Resource utilisation and cost of ankylosing spondylitis in Brazil

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Abstract

Objectives

The present study describes resource utilisation in patients with ankylosing spondylitis (AS) treated at a tertiary public health facility over a one-year period. It also investigates the direct and indirect costs for society associated with the treatment of AS.

Methodology

Ninety AS patients were selected consecutively, and data was analysed retrospectively for one year. Resource utilisation was evaluated through systematic interviews with all patients. Demographic, socioeconomic, and clinical variables were recorded, and questionnaires evaluating quality of life, function, and disease activity were also applied (ASQoL, SF-36, HAQ-S, BASFI, and BASDAI). Estimates of indirect costs were performed using the human-capital approach based on the society perspective.

Results

Most of the patients were men (79%), with a mean age and disease duration of 40 and 16 years, respectively. The mean HAQ-S, BASFI and BASDAI scores were 1, 5, and 4, respectively. The mean ASQoL score for the sample was 8, and the mean Short-Form-36 scores were between 48 (body pain and general health) and 81 (emotional role). The average monthly household income for the group was US\$ 520. The patients had an average of 6 outpatient visits, 6 physical therapy visits and 30 laboratory exams per patient, per year. The average total cost for society was US\$ 4,597 per patient per year, of which 45% were direct costs and 55% were indirect costs.

Conclusion

Ankylosing spondylitis is a disease that represents a considerable burden to Brazil. It is extremely important to carry out studies that assess the costs of chronic diseases, especially in developing nations, in order to determine the best manner of allocating the already scanty resources in such regions.

Key words

Ankylosing spondylitis, resource utilisation, quality of life, direct costs, indirect costs

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Introduction

Ankylosing spondylitis (AS) is the main subtype of a group of diseases called spondyloarthritis. The main clinical characteristics of this group are inflammatory lumbar pain, resulting from sacroiliitis, and inflammation in other sites, such as the axial skeleton, peripheral joints, and entheses (1, 2). As the disease appears at a young age and exhibits gradual physical limitation, AS has a strong socioeconomic impact (3-5).

Previous studies have described the costs related to this disease in various countries, such as the USA (6), Canada (7), England (8), Holland, Belgium, and France (9, 10). The US study is the oldest publication, dating from 2002. In this study the total cost of the disease was US$ 6,720 per patient per year, with indirect costs responsible for the majority of costs (74%). In the Canadian study, the total cost was C$ 9,008, and contrary to other countries, the direct costs predominated in the total costs (62%). The study in England covered the impact of the disease and the cost-effectiveness of infliximab treatment. The total cost of the disease in this country was £6,165 per patient per year, with the indirect costs responsible for 58 percent of these costs. The other European study involved three countries: Holland, France and Belgium. The total cost of the disease in these countries was €10,984, €4,590, and €4,550 per patient per year, respectively. The predominance of indirect costs in the total costs in these three countries was also observed – with 81 percent in Holland, 70 percent in France, and 79 percent in Belgium. As such, the objective of this study is to determine the cost of this disease in a South American country, such as Brazil.

Patients and methods
Patients
Ninety patients meeting the modified New York criteria (1984) (11) for ankylosing spondylitis were selected between May 2005 and January 2006 from the outpatient clinics at the Division of Rheumatology of the Federal University of São Paulo (UNIFESP). Selection was performed consecutively and by convenience during routine consultations. Exclusion criteria involved patients with co-morbidities that would predominate over ankylosing spondylitis in terms of resource utilisation, or those whose medical records were not available at the time of the interview or at any time during the study. All patients were monitored at the outpatient clinics for at least twelve months.

Data collection
Questionnaires were applied during patient interviews. Further data was collected through a review of medical charts. The number of consultations (physician and physiotherapist), hospitalisations and surgeries, as well as intraarticular sessions, laboratory and image exams, drug use, and complementary or alternative therapies (homeopathy, acupuncture, and massage) were quantified. Information was also gathered on means of transportation used, services contracted as a result of functional disability, use of auxiliary equipment (braces, canes, and wheelchairs), and any home or work adaptations made to accommodate disabilities resulting from AS. Quality of life was assessed using two questionnaires: the disease-specific ASQoL (12) (Ankylosing Spondylitis Quality of Life) and the SF-36 (13) (Short Form 36), a widely used generic tool. The ASQoL questionnaire comprises 18 questions, each with a dichotomous "yes/no" response format, scored "1" and "0", respectively. Total scores range from 0-18, with a higher score indicating poor quality of life. The SF-36 Health Survey is a general health-status questionnaire comprising 36 items in eight domains of physical and mental health: physical functioning, social functioning, role physical, role emotional, mental health, vitality, pain and general health perception. Physical and Mental Component Summary scores (PCS and MCS) are calculated by summing domain items and transforming totals onto a scale from "0", or "worst health", to "100", or "best health". Other tools used to assess function and disease activity were also applied, such as HAQ-S (14), BASFI (15), and BASDAI(16). The Health Assessment Questionnaire disability index

modified for the spondyloarthropathies (HAQ-S) is a 25-question self-evaluation tool that asks respondents to rate the degree of difficulty they have in performing tasks in 10 functional areas (dressing, rising, eating, walking, hygiene, reaching, gripping, errands and chores, bending, and driving). Responses to each question can range from 0 (no difficulty) to 3 (unable to do), and the scores of each functional area are averaged to compute the HAQ-S (possible range 0-3). The Bath Ankylosing Spondylitis Functional Index (BASFI) assesses functional limitations in AS via 10 questions, each employing a 10-cm visual analogue scale (VAS). A mean of the scores for the 10 items provides the total BASFI score, with values ranging from 0-10. A high BASFI score indicates greater functional limitation. The Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) uses six 10-cm VAS scales to determine the severity of five major symptoms of AS. A mean of the scores for the six items provides the total BASDAI score. Scores range from 0-10, with a higher score indicating greater disability. All questionnaires have been translated and cross-culturally adapted for use in several languages and cultures, including the Portuguese spoken in Brazil (17-19).

Cost analysis
Costs associated with AS were classified as direct or indirect, with the former further split into medical and non-medical costs, partially structured according to a matrix of cost estimates published in the literature (20). Each resource had its cost defined in Brazilian currency (Real - R$) and converted into 2004 US dollars (R$ 1 = US$ 0.36). Results were obtained by multiplying the unit cost by the number of times a resource was used in the preceding year. Unit costs were valued according to a table used by the Brazilian Public Health System (*Sistema Único de Saúde*) for the year 2004. The Brazilian Public Health System is not centralised. It obeys Federal government policies, and it is virtually available to all Brazilian citizens. Drug costs were taken from the *ABCFARMA* list currently used by pharmacies in Brazil. The unit cost of

transportation was based on the official rates of the Public Transport System in the city of São Paulo. To assess indirect costs, we used the human-capital approach. For working patients, indirect costs were estimated by multiplying the days absent from work due to AS symptoms over the past year by the value of one day's work for the patient (monthly salary X 12/365). Non-AS related absenteeism was excluded. For patients on sick leave or in early retirement due to AS, indirect costs were estimated by multiplying the period away from work during the past year by the average market salary paid to individuals with the same qualifications as the patient, as published by an institution that conducts monthly surveys of positions and salaries in São Paulo, Brazil (21). The cost analysis adopted the society perspective.

Ethical issues
Following a discerning analysis, the Research Ethics Committee of UNIFESP-

EPM approved the present study. Terms of informed consent were explained to the patients, stressing aspects such as the objectives of the study, discomfort, risks, confidentiality of patient identity, absence of personal expenses, and specifically the liberty to withdraw consent for participation in the study at any time during the evaluation, which would in no way affect their continuity of treatment at the São Paulo Hospital. All patients who agreed to participate in the study signed terms of informed consent.

Statistical analyses
Standard deviations and percentages were used to present the data. In discriminating resources used and their respective costs, annual mean values per patient were used.

Results
Ninety patients with ankylosing spondylitis undergoing outpatient treatment at the Rheumatology Service of the São Paulo Hospital–Universidade Federal de

Table I. Demographic and socioeconomic characteristics of patients with ankylosing spondylitis (n=90) in treatment at the UNIFESP* ankylosing spondylitis outpatient clinics during a one-year period.

Gender (%)	Male	71 (79%)
	Female	19 (21%)
Age (years), mean (SD)		40 (12)
Caucasian (%)		56 (62%)
Marital status (%)	Single	33 (37%)
	Married	51 (57%)
	Divorced	4 (4%)
	Widowed	2 (2%)
Education (%)	First grade (elementary)	37 (41%)
	Eighth grade (middle school)	13 (14%)
	High school	28 (31%)
	University (incomplete)	6 (7%)
	University graduate	6 (7%)
City (%)	São Paulo	76 (84%)
	Other	14 (16%)
Housing arrangement (%)	Own home	68 (76%)
	Rented home	22 (24%)
Mean (SD) household income (US$)		520 (476)
Mean (SD) patient monthly income (US$) (N=80)		294 (256)
Employment situation (%)	Employed	29 (32%)
	Unemployed	10 (11%)
	Sick leave	23 (26%)
	Retired	21 (23%)
	Retired but still working	7 (8%)
Retirement cause (%)	Age	1 (4%)
	Disease	26 (93%)
	Work related	1 (4%)

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São Paulo (HSP-UNIFESP) were evaluated between April 2005 and January 2006. Table I displays the demographic and socioeconomic data of the patients studied. Most patients were male (79%), Caucasian (62%), with a mean age of 40 years (19 to 68), married (57%) and with incomplete elementary education (41%). Seventy-six patients (84%) resided in the city of São Paulo and 76 percent of the sample owned their own home. The mean (SD) monthly household income was US$ 520 (476). Twenty-eight patients (31%) were retired due to the disease; two other patients were retired from their principal functions after fulfilling time of service pension requirements, and another was retired from principal function due to age, but these were classified as active, as they were still in the job market (receiving pensions and working as well). Ten patients (11%) were in a functionally inactive situation and 23 (26%) were on leave from work and receiving sick pay. Ankylosing spondylitis accounted for 93 percent of the disease-related retirements. Seven of the retired patients still had some form of paid activity to supplement their income.

Table II displays the clinical characteristics of the patients with AS. There was a difference of approximately six years from the beginning of symptoms and the diagnosis; mean disease duration was 16 years and mean time since diagnosis was 8 years. Most patients walked without assistance and were independent with regard to practical living and hygiene activities. Twenty-four percent of the patients had peripheral arthritis; only 13 patients had undergone prosthetics surgery (all hip surgeries). Most of the deformities observed involved the spine (dorsal and cervical regions). We observed equal mean values for VAS scales related to pain and stiffness (value for both =5). Regarding functional capacity, mean values for the HAQ-S and BASFI were 1 and 5, respectively. Mean disease activity measured by the BASDAI was 4. On the quality of life questionnaires applied, the mean value for the ASQoL was 8, and the following mean values were obtained in the SF-36 components: 55 (physical functioning ca-

Table II. Clinical characteristics of patients with ankylosing spondylitis (n=90) treated at the UNIFESP* ankylosing spondylitis outpatient clinics during a one-year period.

Disease duration, years, mean (SD)		16	(10)
Peripheral arthritis (%)		24	
VAS for pain (0 – 10), mean (SD)		5	(3)
VAS for stiffness (0 – 10), mean (SD)		5	(3)
HAQ -S (0 – 3), mean (SD)		1	(1)
BASFI (0 – 10), mean (SD)		5	(3)
BASDAI (0 – 10), mean (SD)		4	(2)
ASQoL (0 – 18), mean (SD)		8	(5)
Short-Form-36 (0 – 100), mean (SD)	Physical Functioning	55	(27)
	Role physical	71	(29)
	Body pain	48	(20)
	General health	48	(25)
	Vitality	55	(25)
	Social Functioning	70	(27)
	Role Emotional	81	(23)
	Mental health	62	(23)
	PCS**	38	(10)
	MCS***	49	(10)

*Federal University of São Paul; **Physical Component Summary score; ***Mental Component Summary score.

Table III. Number of outpatient visits in patients with ankylosing spondylitis (n=90) treated at the UNIFESP* ankylosing spondylitis outpatient clinic during a one-year period.

Specialty	n.	Mean visits/ Patient/Yr
Rheumatology	337	4
Ophthalmology	32	0.4
Gastroenterology	26	0.3
Orthopedics	21	0.2
Dermatology	17	0.2
Cardiology	16	0.2
Other	72	1
Emergency	46	1
Acupuncture	192	2
Physiotherapy	504	6
Total	1,263	14

*Federal University of São Paulo.

pacity), 71 (role physical), 48 (bodily pain), 48 (general health), 55 (vitality), 70 (social functioning), 81 (role emotional) and 62 (mental health).

Table III displays all AS patient consultations in the previous year. There was a mean of 4 visits to the rheumatology outpatient clinic per year, representing 59 percent of the total number of medical visits. The patients had undergone an average of 2 acupuncture sessions and 6 physiotherapy sessions per year. Table IV displays the number of laboratory examinations ordered at the rheumatology clinics in the previous year. Exams related to disease activity – such

as erythrocyte sedimentation rate – and control of immunosuppressive therapy – such as complete blood count and hepatic function – were the most ordered laboratory exams. Radiograms, especially of the hip and spine, were the most frequently ordered imaging exams (Table V). Dividing the number of exams performed for rheumatological assessment by the total number of visits to the clinic, 7 exams were requested per visit.

In analysing the medication used for the treatment of ankylosing spondylitis, a large majority of the patients were under the use of non-steroidal anti-inflammatory drugs (Table VI). Perhaps for this reason, the most prescribed drugs in the treatment of the associated diseases were gastric protectors. Twelve percent of the patients were under the use of infliximab and one percent was under the use of Etanercept, an anti-TNF drug recently used for the management of the disease.

Table VII displays the resource utilisation for the sample. Only two patients had undergone surgical procedures, but neither was related to ankylosing spondylitis. Four of the six internments were due to AS. Nine patients had undergone injection sessions in the previous year; this procedure was most frequently requested for the hip joint (4 injections). A total of ten helping devices were acquired by the patients in

Table IV. Laboratory tests ordered for ankylosing spondylitis and associated disease management in patients (n=90) treated at the UNIFESP* ankylosing spondylitis outpatient clinics during a one-year period.

Test	Ankylosing spondylitis		Associated diseases	
	n.	Mean lab tests / Patient / Yr	n.	Mean lab tests / Patient / Yr
Complete blood count	216	2	12	0.1
Erythrocyte sedimentation rate (ESR)	207	2	7	0.1
Aspartate transaminase (AST)	204	2	11	0.1
Alanine transaminase (ALT)	204	2	11	0.1
Creatinine	180	2	10	0.1
Urinalysis	178	2	12	0.1
Gamma-glutamyl transpeptidase (GGT)	154	2	10	0.1
Alkaline phosphatase	152	2	10	0.1
Glycemia	112	1	3	0.03
Urea	99	1	5	0.1
C-reactive protein (PCR)	91	1	1	0.01
Other	293	3	83	1

*Federal University of São Paulo.

Table V. Imaging exams ordered for ankylosing spondylitis and associated disease management in patients (n=90) treated at the UNIFESP* ankylosing spondylitis outpatient clinics during a one-year period.

Test	Ankylosing spondylitis		Associated diseases	
	n.	Mean lab tests / Patient / Yr	n.	Mean lab tests / Patient / Yr
Hip joint x-ray	50	1	4	0.04
Lumbar spine x-ray	31	0.3	2	0.02
Thorax x-ray	31	0.3	3	0.03
Sacroiliac joints x-ray	30	0.3	–	–
Dorsal spine x-ray	18	0.2	–	–
Shoulder ultrasonography	18	0.2	–	–
Shoulder x-ray	17	0.2	–	–
Pelvis x-ray	16	0.2	9	0.1
Cervical spine x-ray	15	0.2	–	–
Bone densitometry	13	0.1	–	–
Other	79	1	56	1

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Table VI. Drugs most often prescribed for the treatment of ankylosing spondylitis in patients (n=90) treated at the UNIFESP* ankylosing spondylitis outpatient clinics during a one-year period; more than one drug may have been prescribed simultaneously.

Drugs	Utilisation (%)
Non-steroidal anti-inflammatory drugs	87
Methotrexate	43
Sulfasalazine	31
Prednisone	29
Folic acid	27
Analgesics	18
Infliximab	12
Etanercept	1

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Other studies have been conducted in our country on diseases such as rheumatoid arthritis (22), systemic lupus erythematosus (23), rheumatic fever (24), and osteoporosis (25), all of which found divergent results from data originating from other areas of the world. Hence, it is important to obtain data from our country, as differences in the various health systems worldwide do not permit the unification of findings from different cost-of-illness (COI) studies.

In the population of the present study, males predominated, with a mean disease duration of 16 years, which are similar findings to those of other COI studies on AS (6, 7, 9). The mean functional scores for the BASFI (5) and HAQ-S (1) were slightly higher than those described in other studies (6, 7, 9), demonstrating a more compromised functional capacity in our sample. The mean BASDAI value was 4, which was very similar to the Canadian study (BASDAI=4.33) (7) and a little higher than the tri-nation European study (BASDAI=3.33) (9). There was, however, no difference regarding disease activity when comparing our data with these studies.

Our data revealed an average of 6 medical visits, 6 physiotherapy sessions and 2 acupuncture sessions per patient per year in our AS population. Each patient was seen by an AS-related physician 4 times a year. The American study (6)

the previous year (5 foot pads, 3 canes, 2 pairs of special shoes). The bus (51%) and subway train (26%) were the most commonly used means of transportation in our sample. A total of 2,254 trips were made during the study period. Most adaptations were made at home, representing 4 out of a total of 5 adaptations.

Table VIII displays a description of the indirect costs to the patients as well as to each subgroup. Costs related to retired patients accounted for the largest proportion of indirect costs (65%), in contrast to the value found for the subgroup of employed patients, representing just 2 percent of indirect costs related to the disease.

Table IX displays the annual costs related to AS in our patients. The mean direct medical cost per patient was US$ 2,027.78 per year; the mean direct non-medical cost was US$ 37.37; and the mean indirect cost was US$ 2,531.76. The cost of medication was responsible for most of the direct costs (91.7%), and the indirect cost had a slight preponderance in the overall cost of the disease (55.1%). Mean total cost per patient per year (direct and indirect costs) in our sample was US$ 4,596.91.

Discussion

This is the first study to analyse resource use and cost of AS in Brazil.

Table VII. Resource utilisation of patients with ankylosing spondylitis (n=90) treated at the UNIFESP* ankylosing spondylitis outpatient clinics during a one-year period.

Resources	n.	Mean/Patient/Year
Physician visits	567	6
Physical therapy visits	504	6
Acupuncture visits	192	2
Diagnostic tests	2,657	30
Surgical procedures	2	0.02
Hospitalisations (without surgery)	6	0.1
Intraarticular injections	9	0.1
Devices	10	0.1
Home/work adaptations	5	0.1
Transportation (total number of trips)	2,254	25

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Table VIII. Indirect costs of ankylosing spondylitis estimated based on individual data for 90 Brazilian patients with AS according to work status (Retired, Sick leave and Working).

Work status	Indirect cost Total (US$)	Indirect cost Per Patient/Year (US$)
Retired (n=28)	148,501	5,304
Sick leave (n=23)	75,085	3,265
Working (n=29)	4,272	147
Total (n=80)	227,859	2,848

Table IX. Total annual costs (direct and indirect) related to patients with ankylosing spondylitis (n=90) treated at the UNIFESP* ankylosing spondylitis outpatient clinics.

Total costs	(2004 US$)	(%)
Health care costs (direct)		
Medical costs		
Outpatient appointments		
Physician visits	1,568.08	0.4
Other healthcare professional visits	699.43	0.2
Diagnostic tests	6,614.04	1.6
Drug therapies	170,511.57	41.2
Surgical admissions	383.85	0.1
Medical admissions	2,544.23	0.6
Intraarticular injection sessions	18.56	0.001
Devices and aids	160.11	0.04
Subtotal	182,499.87	44.1
Other disease related costs (direct)		
Transportation	2,817.28	0.7
Help at home, at work and self care	–	–
Adaptations	545.79	0.1
Subtotal	3,363.07	0.8
Indirect costs	227,858.68	55.1
Total costs for 90 patients	413,721.62	100
Mean total cost/patient/year	4,596.91	

*Federal University of São Paulo.

found 4.8 and 1.3 medical and physiotherapy visits per patient per year, respectively, whereas data from the European studies (9) found a greater frequency of physiotherapy visits (19 per patient per year) and a similar number of visits to physicians (4.9 per patient per year). Differences found in various countries regarding the number of visits, especially physiotherapy visits, may be explained by the fact that physiotherapy is not covered by healthcare insurers in the USA. Besides visits to rheumatologists, the most sought-after specialties among our patients were the emergency service (0.5 visits per patient per year), ophthalmology (0.4 visits per patient per year) and gastroenterology (0.3 visits per patient per year); the latter two were likely due to the extraarticular effects of the disease.

Ten patients reported use of auxiliary equipment/materials: five acquired foot pads, three acquired canes and two acquired special shoes. The total cost of this type of utilisation was US$ 160, representing US$ 2 per patient per year, which is a very small amount when compared to the direct and total costs encountered in our study. In rheumatoid arthritis, we know that the use of equipment represents between 4 and 7 percent of direct costs (26, 27), perhaps due to the more peripheral attack of this type of arthritis, with a more intensive functional deterioration. In our study, most of the patients were well adapted to the disease and did not obtain low scores in aspects related to limitations due to physical aspects, as we observed upon applying the SF-36.

The surgeries the patients in our sample underwent were not directly related to ankylosing spondylitis. One patient underwent total thyroidectomy for thyroid neoplasm and another patient had undergone laparotomy for drainage of a pelvic abscess. However, of the six internments occurring among the patients, four were related to ankylosing spondylitis, and 90 percent of the costs attributed to the internments were related to AS. Therefore, treatment and adequate follow-up of the disease could diminish the number of interments and, consequently, the associated costs.

The total number of complementary examinations ordered in our study was 2,657, which translates to 6 exams ordered per medical visit. Most exams performed were laboratory exams, especially full blood count, erythrocyte sedimentation rate and hepatic function assays, frequently ordered to assess disease activity and monitor immunosuppressive drugs. However, the highest cost was related to imaging exams, which represent a financial burden and accounted for 56 percent of examination costs.

Although non-steroidal anti-inflammatory drugs were the ones most used by the patients in our study, costs related to this use were not higher than those attributed to anti-TNF medication. Only 12 patients were under the use of biological agents, but the cost of these drugs accounted for 80 percent of medication costs and 74 percent of total costs, stressing the importance of cost-effectiveness studies regarding these new therapies currently being used. In Brazil, biological agents are provided by the public health system and may represent the largest part of direct costs relating to the disease. Kobelt and colleagues (8) demonstrated that AS treatment with infliximab appears to be cost effective but suggest further studies on larger populations.

Five patients carried out adaptations at home or at work, with a total cost of US$ 546. If we divide this figure by five patients, we have an approximate cost of US$ 109 per patient per year. This figure is minimal if we divide the total cost by all 90 patients. Perhaps the actual cost of adaptations is higher but was not accurately informed due to the fact that data collection was retrospective and therefore dependent upon the patients' memories regarding information.

Expenses related to transportation accounted for most of the non-medical hospital costs (85%) but only represented 2 percent of direct costs and 1 percent of total costs. The most used means of transportation was the city bus. This is likely due to the fact that the sample was made up of individuals with lower *per capita* incomes who acquired bus passes from the São Paulo Transportation Company, which supplies free passes for special passengers with various medical conditions, including AS (28).

Patients on sick leave or in early retirement due to AS were responsible for a large part of the indirect costs of the disease. Incapacity for work can affect up to 20 percent of patients in the first 20 years of the disease (29, 30). Unlike rheumatoid arthritis, which mostly affects women around 40 years of age, AS has the characteristic of occurring at a younger, more productive age and predominates in the men. Thus, costs related to productivity are higher in AS. Other studies have pointed to indirect costs as determining factors of the total costs in AS, accounting for approximately 70 to 75 percent of costs (6, 10).

The human capital (HC) approach was chosen to analyse indirect costs. Other studies have also used friction cost analysis (FC) (10), but this type of approach can underestimate the impact of the disease on productivity, as it uses an estimate based on duration of leave until the moment the individual is placed back at work. The tri-nation European study (10) calculated costs through both approaches, demonstrating lower values for FC, as observed in Holland (FC=US$ 651 *vs.* HC=US$ 10,368), France (FC=US$ 379 *vs.* HC=US$ 3,730) and Belgium (FC=US$ 320 *vs.* HC=US$ 4,222).

Total costs of the disease were divided into direct (45%) and indirect (55%) costs; each category accounted for practically half of the total costs. These data diverge from recent published studies (6, 10), which generally found higher percentages for indirect costs. This is likely due to the fact that our study included patients who were using biological agents, thereby increasing costs related to medication, which accounted for approximately 90 percent of the direct costs in our study.

We found a value of US$ 4,597/patient/year for AS treatment in Brazil. The total cost of AS in our country is lower than costs in other studies. These differences are, above all, due to the value given to diverse healthcare services and treatments, the number of patients involved, and the methodologies used in the studies. *Per capita* spending on healthcare is lower in Brazil as well (31), obviously resulting in lower total costs.

Despite the advantages of a retrospective study, such as low cost and less execution time, this type of study implies a number of limitations, the principal of which is perhaps recall bias. In a study on patients with rheumatoid arthritis, Merkesdal *et al.* (32) demonstrated that patients offer more reliable information regarding loss in productivity in the three months prior to data collection. Disadvantages also include the information contained on medical charts, which are not always completely filled out. Prospective studies with a larger number of patients and carried out over a period of time longer than one year would minimise the limitations found in the present study.

COI studies are useful in comparing healthcare spending on different diseases. It is important to consider the existence of low-prevalence illnesses that cause considerable individual suffering but little resource utilisation, such as AS. Therefore, studies involving individual mortality and morbidity rates should be taken into account in the establishment of priorities in the field of healthcare. The contribution of COI studies is also related to the identification of cost determinants and, consequently, factors that could be modified in order to reduce the economic impact of a particular disease. Therefore, carrying out COI studies in developing countries, which have limited available healthcare funds, is of extreme importance to a better allocation of resources and a more rational administration of healthcare spending.

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