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Economic burden of rheumatoid arthritis: a systematic review

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Abstract

Objective. To summarize the state of knowledge with regard to the economic impact of rheumatoid arthritis (RA) and to highlight any weaknesses in the work conducted to date, so as to inform future RA cost-of-illness studies.

Methods. Four computerized literature databases were searched to identify all the literature relevant to this review. Seven elements indicating a quality cost-of-illness study were established and used to appraise the literature identified critically. Where possible, costs reported by the different studies were converted to 1996 US dollars using the consumer price index for medical care.

Results. Total average medical costs were reported to range from US$5720 (UK£3575) to US$5822 (UK£3638). Medication constituted between 8 and 24% of total medical costs, physician visits between 8 and 21%, and in-patient stays between 17 and 88%. The average number of days absent from work due to a person's RA was reported to range from 2.7 to 30 days/year.

Conclusion. The economic impact of RA in terms of cost was reported to be substantial by all studies reviewed. However, methodological problems meant that discrepancies in the average (per person) annual cost of RA existed across studies.

KEY WORDS: Rheumatoid arthritis, Economics, Costs, Review.

The economic burden of rheumatoid arthritis (RA) is thought to be substantial for both people with RA and health services. As a whole, musculoskeletal disorders impose a considerable burden upon society in terms of morbidity, long-term disability and cost, but their impact in terms of mortality is low compared to other disease groups [1].

The quantification of all costs associated with a particular disease(s), such as RA, can be used as a proxy for the medical and economic burden it places upon society or a target audience such as the patient, the health service or society as a whole, depending on the viewpoint adopted [2]. Such studies are known as cost-of-illness (COI) studies [3–5] and provide informative data to emphasize the scale and nature of a disease as a health problem, and raise the profile of people with that disease as a patient group.

The methodology outlined by Rice [5] considered COI valuations to consist of three cost components: direct costs, indirect costs and psychosocial costs. Direct costs are defined as those costs for which actual payments are made. They include medical costs such as treatment costs, hospital costs and medication, as well as personal costs such as transport costs to the health provider and specialist aids.

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Indirect costs are costs for which resources are lost, but no direct payment is actually made. They can be classified into two groups: morbidity costs which are mainly productivity losses borne by the individual, their family, society and employer due to illness, and mortality costs which are the present value of lost production due to premature death caused by illness.

The third category of costs are referred to as psychosocial or intangible costs. These costs represent the deterioration in the quality of life of patients, as well as their families and friends [6]. For example, people with RA may suffer from disability, pain, reduced self-esteem and feelings of well-being. These costs are extremely difficult to quantify and, therefore, are often omitted from economic studies.

This paper reports the results of a systematic review of published COI studies of RA. The objective of COI studies is not to inform choices about which treatment or therapy is the most cost-effective option for people with RA, but to assist the decision-making process at policy and planning levels by identifying where the major burden of cost might lie in the treatment and care of these people.

The objectives of this paper are 2-fold: (i) to summarize the state of knowledge with regard to the economic impact of RA and (ii) to highlight any weaknesses in the work conducted to date, so as to inform future RA COI studies.

Methods

Four computerized literature databases [Medline 1966–1997; BIDS-ISI 1981–1997 (both science and social science citation indexes); BIDS-EMBASE 1950–1997 (Excerpta Medica)] were searched in the title, abstract and key word fields using the following:

- Rheumatoid arthritis
- Arthritis
- Economics
- Costs
- Cost analysis
- Cost-of-illness
- Burden-of-illness

Titles and abstracts (where available) of the publications identified were then used to assess a paper's potential relevance to this systematic review. The inclusion and exclusion criteria used for this are outlined in Table 1. At this stage, full transcripts of all the papers deemed potentially relevant were obtained and their reference lists checked for any papers not identified by the computerized search. Authors of conference abstracts identified by the literature search were contacted for more detailed information on their study findings.

Several recent efforts have been undertaken to define the necessary elements of economic evaluations [7–9]; however, no formal guidelines for COI studies have been established. Therefore, from the health economics literature, seven key elements of COI studies were compiled for use in this review. These key elements are presented in Table 2 and each one briefly discussed below.

Table 1. Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
• English language • Studies that consider the costs of RA from either the individuals', the health services' and/or society's perspective	• Non-English language • Musculoskeletal disorders other than RA • Economic evaluations of drugs, treatment or therapy • Personal papers/case studies • No costs quoted in the result section • Conference abstracts or review papers

Table 2. Seven key elements of cost-of-illness studies [8–10]

1. Viewpoint of the analysis clearly stated and justified
2. Study population clearly stated.
3. All relevant medical and/or non-medical costs included, and their data sources clearly stated
4. All relevant morbidity and/or mortality costs included, and their sources clearly stated
5. All costs adjusted for differential timing, where appropriate (i.e. discounting)
6. Incremental/attributable costs calculated
7. Sensitivity analysis performed to address parameter uncertainties

The first key element of COI studies, like all economic studies, is the need to specify a viewpoint for the analysis since a commodity may be a cost from, say, the patient's point of view but not from, say, that of the health services [7]. It is also important for the study population to be well defined in terms of sociodemographic characteristics and disease severity to assist the decision-making process and to allow comparisons to be performed across studies. The third and fourth key elements state the need for all COI studies to include the most important and relevant costs for the viewpoint adopted, although it may not be possible for studies to measure and include all the costs incurred. Fifthly, when COI studies are conducted over >1 yr, costs should be discounted to reflect the fact that costs in the future are valued less highly than costs in the present [7]. The sixth key element states that the difference in costs incurred by the study population and a disease-free population (i.e. incremental costs) should be calculated, where possible, in addition to the main analysis to avoid the assumption that without the disease of interest a person would incur no COI. Finally, it is important that all COI studies, like all economic studies, apply sensitivity analysis to their study results to address the uncertainty, imprecision or methodological controversy present in most, if not all, studies [7].

Throughout this report, all costs have been converted into 1996 US dollars using the consumer price index for medical and non-medical resources [10]. Costs have also been converted into UK sterling using the average exchange rate for the appropriate years and are presented in parentheses throughout the text. Where costs have been converted into either US dollars or UK sterling from other currencies, these costs should only be used as a guide because official exchange rates do not adequately reflect the comparative purchasing power of the local currencies in their own markets.

Results

Literature search

The systematic literature search identified 49 articles. Of these, only 15 fulfilled the inclusion criteria in Table 1 and were therefore included in the critical review process. Eleven of the COI study papers identified for review came from the USA and one each from Canada, Sweden, The Netherlands and the UK.

Cost-of-illness criteria

Table 3 displays the established criteria for assessing the standard of COI studies and shows which of the seven elements identified were present in each study. One study [2] based their costs on estimated data and expert opinion, and was therefore excluded from the review at this stage. The viewpoint adopted was not explicitly stated by any of the 14 studies listed in Table 3, but could be implied by the cost data used in all cases. The study population used was provided by all the studies and a clear description of the costs included in the analysis, together with their sources, provided by many.

TABLE 3. Elements present/absent in each of the 14 cost-of-illness studies

	1. Viewpoint	2. Population	3. Medical/ non-medical costs	4. Morbidity/ mortality costs	5. Discounting	6. Incremental/ attributable	7. Sensitivity analysis
Meenan *et al.* [17]	[+]	+	+	+	N/A	0	0
Stone [11]	[+]	+	+	+	+	0	+
Liang *et al.* [19]	[+]	+	+	+	N/A	0	[+]
Spitz 1984 [31]	[+]	+	+	0	N/A	0	0
Lubeck *et al.* [20]	[+]	+	+	0	N/A	0	0
Wolfe *et al.* 1986 [32]	[+]	+	+	0	N/A	0	0
Jacobs *et al.* 1988 [33]	[+]	+	+	0	N/A	0	0
Jonsson *et al.* 1992 [24]	[+]	+	[+]	[+]	N/A	0	0
Yelin 1996 [14]	[+]	+	+	0	N/A	+	0
Lanes *et al.* [18]	[+]	+	+	0	N/A	0	0
Gabriel *et al.* [12]	[+]	+	. +	0	N/A	+	0
Gabriel *et al.* [13]	[+]	+	+	+	N/A	+	0
Clarke *et al.* [15]	[+]	+	+	+	N/A	0	+
van Jaarsveld *et al.* [26]	[+]	+	+	0	N/A	0	0

Notation based on Rothfuss *et al.* [8]: +, present; [+], partly fulfilled; 0, absent.

Discounting was only applicable to one study [11] as all the others estimated costs over a 1 yr period. Three studies [12–14] estimated attributable costs and only two studies [11, 15] used sensitivity analysis.

Study design

Two-thirds of all the studies identified selected their study cohort from a clinical setting rather than a community setting. Only two studies [12, 13] adopted a case–control study design to enable the differences in costs incurred by RA patients and non-RA patients (incremental/attributable costs) to be calculated, rather than limiting themselves to the total costs incurred by RA patients only (absolute total costs). By calculating the incremental costs, the assumption that an individual will incur no COI in the absence of RA is avoided.

A prevalence-based [16] study design, which involved the estimation of the total cost of RA in a given time period (usually 1 yr), was adopted by all studies, except one. Stone [11] used an incidence-based [16] study design to estimate the lifetime costs of RA.

A primary data collection process (questionnaires, interviews, diaries) was adopted by approximately two-thirds of the studies identified. The remainder used a secondary data collection process (national or community databases, clinical opinion).

The majority of studies calculated the direct costs associated with RA; however, many limited themselves to the medical costs (e.g. in-patient and out-patient costs), excluding non-medical costs (e.g. transport, aids and home modifications). Six studies measured indirect morbidity costs in terms of the income lost as a result of absence from work due to a person's RA and only Stone [11] estimated the mortality costs associated with RA.

Study populations

Table 4 displays the patient characteristics of the different studies considered by this review. The percentage of females in each study cohort ranged from 68 to 83% with the mean age ranging from 48 to 63 yr and the mean duration of disease from 0 to 21 yr. The mean level of functional disability, measured by the Health Assessment Questionnaire (HAQ), ranged from 0.96 to 1.53 where stated. [The HAQ is scored on a scale from 0 to 3, where 0 = 'without difficulty', 1 = 'with some difficulty', 1 = 'with much difficulty' and 3 = 'unable to perform'.]

Costs of RA

The costs calculated by the different studies varied dramatically for all of the cost categories. Overall, the mean annual direct costs associated with RA (excluding Stone [11] lifetime costs) were calculated to be US$5720 (S.D. = US$2933), with the highest costs being recorded by Meenan *et al.* [17] for the study population with the youngest mean age (48 yr), one of the shortest disease durations (9.8 yr) and the greatest disease severity (i.e. all stage III RA patients) (Table 5). Stone [11] estimated lifetime direct costs of RA to equal US$15 504 (UK£9690). The mean costs for out-patient visits and in-patient stays (excluding Stone [11] lifetime costs) were US$1855 (S.D. = US$921) and US$4944 (S.D. = US$7041), respectively. The percentage of RA sufferers hospitalized in the cohorts studied ranged from 12% [14] to 26% [17]. For all studies, except two [18, 19], in-patient costs were found to be the largest component of total annual medical costs associated with RA.

Where indirect costs were considered, it was usually as the number of days absent from work per annum due to RA; these ranged from 2.7 days/year [20] to 30 days/year [19] per patient in employment (Table 4). The mean annual indirect cost associated with RA (excluding Stone [11] lifetime costs) was calculated to be US$5822 (S.D. = US$8416). Stone [11] estimated the lifetime indirect costs to be US$37 501 (UK£23 438) (Table 5).

Where incremental costs were calculated, direct medical costs of RA patients were estimated at US$7274 (UK£4546) compared to US$1917 (UK£1198) for non-

TABLE 4. Cohort characteristics by study

	Country	% Female	Mean age	Mean duration of disease	Mean HAQ score	% Working	No. of sick days off work per working patient (per annum)
Clinical based							
Meenan *et al.* [17]	USA	76	48	9.8	–	76	–
Liang *et al.* [19]	USA	80	61	13.5	–	31	30
Lubeck *et al.* [20]	USA	76	55	14.5	1.2	33	2.7
Wolfe *et al.* 1986 [32]	USA	76	56	15.4	1.21	–	–
Jacobs *et al.* 1988 [33]	USA	77	–	–	–	–	–
Yelin 1996 [14]	USA	–	–	–	–	–	–
Lanes *et al.* [18]	USA	–	–	–	–	–	–
Clarke *et al.* [15]	Canada	75	62	20.8	1.03–1.53[a]	22	6.5
van Jaarsveld *et al.* [26]	The Netherlands	69	60 (median)	0–6	1.10	–	–
Community based							
Stone [11]	USA	70	–	–	–	–	–
Spitz 1984 [31]	USA	83	54	15	–	–	–
Jonsson *et al.* 1992 [24]	Sweden	–	–	19	–	–	–
Gabriel *et al.* [13]	USA	73	63	–	–	–	–
Gabriel *et al.* [12]	USA	68	61	–	0.96	–	–

[a]Clarke *et al.* [15] studied two cohorts of RA patients (1983–89 and 1990–94).

TABLE 5. The average (mean) direct and indirect costs for all of the 14 studies reviewed (1996 US dollars)

	Out-patient costs ($)							
	Physician visits	Medication	Diagnostic tests	Total	In-patient costs ($)	Other costs ($)	Total direct costs ($)	Total indirect costs ($)
Clinical based								
Meenan *et al.* [17]	744	746	809	2706	8448	349	11 503	18 422
Liang *et al.* [19][a]	–	–	–	675	505	721	1902	–
Lubeck *et al.* [20]	525	1221	917	3006	3051	910	6967	–
Wolfe *et al.* 1986 [32]	–	–	–	–	26 217	–	–	–
Jacobs *et al.* 1988 [33]	1427	682	–	2717	3770	715	7202	–
Yelin 1996 [14]	1156	–	–	1872	2976	793	5640	–
Lanes *et al.* [18]	–	–	–	491	378	1442	2310	–
Clarke *et al.* [15]								
1983–1989	179	554	267	1099	1536	0	2635	1467
1990–1994	153	558	218	1031	2211	0	3242	1082
van Jaarsveld *et al.* [26]	–	–	–	1735	1915	4040	7691	–
Community based								
Stone [11][b]	–	–	–	6744	5053	3707	15 504	37 501
Spitz 1984	660	962	889	2885	3235	432	6551	–
Jonsson *et al.* 1992 [24]	–	–	–	–	–	–	2723	1649
Gabriel *et al.* [12]	–	–	–	2189	5085	0	7274	–
Gabriel *et al.* [13]	–	–	–	–	–	995	–	1874

[a]Average per person costs of people with RA and OA.
[b]Lifetime costs per person with RA.

arthritic people [12], and indirect costs US$1874 (UK£1171) compared to US$849 (UK£531) [13].

Despite common opinion that indirect costs far exceed direct costs [21–23], the findings of this review were less decisive (Table 4). Two of the four studies that estimated both direct and indirect costs reported direct costs to be the largest contributor of total cost (62–74%) [15, 24], and two studies [11, 17] reported indirect costs to be approximately twice direct costs.

Sensitivity analysis

Stone [11] found lifetime costs to range from US$38 834 to US$90 948, depending upon the discount rate, incidence and cost figures used. Clarke *et al.* [15] found physician costs to increase between 1.0 and 6.4% when physician reimbursement was modified, laboratory and radiology costs to increase between 288 and 333% when laboratory tests were varied, and indirect costs to increase between 1.4 and 17% when the number of

disabled days was modified to include all institutionalized days.

Discussion

State of knowledge with regard to the economic impact of RA

The economic impact of RA in terms of cost was reported to be substantial by all of the studies reviewed. Overall, the mean annual direct and indirect costs per person with RA were found to be US$5720 (UK£3575) and US$5822 (UK£3638), respectively, i.e. approximately equal.

From the individual study results reported in Table 5, it is apparent that vast cost discrepancies exist across studies (see below). Despite a thorough investigation of the data, this variation in cost estimates could not be explained by the sociodemographic or clinical differences that existed across study populations.

By calculating the mean cost as the main statistic, it is likely that the studies published to date have overestimated the annual per person costs of RA owing to the positively skewed distribution associated with cost data [25]. By comparing the median annual direct costs per person, in the three studies where available, agreement is much improved and costs were found to range from US$1011 (UK£631) [15] to US$1060 (UK£663) [26]. The mean annual direct costs for these three studies ranged from US$2635 (UK£1647) to US$7691 (UK£4807).

Overall, in-patient costs were found to represent the largest proportion of direct costs, making less than a quarter of the RA patient population responsible for at least 43% [18] and up to 75% [17] of annual medical costs associated with RA (excluding Liang *et al.* [19] cost estimates for both osteoarthritis and RA).

Methodological problems

The discrepancies in the annual per person costs of RA across studies can be attributed to a number of methodological problems. The first, as mentioned above, is the use of the arithmetic mean to describe the data. Owing to the positively skewed distribution of the cost data in many, if not all, of the studies reviewed above, the median (together with the interquartile range) would have provided a better description of the distribution of the cost data and a more informative measure of the average per person cost [27]. However, the mean and confidence interval are useful summary statistics to the policy maker, who may be interested in the total cost of a particular disease for a cohort of patients as a whole [28].

Discrepancies in the cost of RA can also be attributed to the absence of well-defined guidelines for COI studies, making comparisons across studies extremely difficult. This is particularly true where authors have provided insufficient data about the unit costs and data sources used, and makes it difficult for the reviewer to judge the reliability and validity of the cost estimates quoted.

Thirdly, studies need to be more explicit about the types of costs incorporated into the different cost categories (i.e. direct and indirect) and how they were calculated. For example, direct costs may include medical and/or non-medical costs, and medical costs may include primary and/or secondary health care, and secondary health care costs may include in-patients and/or out-patients, and out-patient costs may include physician visits, medication and/or diagnostic tests, and so on. The same is true for indirect costs that may or may not include the imputed income loss of those people with RA outside the workforce, such as homemakers and retirees.

Finally, the characteristics of the study population (age, sex, severity of disease, duration of disease), at recruitment to the study, may also have an effect on the cost estimates calculated by the different studies and should, therefore, be stated clearly in the study publication. In the majority of papers reviewed above, study participants were recruited from a clinic or hospital setting, which benefit from a relatively homogeneous patient sample in terms of diagnosis, severity of disease and demographic characteristics [29], but may prove less generalizable to the overall disease population by overrepresentation of the more severe RA patients. In contrast, national or community-based populations can provide a more reliable estimate about the range of impacts of RA, in terms of restriction on activities and medical care utilization. Where available, summary statistics on the characteristics of the different study populations were extracted (Table 4), but no obvious associations between these characteristics and the cost estimates achieved were apparent.

As all cost estimation contains some degree of uncertainty, imprecision or methodological controversy, it is important for all studies to test the sensitivity of their results by reworking their analysis applying a series of different assumptions and/or estimates [7]. Only two studies [11, 15] out of the 14 reviewed in this paper performed sensitivity analysis.

The generalizability of the cost of RA estimates to the wider population is difficult due to the community-specific nature of many of the studies. For instance, the COI estimates presented above are not easily generalizable across countries due to variations between health care systems. Most of the studies conducted to date have provided cost estimates specific to the US population and health care system. It is important, therefore, for more studies to be conducted to highlight the magnitude of the impact of the RA on the patient, society and the health care service in other countries, and also to assist the decision-making process in these countries concerning the treatment and care of RA patients.

Guidelines for future cost-of-illness studies

It is important that future studies designed to estimate the economic impact of RA: (i) report direct and indirect costs separately as well as in aggregate [30]; (ii) identify the different components of direct costs to help decision makers identify the budgets on which the major economic burden falls [30]; (iii) clearly state the data

sources and unit costs used to obtain the cost estimates quoted to allow estimates to be reworked for different locations; (iv) test the sensitivity of the study results by repeating the analysis, varying the assumptions underlying the estimates.

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References

1. Rice DP, Hodgson TA, Kopstein AN. The economic costs of illness: replication and update. Health Care Financing Review 1985;7:61–80.
2. McIntosh E. The cost of rheumatoid arthritis. Br J Rheumatol 1996;35:781–90.
3. Sheill A, Gerard K, Donaldson C. Cost-of-illness—An aid to decision-making. Health Policy 1987;8:317–23.
4. Hodgson TA, Meiners MR. Cost-of-illness methodology—A guide to current practices and procedures. Milbank Mem Fund Q Health Society 1982;60:429–62.
5. Rice DP. Estimating the cost of illness. Am J Public Health 1967;57:424–39.
6. Hodgson TA. The state of the art of cost-of-illness estimates. Adv Health Econ Health Serv Res 1983;4:129–64.
7. Drummond MF, Stoddart GL, Torrance GW. Methods for the economic evaluation of health care programmes. Oxford: Oxford Medical Publications, 1987.
8. Rothfuss J, Mau W, Zeidler H. Socioeconomic evaluation of rheumatoid arthritis and osteoarthritis: A literature review. Semin Arthritis Rheum 1997;26:771–9.
9. Department of Clinical Epidemiology and Biostatistics McMaster University Health Sciences Centre. How to read clinical journals: VII. To understand an economic evaluation (part B). Can Med Assoc J 1984;130:1542–9.
10. US Bureau of Labor Statistics. Consumer price index for all items and for medical care: 1970–1996. CPI Detailed Report, 1997.
11. Stone CE. The lifetime economic costs of rheumatoid arthritis. J Rheumatol 1984;11:819–27.
12. Gabriel SE, Crowson CS, Campion ME *et al.* Direct medical costs unique to people with arthritis. J Rheumatol 1997;24:719–25.
13. Gabriel SE, Crowson CS, Campion ME *et al.* Indirect and nonmedical costs among people with rheumatoid arthritis and osteoarthritis compared with nonarthritic controls. J Rheumatol 1997;24:43–8.
14. Yelin E. The costs of rheumatoid arthritis—absolute, incremental and marginal estimates. J Rheumatol 1996;23:47–51.
15. Clarke AE, Zowall H, Levinton C *et al.* Direct and indirect medical costs incurred by Canadian patients with rheumatoid arthritis: A 12 year study. J Rheumatol 1997; 24:1051–60.
16. Scitovsky AA. Estimating the direct cost-of-illness. Milbank Mem Fund Q 1982;60:463–91.
17. Meenan RF, Yelin EH, Henke CJ *et al.* The costs of rheumatoid arthritis. A patient-oriented study of chronic disease costs. Arthritis Rheum 1978;21:827–33.
18. Lanes SF, Lanza LL, Radensky PW *et al.* Resource utilization and cost of care for rheumatoid arthritis and osteoarthritis in a managed care setting—The importance of drug and surgery costs. Arthritis Rheum 1997;40: 1475–81.
19. Liang MH, Larson M, Thompson M *et al.* Costs and outcomes in rheumatoid arthritis and osteoarthritis. Arthritis Rheum 1984;27:522–9.
20. Lubeck DP, Spitz PW, Fries JF *et al.* A multicenter study of annual health service utilization and costs in rheumatoid arthritis. Arthritis Rheum 1986;29:488–93.
21. Allaire SH, Prashker MJ, Meenan RF. The costs of rheumatoid arthritis. Pharmaco-Economics 1994;6: 513–22.
22. Lambert CM, Hurst NP. Health economics as an aspect of health outcome: basic principles and application in rheumatoid arthritis. Br J Rheumatol 1995;34:774–80.
23. Pincus T. The underestimated long term medical and economic consequences of rheumatoid arthritis. Drugs 1995;50(suppl. 1):1–14.
24. Jonsson B, Rehnberg C, Borgquist L *et al.* Locomotion status and costs in destructive rheumatoid arthritis—a comprehensive study of 82 patients from a population of 13 000. Acta Orthop Scand 1992;63:207–12.
25. Lipscomb J, Ancukiewicz M, Parmigiani G *et al.* Predicting the cost of illness: A comparison of alternative models applied to stroke. Med Decision Making 1998; 18:S39–56.
26. van Jaarsveld CHM, Jacobs JWG, Schrijvers AJP *et al.* Direct cost of rheumatoid arthritis during the first six years: A cost-of-illness study. Br J Rheumatol 1998; 37:837–47.
27. Altman DG. Practical statistics for medical research. London: Chapman and Hall, 1991.
28. Barber JA, Thompson SG. Analysis and interpretation of cost data in randomised controlled trials: review of published studies. Br Med J 1998;317:1195–200.
29. Kramer JS, Yelin EH, Epstein WV. Social and economic impacts of four musculoskeletal conditions: A study using national community-based data. Arthritis Rheum 1983; 26:901–7.
30. Drummond MF. Cost of illness—A major headache. Pharmaco-Economics 1992;2:1–4.
31. Spitz PW. The medical, personal, and social costs of rheumatoid arthritis. Nurs Clin North Am 1984;19: 575–82.
32. Wolfe F, Kleinheksel SM, Spitz PW *et al.* A multicenter study of hospitalization in rheumatoid arthritis: effect of health care system, severity, and regional difference. J Rheumatol 1986;13:277–84.
33. Jacobs J, Keyserling JA, Britton M, Morgan GJ Jr, Wilkenfeld J, Hutchings HC. The total cost of care and the use of pharmaceuticals in the management of rheumatoid arthritis: the Medi-Cal program. J Clin Epidemiol 1988;41:215–23.