The Effect of Health Related Quality of Life on Reported Use of Health Care Resources in Patients with Osteoarthritis and Rheumatoid Arthritis: A Longitudinal Analysis

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ABSTRACT. ***Objective.*** In today's cost conscious environment, health services researchers are consistently trying to find ways to predict future health care resource utilization (HCRU) and its associated costs. We evaluated the impact of health related quality of life (HRQL) on future HCRU in patients with arthritis.

Methods. A total of 642 patients with rheumatoid arthritis (RA) and 395 patients with osteoarthritis (OA) completed at least 2 and as many as 6 consecutive surveys at 6 mo intervals. Information collected included demographics, HRQL questionnaires [Medical Outcome Study Short Form 36 (SF-36), Western Ontario McMaster Universities Osteoarthritis Index (WOMAC), and the Stanford Health Assessment Questionnaire (HAQ)], and HCRU over the previous 6 months. Longitudinal data analysis was performed to assess the effect of HRQL on future HCRU.

Results. Statistically significant associations between HCRU and HRQL variables were noted. Higher rates of HCRU were found in those in the worst quarter compared with those in the best quarter of HRQL. With the HAQ, OA and RA patients in the worst quarter reported a 199% ($p < 0.05$) and 48% ($p < 0.05$) increase in rheumatologist visits, respectively. With the WOMAC Function, increases were as high as 196% ($p < 0.05$) in rheumatologist visits for patients with OA. Patients with RA with a high level of HRQL as measured by the SF-36 (physical component score) reported a decrease of 31% ($p < 0.01$) in general practitioner visits and a decrease of 52% ($p < 0.01$) in hospitalization (mental component score).

Conclusion. These findings suggest that HRQL may be used to predict future health care consumption. Such an approach may lead to a more efficient allocation of resources by providing useful information to health care providers and health care decision makers. (J Rheumatol 2002;29:1147–55)

Key Indexing Terms:
HEALTH CARE RESOURCE UTILIZATION HEALTH RELATED QUALITY OF LIFE
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Health care expenditures have been increasing for several decades in industrialized countries. Moreover, the aging of the population in developed countries will result in an increase in the number of people with chronic conditions. It is known that chronically ill patients are high users of health care services. Consequently, it is now of primary interest for public health policy makers to optimize health care expenditures given that the resources allocated to public health are limited.

To permit such optimization, it seems important to identify determinants of health care resources consumed by people with chronic diseases. During the last 2 decades, many studies attempted to evaluate factors explaining the use of health care services in chronically ill and elderly people[1-3]. These studies were essentially grounded in the Andersen model, which relates use of health service to: (1) predisposing factors (i.e., sociodemographic characteristic and health beliefs); (2) enabling factors (i.e., ability to secure health services); and (3) need factors (i.e., illness related factors)[4]. Need factors may be divided between "perceived need" and "evaluated need." Most studies showed that need factors were the most important predictors of health care use[1-3].

Health related quality of life (HRQL) can be categorized as "perceived need," whereas medical diagnoses can be considered part of "evaluated need"[1]. HRQL is indeed a multidimensional self-reported indicator of health status. HRQL is increasingly used today as an evaluation criterion in clinical, therapeutic, and pharmacoeconomic studies[5,6]. It is well recognized that HRQL is a relevant measure for the evaluation of patients in such studies, provided that the instruments are reliable and valid. In clinical practice, many people visit their health care providers because they do not feel well, and their perceived health status is often related to an underlying physiological disease. However, it should be noted that people may report different levels of health status at different times although their underlying physical health may be stable. We use the general term HRQL here to describe any functional or mental aspects of illnesses.

Osteoarthritis (OA) and rheumatoid arthritis (RA) are 2 rheumatic chronic conditions that progress slowly. OA is characterized by a degenerative change in the bone and cartilage of one or more joints and progressive erosion of joint surfaces. RA is an inflammatory disease that induces stiffness, swelling and sometimes destruction of joints. Such diseases lead to functional limitations and disability for those affected. As a result, patients with OA and RA report impairment of their ability to carry out activities of daily living in addition to deterioration in HRQL[7-10]. It has also been shown that patients with such conditions may experience symptoms of depression[11-13]. Both OA and RA are highly prevalent conditions[14,15], particularly in the elderly female population[16,17], and some studies have predicted an increasing prevalence[18,19]. Arthritic patients are very high users of health care services due to the duration of disease and the impairment related to their illness[20-23]. Further, nonmedical costs of such musculoskeletal conditions are substantial[24-26].

Several studies have investigated the determinants of health care resource utilization (HCRU) consumed by arthritic patients, but have produced varying results due to the differences in their applied methodology[27-29]. Nevertheless, self-reported indicators of health were always related to health care utilization. Moreover, psychological and depression scores have been shown to predict subsequent physician visits in RA[30,31]. Interestingly, poorer function as evaluated by the Health Assessment Questionnaire (HAQ) disability index has recently been shown to be associated with higher direct medical cost in patients with RA[23,32-34].

We evaluated the impact of HRQL on future health care resource utilization in people affected by OA and RA. In an environment of limited resources and increasing prevalence of these diseases, identifying the impact of HRQL on HCRU could improve patient care and minimize direct and indirect costs of such conditions by providing better information to health care providers and health care decision makers about the behavior of patients regarding the consumption of health care resources[35]. In this study, 3 different instruments were used, briefly described below. Each of them assesses distinct domains of health.

It can be argued that HRQL and HCRU are merely traits of people with chronic conditions such as OA and RA. One method to test this and determine the predictive value of HRQL on health resource use is through the use of a longitudinal analysis. We performed such an analysis with a comprehensive longitudinal data bank to show that HRQL as measured by valid and reliable HRQL associated instruments can predict future health care resource utilization.

MATERIALS AND METHODS

Data for our analysis were derived from a large cohort of patients with RA and OA who were followed longitudinally by mail survey since 1974 for research purposes in an outpatient rheumatology clinic: the Arthritis Research Center at the University of Kansas, Wichita, Kansas[26,36]. Patients with RA satisfied the 1958 or 1987 diagnostic and classification criteria for RA from the American Rheumatism Association[37,38]. Patients with OA were defined according to the classification criteria for diagnosis from the American College of Rheumatology[39,40]. Except for giving consent and having RA or OA as defined above, there were no selection criteria for inclusion in the data bank. All patients completed comprehensive mailed surveys every 6 months. At each assessment, demographic, HCRU, and HRQL variables were collected. All variables used in the analysis were self-reported.

Demographic variables included sex, age, number of years of education, and current marital status (married/unmarried). The surveys also asked for height and weight, which were converted into body mass index (BMI, expressed in kg/m^2). To assess comorbidity, we used a 21 item list of comorbid conditions and inquired whether the symptom/condition was present during the last 6 months and whether it had been present in the past. The total number of comorbid conditions was calculated (comorbidity index)[41].

HCRU reported by the patient for a 6 month period was classified into the following 6 groups: general practitioner visits; rheumatologist visits; specialist visits (rheumatologist, gastroenterologist, urologist, surgeon, podiatrist); other health care worker visits (chiropractor, physical or occupational therapist, nurse practitioner, physician assistant, social worker); diagnostic procedures (nuclear magnetic resonance, computerized tomography, endoscopy, colonoscopy, radiographs); and hospitalizations (number of inpatient stays and emergency room visits). These groups of resource items were created to reflect meaningful categories of services.

To measure HRQL, 3 instruments were included in the biannual survey: the Medical Outcomes Study Short Form-36 (SF-36) as a generic measure of HRQL, the Stanford Arthritis Center Health Assessment Questionnaire disability index (HAQ), and the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) as disease-specific HRQL measures. The SF-36 was added to the questionnaire assessments in 1995 and the WOMAC was added in 1996. The HRQL instruments were completed by all patients regardless of their diagnosis.

The SF-36 is a generic HRQL instrument. There are 36 items that measure 8 domains of health status as reported by the patient with a 4 week recall period: physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, and mental health[42].

These 8 domains vary in scores from 0 to 100, with lower scores indicating lower levels of HRQL, and can be summarized into 2 summary scores[43]: the physical component summary and the mental component summary. These 2 components are scored in such a way that higher scores reveal better HRQL. One of the strongest attributes of the SF-36 is its consistently high levels of reliability (test-retest and internal consistency) and validity (content, concurrent, criterion, construct, and predictive)[44,45]. The SF-36 has been broadly applied and validated in measurement of health outcomes in various arthritic conditions[46-49].

The HAQ disability index is a disease-specific scale designed to assess the health status of persons with rheumatic diseases[50,51] that measures difficulties in performing activities of daily living, the need for equipment, and the necessity of physical assistance to carry out tasks. It assesses disability over the past week by asking questions in 8 categories of function: dressing, arising, eating, walking, hygiene, reach, grip, and activities. The mean of the 8 category scores gives the disability index, which is continuous from 0 to 3, with higher scores indicating greater dysfunction. Since its development in 1980, this instrument has become one of the most widely used disease-specific HRQL instruments in many rheumatic diseases. It has been shown to possess construct and convergent validity in addition to being reliable and responsive to change over time in numerous studies[52,53].

The WOMAC is also a disease-specific instrument that assesses OA related disability in the hip and the knee. The version used here applied a one week recall period. This instrument produces a separate score for each of the following concepts: physical function, stiffness, and pain[54]. Like the HAQ, lower scores indicate less dysfunction for each concept (physical function 0–170, stiffness 0–20, and pain 0–50). This instrument has proven reliability and validity in different settings and has been widely used in clinical trials to measure outcomes in patients with OA[55-57]. Indeed, the WOMAC has also been used successfully to assess dysfunction in patients with RA[58,59].

Patients were included in this analysis if they completed at least 2 consecutive surveys including the 3 HRQL instruments between January 1996 and December 1998. During this time, attempts were made to recruit additional subjects into the data bank. Such patients often did not agree to longterm participation and had only a single observation in the data bank. In addition, many of these patients had not yet had the opportunity to complete more than a single survey. Others were lost for reasons that included death or mental incapacity. All patients in this analysis had at least 2 surveys and some patients completed as many as 6 surveys during the 36 month period. Nevertheless, we tested whether patients with only one study observation were demographically different or had worse HRQL than those with multiple study observations. We randomly selected one visit from those with multiple observations and compared their data with patients having only a single observation, using t tests.

Regression analysis was performed to evaluate the effect of HRQL on HCRU. The primary independent variables were HRQL as measured by the SF-36 physical component summary, SF-36 mental component summary, HAQ, and the 3 WOMAC dimensions. For clarity, each independent HRQL variable was categorized into quarters. Each quarter was transformed into dichotomous "dummy" variables and the lowest quarter was used as the reference group in all analyses. Potential confounding variables included age, sex, BMI, marital status, comorbidity, and education. The modeling stipulated that health care resource use collected by survey at time t could be predicted by the HRQL assessment from the survey at time t – 1. In other words, the health care resources consumed over the 6 month period between time t – 1 and t were regressed on HRQL scores achieved from survey at time t – 1.

The dependent variables were intrinsically count-data and did not follow a normal distribution. To deal with both the non-Gaussian nature of the dependent variable and the unbalanced longitudinal aspect of the data set, we estimated our regression function using a generalized estimating equation for an underlying Poisson distribution[60,61]. All analyses were performed with the statistical package STATA® version 6.0 with the generalized estimating equation procedure for longitudinal data (XTGEE)[62]. The observations for a particular individual in the data bank were not independent, therefore a within-patient correlation structure was specified. The Poisson model was created with an equal within-patient correlation structure, i.e., the correlations between each time period within the same patient were assumed to be equal. In addition, we implemented the Huber/White/Sandwich estimator of variance that yields valid standard error estimation even if the within-patient correlations are not as hypothesized[62]. To enhance the interpretability of the results, we took the exponential form of the regression coefficient of each HRQL variable from the Poisson analysis to produce an incidence rate ratio (IRR).

In a preliminary bivariate analysis, each independent variable was included in a Poisson model to ascertain its effect on each dependent variable separately. Multivariable models were created by adding the hypothesized covariates into the models individually to assess the extent of confounding. Neither the preliminary bivariate analysis nor the model building exercises showed any evidence that marital status and education should be included in the final models, therefore they were not considered in further analyses. We found that by including age, sex, number of comorbid conditions, and BMI in the model, the effect estimates changed substantially, indicating that our chosen covariates were indeed confounding the relationship between HRQL and HCRU. Each HRQL variable was assessed separately to avoid collinearity between the different instruments. Analyses were performed separately for the OA and RA subgroups.

RESULTS

Between January 1996 and December 1998, 1835 patients completed at least one survey and were potential subjects for the study. Of those, the numbers having 2, 3, 4, 5, and 6 observations in the data bank were 1037, 538, 419, 229, and 37, respectively. Therefore, 1037 completed at least two 6-month consecutive surveys and were included in this analysis. This represents 3297 surveys in all. As expected, patients with one observation were younger (61.6 vs 63.1 yrs; $p = 0.028$) and had shorter duration of disease (10.4 vs 13.6 yrs; $p < 0.001$). They also had a slightly more abnormal SF-36 mental component summary (42.5 vs 44.1; $p = 0.021$). But no statistically significant differences were found for measures of physical status.

Of patients included, 395 had OA and 642 had RA. They completed 1277 and 2020 surveys, respectively. Table 1 illustrates the characteristics of the patient group at their first survey during the 3 year period. RA patients were younger than the OA patients by about 8 years and had fewer comorbid conditions. Urinary problems (58% for OA

Table 1. Characteristics of patients at first study survey.

Characteristic	OA Patients, n = 395	RA Patients, n = 642
Age, yrs, mean (SD)	68.4 (11.2)	60 (13.8)
% Female	73.2	76.6
Education level, yrs, mean (SD)	13.3 (2.4)	12.9 (2.2)
% Married	68.9	71.5
% White	95.7	96.3
BMI, kg/m^2, mean (SD)	31.1 (6.8)	26.5 (5.7)
Number of comorbid conditions, mean (SD)	4.9 (2.8)	3.9 (2.8)
Duration of disease, yrs, mean (SD)	18 (11.5)	12.4 (10.3)

and 43% for RA patients), hypertension (59% OA and 38% RA), gastrointestinal ulcers (42% OA and 36% RA), cardiovascular conditions (42% OA and 28% RA), and depression (32% OA and 33% RA) were the most reported comorbid conditions. The majority of patients were married and white. As might be expected, there was a high proportion of women.

Table 2 displays the percentage of patients with different types of HCRU by diagnosis. From this table, skewed distributions of the health care resource utilization data are evidenced. Table 3 shows the quartile cutoffs for each HRQL instrument. We computed the mean scores by patient for each HRQL instrument. It should be kept in mind that the SF-36 is scored in such a way that high scores indicate better HRQL. However, higher scores on the HAQ and WOMAC indicate worse HRQL. The observed scores from the 2 summary component of the SF-36 clearly showed that OA and RA patients experienced a low level of function both physically and mentally. For comparison purposes, the median norms for the healthy US population with no chronic conditions as published by the developers of the SF-36 are 55.8 for the physical component summary and 54.7 for the mental component summary[43]. Interestingly, the cutoffs for the 75th percentile for both disease-specific instruments was less than half of the worst possible score, suggesting that most patients with OA and RA did not perceive severe dysfunction as evaluated by such instruments.

Tables 4 and 5 show the multivariable results for the effect of HRQL variables on HCRU. Compared to the highest levels of HRQL (4th quarter for the SF-36 and 1st quarter for the HAQ and WOMAC), poor HRQL (1st quarter for the SF-36 and 4th quarter for the HAQ and WOMAC) was associated with increased consumption of health care resources for all models except physical component summary and rheumatologist visits for patients with OA, and WOMAC Stiffness and other health care worker visits for patients with RA. Although there was a numerical pattern towards more HCRU across each quarter of HRQL decrement, the estimates for the 2nd and 3rd quarter were seldom significant.

Table 2. Percentages of patients with different types of health care resource utilization by diagnosis.

	Health Care Resource Utilization											
	GP Visits		Rheumatologist Visits		Specialist Visits		Health Care Worker Visits		All Procedures		Hospitalizations	
Number	OA, n = 395	RA, n = 642	OA, n = 395	RA, n = 642	OA, n = 395	RA, n = 642	OA, n = 395	RA, n = 642	OA, n = 395	RA, n = 642	OA, n = 395	RA, n = 642
0	30.7	39.9	93.8	35.0	68.7	29.0	66.6	67.9	71.6	72.5	83.2	84.0
1	29.9	24.1	4.6	24.8	13.6	22.5	11.2	12.4	16.8	14.6	11.2	10.8
2	18.7	16.1	0.5	18.7	7.5	18.4	5.3	5.7	4.3	6.2	2.6	3.4
3	9.4	8.5	0.3	10.4	3.7	9.9	4.0	2.8	2.7	3.3	1.3	1.5
4	4.8	4.1	0.8	3.9	2.7	8.3	1.3	1.8	1.9	1.8	0.8	0.3
5	2.4	1.9	0	1.6	1.1	390.3	1.3	0.8	1.3	0.6	0.3	0
6	1.6	3.1	0	3.4	1.1	5.1	1.3	1.1	0.5	0.5	0.3	0
7	0.3	0.3	0	0	0.8	0.5	0.8	0.8	0.2	0.2	0.3	0
8	0	0.2	0	0.3	0.5	0.8	0.8	0.8	0	0.3	0	0
9	0	0	0	0	0	0.3	0.3	0.5	0.2	0	0	0
10	0.8	0.6	0	0.2	0	0.3	1.0	0.3	0	0	0	0
>10	1.4	1.2	0	1.7	0.3	1.6	6.1	5.1	0.5	0	0	0

Table 3. Order statistics for HRQL responses.

HRQL Instruments	Diagnosis	Minimum	25%	Median	75%	Maximum
SF-36 PCS	OA	3.4	15.2	22.9	32.1	48.0
	RA	3.3	17.3	24.7	32.9	50.4
SF-36 MCS	OA	4.5	21.6	35.9	49.3	65.6
	RA	3.2	23.2	37.0	49.9	67.0
HAQ (0–3)	OA	0	0.2	0.6	1.1	2.8
	RA	0	0.2	0.7	1.3	3.0
WOMAC Function (0–170)	OA	0	17.8	36	70	166.3
	RA	0	12.6	32	64	161.5
WOMAC Stiffness (0–20)	OA	0	2.6	5.2	9.3	19.5
	RA	0	2.0	5.1	9.4	20.0
WOMAC Pain (0–50)	OA	0	5.0	10.8	19.3	48.5
	RA	0	3.3	8.7	17.5	46.6

PCS: Physical component summary, MCS: Mental component summary.

Table 4. Multivariable regression analysis of HCRU on HRQL quarter in OA patients (n = 395). Incidence rate ratio comparing the different quarter with the reference one controlling for age, sex, BMI and comorbidities.

HRQL	Health Care REsource Utilization GP Visits	Rheumatologist Visits	Specialist Visits	Health Care Worker Visits	All Procedures	Hospitalizations
SF-36 PCS†	1.1 (0.9–1.3)	1.8(0.7–5.0)	1.1 (0.8–1.5)	0.9 (0.5–1.6)	1.0 (0.7–1.4)	1.2 (0.8–1.9)
	1.0 (0.8–1.3)	0.6 (0.2–1.7)	0.6 (0.4–0.9)	0.7 (0.4–1.1)	0.9 (0.6–1.3)	0.7 (0.4–1.2)
	0.8 (0.6–1.2)	0.8 (0.3–2.1)	0.6 (0.4–0.9)	0.6 (0.4–1.1)	0.6 (0.4–0.9)	0.7 (0.4–1.5)
SF-36 MCS†	0.8 (0.6–1.0)	0.9 (0.5–1.5)	1.0 (0.7 –1.5)	1.2 (0.7–2.0)	0.9 (0.6–1.4)	0.7 (0.5–1.1)
	0.8 (0.7–1.0)	1.0 (0.5–1.8)	0.9 (0.6–1.4)	0.8 (0.4–1.8)	0.8 (0.5–1.1)	0.7 (0.4–1.1)
	0.6 (0.5–0.8)	0.7 (0.3–1.5)	1.0 (0.6–1.7)	0.6 (0.2–1.4)	0.5 (0.3–0.8)	0.4 (0.3–0.8)
HAQ††	1.4 (1.1–1.8)	0.6 (0.2–1.7)	1.4 (0.9–2.0)	1.3 (0.8–2.3)	1.7 (1.1–2.5)	1.7 (1.0–2.9)
	1.5 (1.1–1.9)	1.8 (0.9–3.7)	1.7 (1.1–2.5)	1.5 (0.6–3.7)	1.9 (1.3–2.9)	1.5 (0.8–2.5)
	1.3 (0.9–1.7)	3.0 (1.1–8.2)	2.2 (1.4–3.7)	1.6 (0.9–3.0)	2.1 (1.3–3.4)	1.6 (0.8–3.3)
WOMAC Function††	0.9 (0.7–1.3)	1.1 (0.5–2.6)	0.9 (0.6–1.5)	1.3 (0.7–2.4)	0.8 (0.5–1.4)	0.7 (0.3–1.5)
	1.3 (0.9–1.8)	1.5 (0.6–3.7)	1.1 (0.7–1.8)	1.9 (0.8–4.6)	1.0 (0.6–1.8)	1.5 (0.8–2.8)
	1.1 (0.8–1.6)	3.0 (1.1–8.2)	1.6 (1.0–2.7)	1.3 (0.7–2.4)	1.6 (1.0–2.7)	1.5 (0.8–3.4)
WOMAC Stiffness††	1.1 (0.8–1.5)	1.7 (0.7–4.4)	1.0 (0.6–1.6)	1.8 (1.0–3.2)	1.1 (0.7–1.9)	0.9 (0.4–1.9)
	1.1 (0.8–1.4)	2.1 (0.9–4.9)	1.7 (1.0–3.0)	2.2 (1.1–4.7)	1.4 (0.9–2.3)	0.9 (0.6–1.6)
	1.2 (0.9–1.6)	2.3 (0.9–6.1)	1.5 (0.8–2.5)	2.0 (1.2–3.4)	1.7 (1.1–2.8)	1.4 (0.8–2.4)
WOMAC Pain††	1.1 (0.8–1.4)	1.4 (0.8–2.8)	1.2 (0.7–2.0)	1.2 (0.7–2.1)	1.4 (0.7–2.5)	1.0 (0.5–2.1)
	1.2 (0.9–1.6)	2.1 (0.9–5.0)	1.1 (0.7–1.9)	2.1 (1.2–4.0)	1.4 (0.8–2.5)	1.0 (0.5–2.0)
	1.3 (0.9–1.8)	2.2 (0.9–5.0)	2.0 (1.2–3.4)	1.3 (0.8–2.2)	2.6 (1.5–4.8)	1.7 (0.8–3.4)

Analyses were performed separately for each HRQL instrument.
Figures in parentheses are 95% CI.
† For the SF–36 physical and mental component summaries (PCS and MCS), the reference group is the worst quarter (lower scores). The last row corresponds to the best quarter (higher scores). The first and the middle rows correspond to second worst and third worst quarters, respectively. IRR < 1 indicate that patients in the second worst, the third worst, or in the best quarters consume less resource than those in the worst.
†† For the HAQ and the WOMAC, the reference group is the best quarter (lower scores). The last row corresponds to the worst quarter (higher scores). The first and the middle rows correspond to the second worst and the third worst quarters, respectively. IRR > 1 indicate that patients in the second worst, the third worst, or in the worst quarters consume more resources than those in the best.
BMI: body mass index.

General practitioner visits were predicted well with each of the HRQL instruments for patients with RA. Poor HRQL scores as measured by the 2 summary scales of the SF-36 were associated with an increase in future visits of about 45%. The increase was about 60% with the WOMAC Function and the WOMAC Pain scales. The mental component summary of the SF-36 was the one scale that significantly predicted general practitioner visits for OA patients. Increased rheumatologist visits and specialist visits were also shown to be associated with lower HRQL scores for RA patients. For OA patients, the SF-36 physical component summary and the HAQ predicted an increase in specialist visits. With the HAQ and the WOMAC Function, OA patients in the worst quarter experienced a number of rheumatologist visits that was almost 3 times that of patients in the best quarter. Other health care worker visits were not consistently predicted by all HRQL instruments for RA or OA; however, the HAQ, SF-36 mental component summary, and WOMAC Function were associated with about a 2-fold increase in visits between RA patients in the worst quarter compared to those in the best. Poor HRQL scores of the 2 summary scales of the SF-36, HAQ, and WOMAC Pain were all strongly associated with increased future use of medical procedures for both RA and OA patients. Hospitalizations, the most economically burdensome variable, were experienced almost twice as much among RA patients with poor HRQL compared to those with the highest level of HRQL as measured by all instruments except the SF-36 physical component summary. The SF-36 mental component summary was the one scale that indicated an increase in hospitalizations among OA patients with low levels of HRQL.

DISCUSSION

This study revealed that the SF-36, HAQ, and WOMAC were all directly linked to future health care resource consumption: lower HRQL scores predicted increased consumption of health care resources. There were more

Table 5. Multivariable regression analysis of HCRU on HRQL quarter in RA patients (n = 642). Incidence rate ratio comparing the different quarter with the reference one controlling for age, sex, BMI, and comorbidities.

HRQL	Health Care Resource Utilization					
	GP Visits	Rheumatologist Visits	Specialist Visits	Health Care Worker Visits	All Procedures	Hospitalizations
SF–36 PCS†	0.8 (0.7–0.9)	0.8 (0.7–1.0)	0.8 (0.7–0.9)	0.9 (0.5–1.5)	0.7 (0.5–0.9)	0.8 (0.6–1.2)
	0.8 (0.6–0.9)	0.8 (0.6–0.9)	0.8 (0.6–0.9)	0.6 (0.4–1.0)	0.5 (0.4–0.7)	0.6 (0.4–0.9)
	0.7 (0.5–0.9)	0.6 (0.5–0.7)	0.5 (0.4–0.7)	0.9 (0.5–1.5)	0.3 (0.2–0.5)	0.7 (0.5–1.1)
SF-36 MCS†	0.8 (0.7–1.0)	0.9 (0.7–1.1)	0.9 (0.8–1.1)	0.7 (0.4–1.3)	0.7 (0.5–1.0)	1.0 (0.7–1.4)
	0.8 (0.6–1.0)	0.8 (0.6–1.0)	0.8 (0.7–0.9)	0.7 (0.4–1.2)	0.7 (0.5–0.9)	0.9 (0.6–1.3)
	0.7 (0.5–0.9)	0.6 (0.5–0.8)	0.7 (0.5–0.8)	0.5 (0.3–0.9)	0.5 (0.4–0.7)	0.5 (0.3–0.7)
HAQ††	1.0 (0.8–1.3)	1.0 (0.8–1.3)	1.1 (0.9–1.4)	0.9 (0.4–1.5)	1.2 (0.8–1.9)	1.1 (0.7–1.8)
	1.1 (0.9–1.4)	1.3 (1.0–1.7)	1.4 (1.1–1.8)	0.9 (0.6–1.6)	1.9 (1.3–2.8)	1.5 (1.0–2.3)
	1.4 (1.1–1.8)	1.5 (1.1–2.0)	1.7 (1.3–2.2)	1.9 (1.1–3.5)	2.6 (1.7–3.9)	2.1 (1.3–3.3)
WOMAC Function††	1.1 (0.9–1.4)	1.4 (1.1–1.7)	1.2 (0.9–1.6)	1.5 (0.8–2.6)	1.6 (1.1–2.4)	1.5 (0.9–2.6)
	1.0 (0.8–1.3)	1.3 (1.1–1.7)	1.3 (0.9–1.7)	1.2 (0.6–2.4)	1.6 (1.0–2.5)	1.1 (0.7–2.0)
	1.6 (1.2–2.1)	1.6 (1.2–2.1)	1.7 (1.3–2.3)	1.9 (1.1–3.5)	2.2 (1.4–3.4)	1.9 (1.1–3.3)
WOMAC Stiffness††	1.2 (0.9–1.4)	1.0 (0.9–1.3)	1.0 (0.9–1.3)	0.7 (0.4–1.3)	1.1 (0.8–1.6)	1.3 (0.7–2.2)
	1.2 (1.0–1.6)	1.0 (0.9–1.3)	1.0 (0.8–1.3)	0.8 (0.5–1.3)	1.0 (0.7–1.5)	1.1 (0.6–1.9)
	1.5 (1.1–1.9)	1.2 (1.0–1.5)	1.2 (1.0–1.5)	0.6 (0.4–1.1)	1.5 (1.0–2.1)	1.8 (1.0–2.9)
WOMAC Pain††	1.1 (0.9–1.4)	1.3 (1.0–1.6)	1.2 (1.0–1.5)	1.1 (0.6–1.9)	1.1 (0.8–1.6)	1.2 (0.7–2.1)
	1.0 (0.8–1.3)	1.3 (1.0–1.6)	1.2 (0.9–1.6)	1.2 (0.5–2.7)	1.4 (0.9–2.1)	1.6 (0.9–2.7)
	1.6 (1.2–2.2)	1.2 (0.9–1.6)	1.4 (1.1–1.9)	1.2 (0.5–2.7)	1.7 (1.1–2.6)	2.0 (1.2–3.4)

Analyses were performed separately for each HRQL instrument.
Figures in parentheses are 95% CI.
† For the SF–36 physical and mental component summaries (PCS and MCS), the reference group is the worst quarter (lower scores). The last row corresponds to the best quarter (higher scores). The first and the middle lines correspond to second worst and the third worst quarters, respectively. IRR < 1 indicate that patients in the second worst, the third worst, or in the best quarters consume less resources than those in the worst.
†† For the HAQ and the WOMAC, the reference group is the best quarter (lower scores). The last row corresponds to the worst quarter (higher scores). The first and the middle lines correspond to the second worst and the third worst quarters, respectively. IRR > 1 indicate that patients in the second worst, the third worst, or in the worst quarters consume more resources than those in the best.

significant results among patients with RA than patients with OA, which may be due to the smaller OA sample size in this study. Our analysis revealed a difference in the use of health services especially between the upper and the lower quarter, and there was clearly evidence of a pattern of increasing health care resource consumption as HRQL deteriorated. We would expect that substantial differences in HRQL scores would be needed to find a significant change in resource consumption.

In our study, both RA and OA patients were relatively homogeneous in terms of HRQL scores. For all the instruments, 75% of patients were clustered in the lower sections of the corresponding scales. This lack of variability in the HRQL scores might explain the lack of widespread significant findings among the second and third quarter. With a group more heterogeneous, quality of life measures may be more sensitive to the prediction of HCRU.

Remarkably, even though OA and RA are physical conditions, the SF-36 mental component summary, which measures mental health, appeared to be a good predictor of resource use. It seems that there is a psychological component that can explain consumption of physician visits and other health care services. Similar affirmation has already been reported[30,31], and is consistent with the fact that RA and OA have been found to be associated with symptoms of anxiety and depression. Our data reinforce that chronic rheumatic diseases have a major impact on the psychological condition of the people affected, and that these people consume more health services than those not experiencing a negative effect on their psychological well being. We did not include indicators of clinical severity of disease in the prediction model of future HCRU. Nevertheless, the HRQL instruments used have been shown to correlate in the right way with such an indicator[7,63,64]; higher severity as measured by a clinical variable leads to greater dysfunction and disability, and so, to impaired HRQL.

Several limitations of the study should be acknowledged. First, it can be argued that change in HRQL between 2 surveys could have been used to predict HCRU. However, this would require the completion of at least 3 surveys, which would have reduced our sample size dramatically. Second, although health care consumption is a complex phenomenon that may be related to many different factors, we considered in our explanatory variable set only HRQL data and few controlling variables. We did not take into account socioeconomic factors or past consumption of health care resources. One would expect that insurance type, income level, and other variables that describe a patient's access to health care would be associated with consumption of health care resources. However, we found that education level, which can be considered a proxy for income level, did not confound the relationship between HRQL and HCRU. Third, variables such as HRQL and HCRU may be embraced in a "chicken and egg" relationship. However, our primary focus was to study these 2 variables in a predictive relationship for exploration purposes and we did not consider a more complex approach. Lastly, we were unable to differentiate between patient initiated visits and physician requested visits. Such distinction is noteworthy. We did not assess separately the predictive effect of HRQL on each of these health care resource components. By looking at all health care services consumed, we may have underestimated the effect of HRQL on patient initiated visits. HRQL instruments are patient self-evaluated measures. We can reasonably assume that such measures are better predictors of patient initiated visits rather than physician requested visits. In substantial chronic illness such as OA and RA, there is often a baseline level of health service utilization that is required for supervision of the illness. This level of physician initiated utilization may increase when the illness becomes more severe in the eyes of the patient or the physician, but does not usually become lower, particularly in RA, where toxic medication must be supervised. A recent study[65] of self-care education in patients with OA of the knee indicates that patient initiated visits can be reduced in a primary care setting. It seems likely that the setting (primary versus specialty care) and the illness (RA versus OA) mediate differences between patients and physician initiated visits. Further longitudinal research based on greater length of study may be considered. By distinguishing between patient initiated versus physician initiated HCRU and by addressing the "chicken and egg" issue, such studies might be expected to yield useful information on the exact role of HRQL as a predictor of health care consumption.

In the context of high health care spending and increasing prevalence of chronic diseases, this kind of analysis could allow health care providers and health care decision makers to concentrate their efforts where they are most needed. By thoroughly studying the effect of HRQL on resource use, we would be able to identify what dimensions of HRQL for specific pathologies are highly related to what kind of health service utilization. In this way, we could identify specific aspects of the disease and its treatment that could be targeted for better outcomes. It may concern new therapeutic strategies, better patient care, or implementation of self-care education programs. As stated, the latter has recently been shown to be associated with a substantial decrease in health care cost in patients with OA of the knee[65]. As an example, we have shown that RA patients reporting better HRQL scores with the SF-36, HAQ, and WOMAC generally use less health care resources than those reporting poor HRQL scores. Therefore, implementation of a health care strategy that has been shown to improve HRQL based on these instruments should be supported. The advantage is 2-fold — from a medical point of view, patient health may be improved and from an economic point of view, direct cost of the disease may be reduced.

Health care resource utilization is far from being fully understood, but health care consumption is increasing dramatically over time. In the future, we can reasonably assume that a greater interest will be dedicated to the restriction of health care spending. In terms of public health, it is simply unthinkable that such restriction could be applied blindly. At this time, self-reported health status measures are well recognized and increasingly used in the evaluation of health. This study showed that validated and self-reported quality of life measures are linked to HCRU in patients with OA and RA. As described previously, such findings may have important implications in the health care field by improving patient care and improving rationalization of health expenditures. However, little research has been conducted in this field, and more studies are needed. We strongly recommend distinguishing between patient initiated HCRU and physician requested utilization, and investigating variables other than ours to elucidate the complex relationship between HRQL and HCRU.

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