

# Costs and Predictors of Costs in Rheumatoid Arthritis: A Prevalence-Based Study

CRISTINA LAJAS,<sup>1</sup> LYDIA ABASOLO,<sup>1</sup> BOUTAYEB BELLAJDEL,<sup>1</sup> CÉSAR HERNÁNDEZ-GARCÍA,<sup>1</sup> LORETO CARMONA,<sup>2</sup> EMILIO VARGAS,<sup>1</sup> PABLO LÁZARO,<sup>3</sup> AND JUAN A. JOVER<sup>1</sup>

**Objective.** To analyze the annual cost of rheumatoid arthritis (RA) and its predictive factors.

**Methods.** Data were obtained from a 12-month retrospective cohort of 201 RA patients, randomly selected from a rheumatology registry, through a structured interview and records of the Central Information System of the hospital. Results were divided into direct, indirect, and total costs in 2001 US dollars. A sensitivity analysis was performed. Multiple linear regression models for the different types of costs were carried out.

**Results.** The total cost was \$2.2 million per year, with a cost attributable to RA of \$2.07 million per year. The average cost per patient was \$10,419 per year (ranging from \$7,914 per patient per year in the best scenario to \$12,922 per patient per year in the worst case). Direct costs represent nearly 70% of total costs. We found an average increment in total costs of \$11,184 per year per unit of Health Assessment Questionnaire (HAQ) score ( $P < 0.0001$ ) and an average annual increment of \$621 per year of disease ( $P < 0.0001$ ). After adjustment, the HAQ score, inability to perform housework tasks, and being permanently disabled for work were the only predictors of high costs.

**Conclusion.** Our data show a remarkable economic impact of RA over society and link the costs of the disease to its consequences in terms of functional disability, work disability, and housework disability.

**KEY WORDS.** Rheumatoid arthritis; Costs; Disability.

## INTRODUCTION

Different studies have shown that musculoskeletal disorders have a great impact on individuals and society because of their high prevalence, morbidity and disability potential, and large use of acute and long-term health care and support resources (1,2). Rheumatoid arthritis (RA) represents the paradigm of chronic inflammatory musculoskeletal disorder with a high prevalence and a progressive clinical course negatively affecting patients' quality of life, function, and life expectancy. Besides the conse-

quences on the health status of individuals, RA has a substantial economic impact on patients, their families, and society (3–6).

Health economic studies are now an essential part of health care evaluation. The cost of any condition can be divided into 3 major components (7,8). Direct costs include all expenses requiring actual payment or time spent due to the disease itself or to disability. Indirect costs represent the loss of resources as a consequence of work disability or unemployment. Finally, intangible costs are those related to decrease in quality of life and are not easily estimated because of difficulties in quantifying these dimensions of disease.

The annual costs of RA have been estimated to be 2 billion dollars in England in 1992 (9) and 8.7 billion dollars in the US in 1991 (10). Approximately half of these costs were direct costs and half were related to loss of productivity among working-age patients. However, only a few studies have addressed determinants of costs in RA from a societal perspective (11,12). Factors influencing total costs of RA might help clinicians and decision makers in rationalizing resource allocation in a time of economic constraints for social and health care services. We analyzed individual and social factors influencing costs of RA in Spain from a societal point of view and by using a prevalence-based approach.

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<sup>1</sup>Cristina Lajas, MD, Lydia Abasolo, MD, Boutayeb Bellajdel, MD, César Hernández-García, MD, PhD, Emilio Vargas, MD, PhD, Juan A. Jover, MD, PhD: Hospital Clínico San Carlos, Madrid, Spain; <sup>2</sup>Loreto Carmona, MD, PhD: Hospital Universitario La Princesa, Madrid, Spain; <sup>3</sup>Pablo Lázaro, MD, PhD: Técnicas Avanzadas de Investigación en Servicios de Salud, Madrid, Spain.

Address correspondence to Juan A. Jover, MD, PhD, Rheumatology Service, Hospital Clínico San Carlos, c/ Profesor Martín Lagos s/n, 28040 Madrid, Spain.

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## PATIENTS AND METHODS

**Study population.** The Seventh Health District of the Community of Madrid (CM), Spain, provides primary and specialized universal health care to a population of around 450,000 people through more than 300 primary care physicians who refer their patients for specialized care to the Hospital Clínico San Carlos (HCSC), a university hospital covering tertiary care in all medical and surgical specialties.

The rheumatology service (RS) offers specialized care in rheumatology for all patients referred either from primary care or from any other specialties at the HCSC. All patients attending the HCSC-RS are registered in a clinical relational database (BDCR), which includes sociodemographic, administrative, and diagnostic data (coded according to International Classification of Diseases, Ninth Revision). All patients included in the BDCR by December 31, 1997 with a diagnostic code for RA (714.00) were eligible for the study (913 of 15,373 patients).

**Patient selection and recruitment.** A simple random sample of 342 RA patients was selected. This sample size was sufficient for calculating mean total costs with a 95% confidence interval (CI), assuming a standard deviation of 50%. The clinical records of the patients selected were reviewed to confirm that they had fulfilled the American College of Rheumatology (ACR) classification criteria for RA (13) at some time during their followup period. Patients were then contacted and invited to participate. Patients were first telephoned (at least 3 calls on 3 different days at different hours). If they could not be reached, then they were sent a letter with information about the study and were invited to participate. If no answer was obtained after 1 month, we searched the CM Social Services and Civil Registry records to verify whether they had been institutionalized or were deceased. Patients not fulfilling the ACR classification criteria, those who could not be located for any reason, or those who refused to participate were excluded from the study and replaced by the next randomly selected patient. Institutionalized patients were not excluded unless they refused to enter the study.

**Variables and data collection.** Data were obtained from 2 different sources. First, a systematic search was completed of the central information system at the HCSC and of the BDCR using the patients' identification code. This source of data comprise objective information about all medical expenses derived from contacts of patients with specialized care, and included variables such as physicians' visits, physical therapy or rehabilitation, nursing care, emergency room visits, medical and surgical admissions, tests, and procedures. To collect data not available from this source, a single, structured, 60-minute personal interview with patients was scheduled. The questionnaire included variables about sociodemographic characteristics, duration of the disease (time from onset of symptoms), comorbidity, occupational profile, primary health care use, RA-related and unrelated medications, other therapies, transportation, disability expenses (including

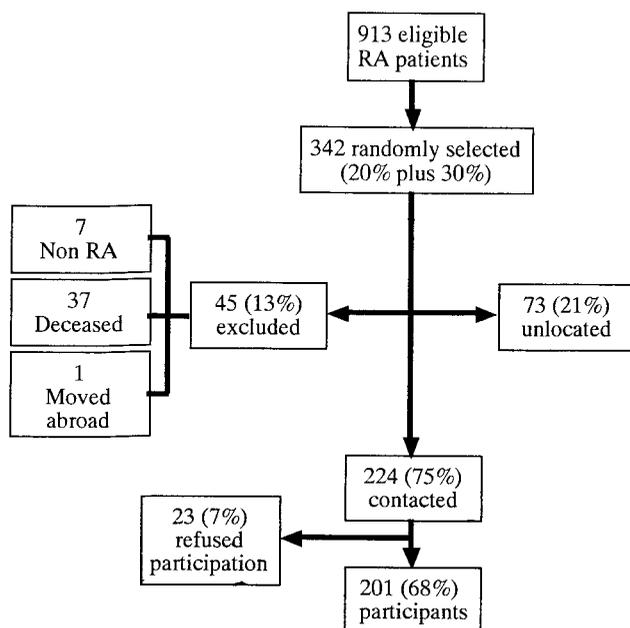
compensation payments for temporary work disability [TWD] or permanent work disability [PWD], costs of help for daily activities, basic daily activities, occasional home help, long-term institutionalization, technical aids, home and work modifications, and moving expenses), and functional status assessed by the Spanish version of the self-administered Health Assessment Questionnaire (HAQ). All interviews were carried out by 2 of the investigators (CL and BB). Only data from the 12 months previous to the date of interview were included.

**Identification and assignment of costs.** All variables related to potential costs a patient might have incurred were reviewed independently by 2 investigators who classified them according to their relationship with RA, applying a correction coefficient of 0 if they were unrelated to RA, 0.5 if they were partially related to RA, and 1 if they were fully related to RA. If there were discrepancies among reviewers, that variable was discussed by the investigator team. Total costs were quantified by multiplying each cost variable by the number of times they were incurred in the 12 months previous to the date of interview. The RA-related costs were quantified by multiplying total cost of each variable by their correction coefficient. Each cost variable was assigned a financial value based on the following sources: reference prices of the National Institute of Health in the CM, the National Institute of Statistics, the National Institute of Social Security, the Trade Chamber of Madrid, and the 1997 National Pharmacotherapeutical Catalogue. The financial value of each nonpaid hour of help (e.g., informal caregivers, relatives) was calculated as the 100% hourly cost of nonspecialized work in Madrid. Any costs paid directly by the patient were recorded as the amount of money specified during the interview.

**Classification of costs.** We classified as direct costs all medical costs and nonmedical costs derived from help at work, home and self-care, aid devices, transport, moving expenses, and time spent in the different forms of care, whether they were paid by an individual patient or by an institution. Indirect costs included compensation payments for TWD, PWD, and the costs of housekeeping help if the patient was a housewife.

**Analysis.** The frequency distribution or central tendency indexes of all variables related to comorbidity, sociodemographic and occupational profile, and functional status were obtained to characterize the patient sample.

For the economic analysis, results were divided into direct, indirect, and total costs, in 2001 US dollars. A separate analysis was performed for RA-related costs and integral costs (including RA-related and unrelated costs). We obtained the mean cost per patient in the last year of disease and the yearly costs per disease duration. The robustness and consistency of the results obtained were tested with a one-way sensitivity analysis, assuming 2 different scenarios: the best scenario (minor cost) using the lowest limit of the 95% CI for each measured cost, and the worst scenario (maximum cost) using the highest limit of the CI.



**Figure 1.** Flow chart of the selection process and response to the study of 913 rheumatoid arthritis (RA) patients.

Bivariate associations were explored between costs and descriptive variables using one-way analysis of variance with paired comparison adjusted by Bonferroni's correction. Correlation between continuous variables was analyzed by Pearson's test. Multiple linear regression models for the different types of costs were carried out with those variables achieving a *P* value below 0.05 in the bivariate analysis. All analyses were performed using Stata 5.0 statistical software (Stata Corporation, College Station, TX).

## RESULTS

**Description of the sample.** Figure 1 shows the response flow chart of the study. Of the 342 patients initially selected, 7 (2%) were excluded because they did not fulfill the classification criteria for RA, and 111 (32%) could not be located. Of these, 37 (11%) had died, 1 had moved to another country, and 73 patients (21%) could not be contacted after several attempts. Twenty-three additional patients (7%) refused participation. Finally, 201 patients were interviewed and participated in the study (68% of the selected sample). There were no significant differences in terms of age, sex, and disease duration between participants and nonparticipants or participants and eligible patients.

**Sociodemographic, clinical, and labor characteristics.** The mean age at interview ( $\pm$  SD) was  $64.3 \pm 11.8$  years, 77.6% were women, and the median disease duration was 7.7 years (interquartile deviation 3.3–14.3). The median HAQ score was 1.025 (0.37–1.5). Seventy-one percent of patients had at least 1 chronic disease other than RA, and 4% of the patients had an acute illness requiring medical

care in the previous 12 months. Other sociodemographic and occupational characteristics are depicted in Table 1.

**Cost of disease.** The total cost for the sample was 2.2 million per year in 2001 dollars, with a cost attributable to RA of 2.07 million per year (Table 2). The average total cost per patient was \$10,419 per year or \$867 per month.

Direct costs represent nearly 70% of total costs. Medical costs, including health care visits, medications, tests, procedures, and hospital admissions, accounted for 40% of direct costs, whereas nonmedical costs represented 60% of direct costs. Nearly half of medical costs were related to

**Table 1. Sociodemographic and occupational characteristics**

Level of education (%)	
None	10
Elementary	60
High school	22
Higher	6
Marital status (%)	
Married	62.7
Widowed	22.4
Other	15
Social support (%)	
Living with relatives	82.5
Living alone	15.9
Living at institutions	0.5
Work situation (%)	
Working status*	
Active	17.9
Employed	62.1
Unemployed	24.3
Unclassified	13.5
Retired	21.4
Permanently disabled	19.4
Housewife	40.8
Occupation (%)*	
Unspecialized manual work	40.8
Administrative	20.4
Specialized manual work	22.4
Professional	10.2
Manager	6.1
Physical requirements of work (%)	
None	25
Mild	20.8
Medium	12.4
Heavy	41.6
Work stability (%)*	
Indefinite contract	13.5
Functionaries	29.7
Temporal contract	16.2
Unclassified	40.5
Type of work (%)*	
Self-employed	40.5
Working for other	43.2
Unclassified	16.2
Ability to perform housework tasks (%)	
None	16
Some	34.5
Many	13.5
All	36

\* Active workers only.

	<b>Total costs*</b>	<b>RA-related costs*</b>	<b>Percent RA-related costs</b>
Direct costs	1,567.7	1,447.7	92.35
Medical costs	686.0	568.6	82.89
Professional time	98.4	79.0	80.32
Laboratory tests	40.5	36.7	90.27
Diagnostic image	25.5	14.9	58.8
Other diagnostic procedures	1.8	0.8	43.55
Drug therapies	177.6	138.4	77.84
Medical admissions	51.7	24.4	47.14
Surgical admissions	290.5	249.6	85.92
Nonmedical costs	881.7	879.1	99.71
Help at home work and self care	494.6	494.6	100
Help devices	68.8	68.8	100
Moving address	295.9	295.9	100
Transportation	22.4	19.8	88.71
Indirect costs	710.3	646.7	91.04
Work compensation	477.7	414.2	86.7
Temporary work disability	82.3	64.3	78.17
Permanent work disability	384.6	339.0	88.13
Other work compensations	10.8	10.8	100
Help for housewives at home	232.6	232.6	100
Total	2,278.0	2,094.4	91.94
Total/patient	11.3	10.4	91.87

\* In thousand 2001 US dollars. RA = rheumatoid arthritis.

orthopedic surgeries, most of them total joint replacement procedures. Medications, professional time, medical admissions, and laboratory tests accounted for the rest of medical costs. Nonmedical direct costs included expenses in help and care of disabled patients, adaptations, and moving expenses.

Indirect costs represented 30% of the total costs, most of them due to lost productivity of active workers because of PWD. The necessity of help for housewives at home, which might be viewed as a type of TWD for people working at home, was also a significant contributor to indirect costs.

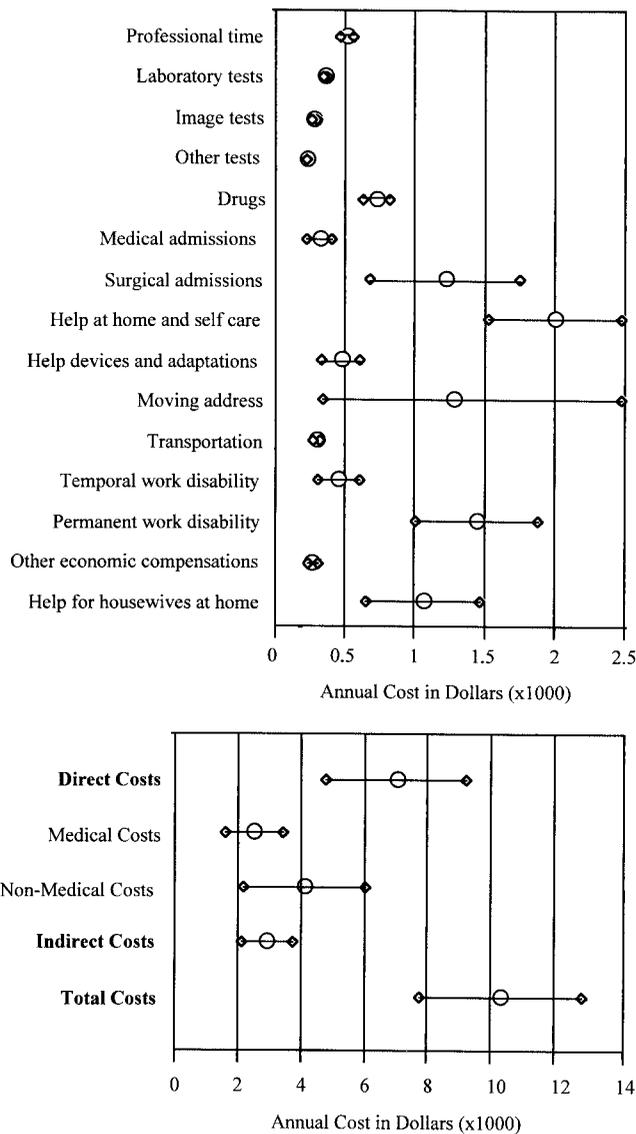
**RA-related and unrelated costs.** We distinguished between the costs related to RA and the global health care costs in our patients. As expected, the highest amount of global health care cost was directly or indirectly related to RA care (Table 2). We found that only 10% of global health care costs in our sample was unrelated to RA. The vast majority of RA-unrelated costs were direct medical costs due to comorbidity. However, direct nonmedical costs and indirect costs were almost fully attributable to RA.

**Sensitivity analysis.** We carried out a one-way sensitivity analysis of RA-related costs to test the consistency and robustness of our results (Figure 2). We found that total costs might range from \$7,914 per patient per year in the best scenario to \$12,922 per patient per year in the worst case. We found estimates of professional time, TWD, and diagnostic procedures very precise; however, categories with a low number of patients or a wide range of prices—such as moving to a new home, PWD, or housekeeping

help for housewives—showed a higher degree of variability, making estimates less accurate.

**Determinants of costs.** To assess factors influencing RA-related cost of disease in our patients, we looked for associations between demographic, clinical, and occupational variables and total, direct, and indirect costs. Total costs increased significantly with disease duration but especially with HAQ score ( $r = 0.32$  and  $r = 0.49$ , respectively; Figure 3). We found an average increment in total costs of \$11,184 per year per unit of HAQ score ( $P < 0.0001$ ) and an average annual increment of \$621 per year of disease ( $P < 0.0001$ ). When we separately analyzed direct and indirect RA-related costs, there were different patterns of association with HAQ score and with duration of disease. Both indirect and direct costs increased proportionally with higher HAQ scores. Indirect costs also rose proportionally with disease duration. However, direct costs tended to be higher at the beginning, with main expenses being in professional time, tests, and procedures, and then again after 10 years of disease duration, mostly due to costs in medication, hospital admissions, and technical aids (Table 3).

We also found statistically significant differences in costs depending on work situation, housework tasks, and social support (Table 3). As expected, people with permanent work disability incurred significantly higher costs, whereas retired people had fewer expenses than housewives, or active, or permanently disabled people. People unable to perform any tasks at home and institutionalized people had higher costs than individuals in other categories.



**Figure 2.** Sensitivity analysis. Circles represent the basal case (represented by the arithmetic mean) and rhombuses the best scenario (minor cost of the disease, represented by the lowest limit of the 95% confidence interval for each measured cost), and worst scenario (maximum cost of the disease, represented by the highest limit of the confidence interval).

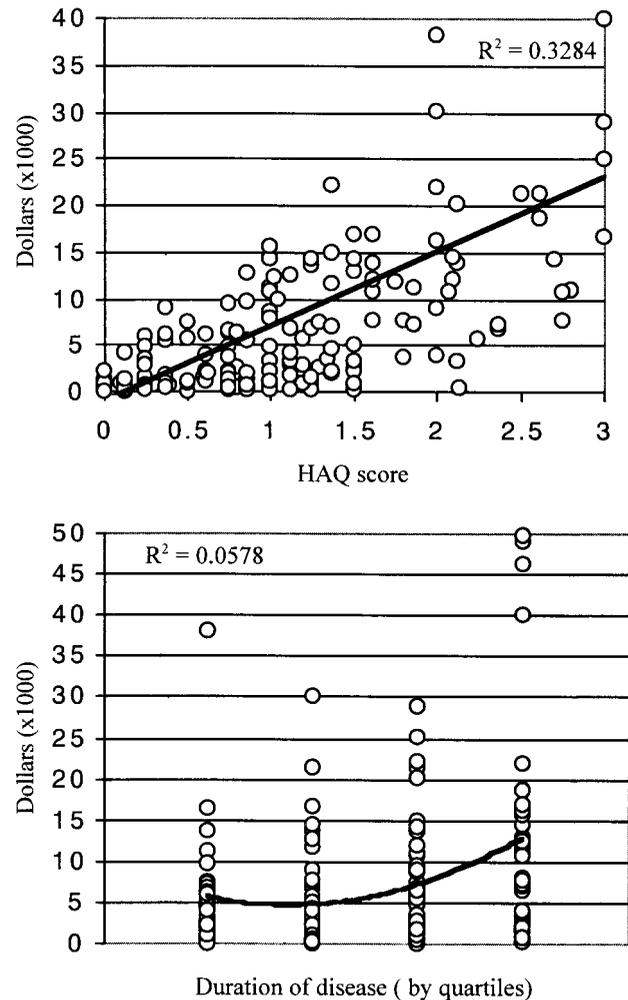
At the multivariate analysis (Table 4), only HAQ score, permanent work disability, and housework tasks remained statistically significant, suggesting again that costs of disability remain the major component of RA costs.

**DISCUSSION**

We have analyzed annual costs of RA in a large retrospective cohort of patients referred to specialized care in a tertiary hospital. Our sample was representative of RA patients in our health district (14) and similar to other cohorts of RA patients reported (15,16). We found an annual cost per RA patient of \$11,341 in 2001 US dollars, approximately 90% of this amount attributable to the RA itself. The RA-related costs approached 100% of total costs

when indirect costs and direct nonmedical costs were analyzed separately, reflecting that costs of RA are in a large proportion the costs of disability caused by disease. However, RA-related health care costs represented only 80% of total costs, reflecting the coexistence of different, non-RA-related, comorbid conditions in a substantial number of patients. Thus, the annual total cost per patient attributable to RA was \$10,419, with a sensitivity analysis showing a lower cost of \$7,914 and a higher cost of \$12,922 per year. Our data falls in the range of other studies showing estimates of annual cost ranging from \$5,300 to \$7,000 per patient (9,17). Because the prevalence of RA in Spain has been estimated at 0.5% of the general population (18), the annual economic impact of RA over the Spanish society might be more than \$2 billion, which highlights the substantial burden that RA imposes on industrialized societies.

Direct costs represented the largest contributor to the total cost of disease (almost 70% of the global economic burden of RA). This distribution of costs is similar to that reported in Canada (17), but differs from other studies in which direct costs represented no more than 50% of total costs (9,10,19). These discrepancies might be explained by



**Figure 3.** Correlation of total costs and Health Assessment Questionnaire (HAQ) score (top) and duration of disease (bottom).

**Table 3. Association of RA annual costs with other variables\***

	Cost in dollars (×1,000)					
	Total costs (mean ± SD)	P	Direct costs (mean ± SD)	P	Indirect costs (mean ± SD)	P
Duration of RA		0.008		0.05		0.0001
<2 years	11.5 ± 25		10.3 ± 23		1.2 ± 1	
2–10 years	7.2 ± 8		4.8 ± 5		2.4 ± 4	
>10 years	15.7 ± 22		10.2 ± 18		5.5 ± 6	
Social support		0.0001		0.0000		0.0000
Living with family	10.5 ± 18		7.4 ± 16		3.1 ± 4	
Living alone	11.5 ± 13		7.7 ± 11		4.1 ± 5	
Living at institution	83.4 ± 0		39.5 ± 0		43.9 ± 0	
Housework tasks		0.0000		0.0000		0.0001
None	1.7 ± 29		19.5 ± 24		7.1 ± 9	
Some	12.9 ± 19		8.7 ± 18		4.2 ± 5	
Many	8.0 ± 8.3		4.9 ± 5		3.0 ± 5	
All	4.5 ± 5		2.9 ± 4		1.5 ± 2	
Work situation		0.0000		0.01		0.0000
Active worker	9.3 ± 24		7.4 ± 23		1.9 ± 4	
Housewife	8.1 ± 12		5.2 ± 9		2.9 ± 5	
PWD	25.7 ± 22		15.5 ± 20		10.2 ± 5	
Retired	6 ± 9		5.9 ± 9		0.1 ± 0.7	

\* P values from analysis of variance for comparisons between groups. RA = rheumatoid arthritis; PWD = permanent work disability.

differences either in the intrinsic characteristics of each study population, health care system organization, or the methodology employed. Our patients made little use of long-term institutionalization but showed notable use of different forms of long-term care and help at home, including informal care delivered by relatives or informal caregivers. Because unpaid time was categorized among indirect costs in some studies and it represented more than 22% of direct costs in our study, the differences with other studies might be related both to specific definition of direct costs and a different pattern of use of sociosanitary resources, that is, all those related to a person’s care. Admissions for orthopedic surgery and drug therapies, accounting for 17% and 11% of direct costs, respectively, were also major contributors to direct costs (12,17,20).

Productivity losses caused mainly by PWD of active workers and by the temporary or permanent disability of housewives to perform their duties at home accounted for the major part of indirect expenses. Similar results have

been published in other studies (17), and differences with other studies (8–10,19,21–24) might be due to the relatively low rate of active workers in our population and the underestimation of the economic burden of “work disability of house keepers” as described by Reisine (25,26). We did not include as production losses unemployment status or premature deaths (21).

Several variables were associated with higher RA-related costs. Duration of disease had a bimodal association with costs attributable to RA, with patients both with initial disease and long-lasting disease incurring higher costs than people with an intermediate duration of disease. The higher cost in patients with long-term RA was attributable both to direct and indirect costs (11), reflecting the impact of RA over function along years of disease, especially in terms of PWD. Conversely, patients with early disease incurred mainly direct costs, reflecting the intensive use of diagnostic and therapeutic procedures in these phases of the disease. However, duration of disease lost its statistical significance at the multivariate analysis when the HAQ score was introduced to the model.

We found an increment of \$8,084 per year per unit of HAQ score. Similar associations with HAQ score have been reported (11,12), suggesting that functional disability is a major determinant of costs in RA. However, we also observed that PWD attributable to RA and inability to perform housework tasks were also independently associated with higher costs. This suggests that the spectrum of RA-related disability is broader than the functional disability measured by HAQ score and has some distinct peculiarities in active workers and housekeepers. Our results confirm the strong link between disability and cost in RA and extend this connection not only to functional disability but also to other forms of measuring handicap in RA patients.

**Table 4. Linear regression model of RA annual costs\***

	Estimate†	95% CI	P
Age (years)	−0.0016	−0.16, 0.1	NS
Sex (female)	−3.27	−8.1, 7	NS
Duration of disease	0.13	−0.08, 0.35	NS
Housework tasks‡	2.94	1.4, 4.8	0.004
Permanent work disability	11.24	6.36, 16	0.0001
HAQ score	7.05	4, 9.9	0.0001

\* Parameters of the model: R<sup>2</sup> = 0.45; P < 0.0001. RA = rheumatoid arthritis; 95% CI = 95% confidence interval; NS = not significant; HAQ = Health Assessment Questionnaire.  
 † In US dollars (×1,000).  
 ‡ Household tasks were classified as continuous, ranging from 0 (all tasks at home) to 3 (none).

We did not find any relationship between different descriptive occupational variables and costs, but the low rate (11%) of active employed people in our sample as compared with other studies (12,17,19) do not allow firm conclusions. It has been described that workers with RA who can pace their own rhythm of work are more likely to continue performing their jobs (27). Because the low rate of active people in our sample was at least partially caused by an increased number of unemployed and permanently disabled individuals, one would hypothesize that the analysis of the sociolaboral context might be extremely useful to palliate the negative impact of RA in the workforce.

In conclusion, our data shows a global impact of RA similar to other studies, and links the costs of the disease mostly to its impact in function and the degree of disability of the patients. Although there is a great deal of consensus on the individual and societal advantages of an early and more efficient therapy of RA (24,28,29), it should be emphasized that disability is multidimensional and often the result of an ecological gap between environment demands and individual skills. For this reason, a coherent social response to RA would include preventive programs, aiming to reduce the levels of disability and institutional care, without promoting inadequate self or family care.

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