. All values are dollars.

	OA Mean Costs		Marginal cost of OA (case cost minus control cost)	Chronic Back Pain Mean Costs		Marginal Cost of low back pain (case cost minus control cost)
	Cases N = 5129	Controls N = 15,357		Cases N = 3864	Controls N = 11,557	
Other medical specialties	1263	501	762	1222	456	766
Primary care	514	272	242	590	264	326
Surgical specialties	893	202	691	477	207	270
Outpatient rehabilitation	195	26	169	283	23	260
Pain clinic	55	13	42	220	5	214
Outpatient surgery	679	185	495	390	191	199
Radiology	139	47	92	227	47	181
Emergency department	176	77	99	212	74	138
Other outpatient services	224	105	119	201	98	103
Neurology	72	20	52	84	18	66
Cardiology	100	54	46	95	44	51
Gastroenterology	101	60	41	88	58	30
Mental health clinic	38	23	15	49	20	28
Laboratory	36	22	14	41	21	21
Ambulance	36	12	24	30	11	19
Ophthalmology/optometry	88	71	18	77	62	16
Home health	46	24	21	32	18	14
OB/GYN	27	19	7	32	27	5
Total	4684	1734	2950	4349	1643	2706

All difference significant at 0.01 level by Mann-Whitney rank-sum test.

utilization is for services not commonly associated with musculoskeletal disease.

By using case-control methods and the comprehensive utilization database of this population based cohort, we were able to describe the "marginal costs" (also known as "incremental costs") associated with these conditions, which is the total cost difference between cases and controls by each category. This is in contrast to studies that attempt to focus only on the care that can be directly attributed to a particular condition, which is often known as the "attributable costs" approach. The marginal costs method has the advantage of being able to identify areas of unexpectedly increased utilization that can be overlooked when analyzing only attributable costs. Using this method, we were able to describe how OA and CBP also affect utilization for other related conditions, especially depression and gastroenteritis, which would have been difficult to examine without a closely matched reference population. Recent consensus reports on economic studies in rheumatology have strongly recommended using reference populations and data whenever possible, and this project indicates the usefulness of such an approach[6,14,15].

The only other population based study that has compared OA utilization and costs to a reference population was published by Gabriel, *et al* in 1997, and was based on the Mayo Clinic's Olmsted County Healthcare Utilization and Expenditures Database[16]. That study was substantially different from ours in several ways. Most important, it was not a matched case-control study: all persons who had an OA diagnosis at any time during a 12 year period (n = 6742, mean age 69.0 yrs, 65.5% female) were compared to all adults from the same population who did not have an arthritis diagnosis (n = 25,904, mean age 51.5 yrs, 51.3% female). The Olmsted County population most likely was not as severely affected as ours because they included persons who may have had only one OA diagnosis during this time period. Also, the Mayo Clinic database does not have pharmacy data, so prescription drug use had to be estimated from a limited medical record abstraction. Nevertheless, the Gabriel study did find that average direct medical costs for OA were more than twice those of the reference group, and that care was also increased for almost every other condition including respiratory, cardiovascular, gastrointestinal, neurological, and psychiatric conditions, and for general medical care. The OA patients used more (in decreasing order) cardiac agents, diabetes medications, diuretics, beta blockers, and ulcer medications, but the age and sex adjusted median price for prescription medications was not different between the OA and nonarthritic patients ($75.37 vs $75.90, respectively). Our results differed, in that we found overall outpatient and prescription pharmacy utilization to be much greater than that seen in the Mayo Clinic study, with prescriptions and utilization for depression and gastritis symptoms accounting for much of the difference.

Lanes, *et al* in 1997 reported on the costs and utilization

Table 6a. Prescriptions by therapeutic class for OA.

Drug Grouping System Description	Cases		Controls		Differences	
	Total Fills	Fills/Member	Total Fills	Fills/Member	Fills/Member	Relative Difference, %
	N = 5129		N = 15,357			
NSAID	9152	1.78	6621	0.43	1.35	414
Narcotic–analgesic	7780	1.52	5771	0.38	1.14	404
Muscle relaxants	1554	0.30	1817	0.12	0.18	256
Anticonvulsants	2270	0.44	2877	0.19	0.26	236
Gastric acid secretion reducers	4999	0.97	7873	0.51	0.46	190
Antidepressants/SSRI/anxiolytics	9450	1.84	15,155	0.99	0.86	187
Corticosteroids	3188	0.62	5674	0.37	0.25	168
Antibiotics	7108	1.39	12,928	0.84	0.54	165
Antihistamines	3116	0.61	6277	0.41	0.20	149
Other	13,046	2.54	26,713	1.74	0.80	146
Bone resorption suppression agents	1632	0.32	3744	0.24	0.07	131
Antihypertensive & cardiac	20,181	3.93	47,971	3.12	0.81	126
Hormone replacements	11,318	2.21	27,340	1.78	0.43	124
Diabetes medications & tests	5049	0.98	12,756	0.83	0.15	119
Lipotropics	3697	0.72	9849	0.64	0.08	112
Total	103,540	20.19	193,366	12.59	7.60	160

All differences significant at 0.01 level by Mann-Whitney rank-sum test. Relative difference is calculated by dividing fills per case by fills per control. SSRI: selective serotonin reuptake inhibitors.

Table 6b. Prescriptions by therapeutic area for chronic back pain.

Drug Grouping System Description	Cases		Controls		Differences	
	Total Fills	Fills/Member	Total Fills	Fills/Member	Fills/Member	Relative Difference, %
	N = 3864		N = 11,557			
Muscle relaxants	3011	0.78	1160	0.10	0.68	776
Narcotic–analgesic	8801	2.28	3931	0.34	1.94	670
Anticonvulsants	3091	0.80	1735	0.15	0.65	533
NSAID	5888	1.52	4911	0.42	1.10	359
Antidepressants/SSRI/Anxiolytics	9893	2.56	10,354	0.90	1.66	286
Gastric acid secretion reducers	3709	0.96	5486	0.47	0.49	202
Antibiotics	5579	1.44	9627	0.83	0.61	173
Bone resorption suppression agents	1117	0.29	1951	0.17	0.12	171
Corticosteroids	2381	0.62	4160	0.36	0.26	171
Other	10,571	2.74	18,507	1.60	1.13	171
Antihistamines	2501	0.65	4576	0.40	0.25	163
Hormone replacements	8335	2.16	17,665	1.53	0.63	141
Antihypertensive & cardiac	13,483	3.49	29,960	2.59	0.90	135
Lipotropics	2702	0.70	6273	0.54	0.16	129
Diabetes medications & tests	3850	1.00	9145	0.79	0.21	126
Total	84,912	21.98	129,441	11.20	10.77	196

All differences significant at 0.01 level by Mann-Whitney rank-sum test. Relative difference is calculated by dividing fills per case by fills per control. SSRI: selective serotonin reuptake inhibitors.

for OA and rheumatoid arthritis in a group model HMO using an attributable costs approach[17]. As in our study, their case accrual period was one year, but costs were estimated using Medicare reimbursement schedules. Case selection criteria were also slightly different, and they found an overall OA prevalence of 10.5% (8.5% treated) among all adult members age 30 and over, with over two-thirds of those with OA in this HMO age 65 and older. The estimated average cost of OA care was $543 per patient-year, with 46% of that attributed to hospital care, most of which was for hip or knee replacement. Arthritis related prescription drugs (NSAID, analgesics, injected steroids, and anti-ulcer drugs) accounted for 32% of the total medical costs ($173 per patient), and only 3.3 office visits per year were attributed to OA, including 1.2 visits to physical therapy. The remarkable difference in outpatient costs reported by the Lanes study (only 22% of OA attributed costs, or $119 per year) and those in our study (57% of OA marginal costs, or $2949 per year), illustrates not only the large amount of utilization that might be missed in an attributable cost analysis, but also how limiting the items selected for inclusion can significantly affect the interpretation of the data.

Table 7a. Prescription costs by therapeutic area for OA.

Drug Grouping System Description	Cases Cost/Member, $ N = 5129	Controls Cost/Member, $ N = 15,357	Differences Cost/Member, $	Differences Relative Difference, %
NSAID	126.92	26.84	100.07	473
Narcotic–analgesic	39.58	10.49	29.08	377
Muscle relaxants	13.35	5.36	8.00	249
Anticonvulsants	43.12	15.21	27.91	284
Gastric acid secretion reducers	135.14	70.01	65.13	193
Antidepressants/SSRI/anxiolytics	125.94	71.29	54.65	177
Corticosteroids	31.01	22.12	8.89	140
Antibiotics	63.55	35.88	27.66	177
Antihistamines	42.81	29.42	13.39	146
Other	185.57	119.25	66.32	156
Bone resorption suppression agents	25.22	19.49	5.73	129
Antihypertensive & cardiac	160.68	133.08	27.60	121
Hormone replacements	44.54	37.72	6.82	118
Diabetes medications & tests	60.77	50.39	10.38	121
Lipotropics	86.22	76.30	9.92	113
Total	1,184.43	722.86	461.58	164

All differences significant at 0.01 level by Mann-Whitney rank-sum test. Relative difference is calculated by dividing cost per fill per case by cost per fill per control. SSRI: selective serotonin reuptake inhibitors.

Table 7b. Prescription costs by therapeutic area for chronic back pain.

Drug Grouping System Description	Cases Cost/Member, $ N = 3864	Controls Cost/Member, $ N = 11,557	Differences Cost/Member, $	Differences Relative Difference, %
Muscle relaxants	34.66	4.66	30.00	744
Narcotic–analgesic	76.57	7.48	69.09	1024
Anticonvulsants	85.51	12.74	72.77	671
NSAID	101.93	26.99	74.94	378
Antidepressants/SSRI/anxiolytics	172.21	67.21	105.00	256
Gastric acid secretion reducers	134.25	65.73	68.51	204
Antibiotics	66.53	35.69	30.84	186
Bone resorption suppression agents	22.56	13.58	8.98	166
Corticosteroids	31.26	20.52	10.74	152
Other	223.24	105.57	117.67	211
Antihistamines	43.76	28.75	15.01	152
Hormone replacements	45.28	31.92	13.36	142
Antihypertensive & cardiac	146.43	110.82	35.61	132
Lipotropics	84.56	63.97	20.58	132
Diabetes medications & tests	62.63	47.26	15.37	133
Total	1,331.38	642.90	688.48	207

All differences significant at 0.01 level by Mann-Whitney rank-sum test. Relative difference is calculated by dividing cost per fill per case by cost per fill per control.

There are very few data on which to compare our findings on CBP costs. Most cost analyses for CBP are either global estimates based on national data[18] or clinical trials of highly selected patients that compare various treatment modalities[19-23]. In a report on 6000 patients aged 21 to 64 who were hospitalized for back pain in 1993[24], average annual costs for those treated surgically were $13,990, with just over half this total attributed to hospital charges, and an average length of stay of 3.1 days. Average annual costs for medically treated patients in this study were $7120, and the average length of stay was 4.1 days. Our data for hospitalized patients are similar to these figures. In a study of Medicaid patients who were enrolled in the program from July 1991 to June 1992, Taylor and colleagues examined utilization of prescription drugs in 6744 non-elderly low back pain patients from Iowa[25]. Average annual costs were $163 per person for drugs directly related to back pain and, as in our study, antidepressants accounted for a high proportion of the pharmacy expenditures.

Several limitations in our study must be considered,

especially when comparing our data to that from other populations. Costs and utilization for management of CBP can vary widely, and are affected largely by access to special services and physician practice behavior. Patients in the Lovelace system have relatively open access to a procedurally based pain clinic, which was visited by 9.2% of the OA patients and 31.2% of the CBP patients at least once during the study year. This may result in higher costs than other programs that emphasize noninvasive allopathic, chiropractic, physical therapy, or educational approaches. Other managed care systems are likely to have physician practice patterns and treatment resources that are different from the Lovelace system, and their costs and utilization for OA and CBP will be affected by these differences. Charge data may not accurately reflect true costs, and the charge data provided by Lovelace network providers do not necessarily represent what was eventually paid to them. Nevertheless, these inaccuracies do not affect the comparison of our case and control groups, and we have presented the data in terms of utilization of services and costs to help facilitate comparison with data from other medical systems.

The data from this study reveal several areas in OA and CBP management where costs could be reduced or services improved. Disease management programs have been most successful in complicated diseases such as diabetes or OA where costs can be reduced by preventing unnecessary hospitalizations, and care improved by applying evidence based treatment guidelines. We found that about one-third of the OA and CBP patients in the LHP were medically complicated, as evidenced by a high prevalence of comorbid conditions and by substantially increased utilization of drugs and services not directly related to musculoskeletal pain. Clinical trials in other populations have shown that application of diagnosis and treatment protocols for CBP can reduce total healthcare costs while improving outcomes and patient satisfaction. We believe that development and implementation of disease management programs for OA and CBP in this and other health systems are very likely to be clinically successful and able to demonstrate cost-effectiveness.

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Appendix 1

ICD-9 discharge diagnosis codes used to identify patients with osteoarthritis.

715.xx Osteoarthritis and allied disorders; primary or secondary, localized or generalized; any site

716.xx Other and unspecified arthropathies; all types; any site
719.4 Pain in joint (arthralgia)
719.5 Stiffness in joint, not elsewhere classified
719.6 Other symptoms referable to joint (crepitus, snapping hip)

Appendix 2

ICD-9 Discharge diagnosis codes used to identify patients with chronic back pain.
722.10 Lumbar intervertebral disc without myelopathy
722.2 Displacement of intervertebral disc, site unspecified, without myelopathy
722.5x Degeneration of thoracic or lumbar intervertebral disc
722.6 Degeneration of intervertebral disc, site unspecified
722.70 Intervertebral disc disorder with myelopathy, unspecified region
722.73 Intervertebral disc disorder with myelopathy, lumbar region
722.80 Postlaminectomy syndrome, unspecified region
722.83 Postlaminectomy syndrome, lumbar region
722.90 Other and unspecified disc disorder, unspecified region
722.93 Other and unspecified disc disorder, lumbar region
724.00 Spinal stenosis, other than cervical, unspecified region
724.02 Spinal stenosis, other than cervical, lumbar region
724.2 Lumbago
724.3 Sciatica
724.4 Thoracic or lumbosacral neuritis or radiculitis, unspecified
724.5 Backache, unspecified
724.6 Disorders of sacrum
724.7 Disorders of coccyx
724.71 Hypermobility of coccyx
724.79 Disorders of coccyx, other
724.8 Other symptoms referable to back
724.9 Other unspecified back disorders
738.4 Acquired spondylolisthesis
738.5 Other acquired deformity of back or spine
739.3 Nonallopathic lesions, not elsewhere classified, lumbar region
739.4 Nonallopathic lesions, not elsewhere classified, sacral region
756.11 Anomalies of spine, spondylolysis, lumbosacral region
756.12 Anomalies of spine, spondylolisthesis
846.x Sprains and strains of sacroiliac region
847.2 Sprains and strains of other and unspecified parts of back, lumbar
847.3 Sprains and strains of other and unspecified parts of back, sacrum
847.9 Sprains and strains of other and unspecified parts of back, unspecified site of back