

The Economic Burden of Rheumatoid Arthritis in a Developing Nation: Results from a One-Year Prospective Cohort Study in Thailand

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ABSTRACT Objective. To assess annual direct and indirect costs in a prospective cohort of patients with rheumatoid arthritis (RA) in Thailand from the societal perspective.

Methods. Data on costs and intangible losses were prospectively collected at regular intervals over a one-year period from 158 RA patients who attended a major tertiary care facility in Bangkok, Thailand. Direct medical, direct nonmedical, indirect, and total costs were estimated according to patients' respective health insurance conditions and converted to 2001 US dollars using published purchasing power parity estimates. Sensitivity analyses were performed and the predictors of costs and intangible losses were investigated.

Results. The average societal cost of RA was estimated to be US\$2682, 41.4% of patients' average annual income. Average direct and indirect costs were estimated to amount to US\$2135 and US\$547 per patient per year, respectively. Seventy-three patients (46.2%) experienced at least one event of intangible losses and 46 patients (29.1%) had decreased earnings ability because of RA. Poor physical function, joint deformity, high number of disease modifying antirheumatic drugs, and steroid use contributed to higher costs and presence of intangible losses.

Conclusion. RA consumes a significant proportion of patients' annual average incomes and poses a significant economic burden to society. Since RA mainly affects a working-age population, early and timely treatment of this disease can improve both the suffering and the economic productivity of patients in Thailand. (First Release Dec 15 2006; *J Rheumatol* 2006;34:57–63)

Key Indexing Terms:

COST ANALYSIS RHEUMATOID ARTHRITIS BURDEN OF ILLNESS DISABILITY

Rheumatoid arthritis (RA) is a chronic inflammatory joint disease associated with longterm disability and premature mortality. The disease has a substantial economic impact on patients, their families, and society¹⁻⁴. In the USA, approximately 25% of patients with RA with mean disease duration of 6 years had to stop working permanently because of the disease⁵, and many are on sick leave or have to change to part-time jobs. Patients' loss of work and leisure is considerable

due to difficulties in performing daily activities, and the need to visit rheumatologists and allied health professionals. In addition, RA has a major impact on the psychosocial aspect of patients and their caregivers. Limitation of leisure and social activities, psychological distress, and depression resulting from chronic pain and disability are also commonly observed in patients with RA^{1,3,4,6}.

Studies in Western countries have confirmed the economic burden of RA on society. A number of these concern mainly the direct costs related to RA (e.g., medical costs and drug monitoring costs, costs of hospitalization, transportation costs, costs of aids and devices)⁷⁻⁹. However, indirect costs (e.g., productivity loss) and intangible costs (e.g., loss of quality of life), which are more difficult to assess in monetary terms, have also been shown to constitute major components of RA total costs¹⁰⁻¹⁴.

To date, there has been scarce information on the cost of RA from developing countries, since health policies of these countries generally focus on fatal diseases, such as cancer, coronary heart diseases, and acquired immune deficiency syndrome (AIDS). RA has attracted less attention because it does not result in rapid and significant deaths compared to cancer or AIDS. It thus appears to be a prime candidate to illustrate the problems of chronic diseases, as they continue to cause substantial losses in economic productivity to society^{15,16}.

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Data from the developed countries have shown that functional disability is the main determinant of economic productivity^{8,15,16}. Thus, early and appropriate treatment of RA has the potential to reduce suffering and improve economic output.

Since there is an almost complete lack of awareness of RA in Thailand, government subsidization for this disease is very small, with patients facing considerable out-of-pocket expenses. We sought to determine the cost of RA in Thailand from the societal perspective. Components of costs were explored and analyzed for the relationship with RA disease activity and functional measures.

MATERIALS AND METHODS

Patients. Consecutive patients attending the RA clinic at King Chulalongkorn Memorial Hospital, Bangkok, between June 2001 and January 2002 were included in this study and followed for one year, with assessments performed every 8–12 weeks. King Chulalongkorn Memorial Hospital is a 1500-bed tertiary care hospital and medical school. All patients met the American College of Rheumatology 1987 revised criteria for the classification of RA¹⁷. Eligible patients had to fulfill the following criteria regardless of their disease activity status and the use of disease modifying antirheumatic drugs (DMARD): (1) age \geq 18 years; (2) able to attend the clinic as appointed; and (3) able to give signed informed consent. This study was approved by the Ethics Committee, Faculty of Medicine, Chulalongkorn University.

Healthcare systems and financial reimbursements in Thailand. There are several ways for inhabitants of Thailand to obtain healthcare coverage: (1) public-sector health insurance, (2) private-sector health insurance or social security system, and (3) health insurance for low-income citizens. The public-sector health insurance covers government employees and their family members. It provides full coverage for both ambulatory and inpatient care in public hospitals, with partial coverage only for inpatient healthcare services in private hospitals. Outpatient healthcare services in private clinics and hospitals are not reimbursed. The private-sector health insurance or social security covers healthcare services for people working in the private sector. All private-sector employees contribute a proportion of their gross wage for healthcare insurance (3% each paid by the employee and employer). Both government and private-sector employees may have additional private insurance through extra premiums. Health insurance for low-income citizens provides government-subsidized ambulatory and inpatient care at no charge to all low-income citizens in possession of the Health Welfare Card¹⁸. However, universal coverage was introduced in 2002 for all low-income citizens as a large number of people with very low income were not in possession of a Health Welfare Card¹⁹. The universal coverage system provides healthcare services free of charge, but people have to pay a fee of 30 baht (US\$ 2.50) for each visit or admission. Patients cannot make their own choice of hospital, but are required to attend a prespecified primary care unit or hospital.

Severely disabled patients with RA receive additional healthcare and social services provided by the Thai government, but there are no disability payments for these patients²⁰.

Data collection. At baseline and each visit, patients underwent clinical examinations by a rheumatologist, and completed health status and cost questionnaires administered by a trained nurse. The clinical assessments included: number of swollen joints, Ritchie articular index, severity of pain, patient and physician global assessments of disease activity (5-point Likert scales), functional ability using the Thai version of the Health Assessment Questionnaire Disability Index (HAQ-DI)²¹, erythrocyte sedimentation rate (ESR), and presence of extraarticular manifestations. The cost questionnaires inquired about patient's demographic and socioeconomic data, direct costs, indirect costs, and the presence of reduced quality of life due to RA.

Direct costs. Direct medical costs comprised the costs related to medications, laboratory tests and procedures, hospitalizations, aids and devices, rehabilitation, and alternative medicine. Direct nonmedical costs, such as costs of trans-

portations and meals on each visit and household help, were also included. Also collected for direct costs were overhead costs, and maintenance costs of RA clinic and related clinics. These costs were obtained from hospital-based costing reports performed at King Chulalongkorn Memorial Hospital²².

Indirect costs. Indirect costs included the cost estimates from work absenteeism and loss of productivity by the patients and their family members and/or caregivers due to RA. Costs from work absenteeism were calculated from the lost work time per year and the patients' and their families'/caregivers' salaries or wages. For unemployed patients and patients working as homemakers, income loss was calculated based on the minimum wage rate (170 baht; US\$14 per day).

Intangible costs. Intangible costs in this study were not assessed in monetary terms. They were described as the presence or absence of events with an influence on the patient's personal life due to RA. They included residential moves, house alterations, lost social and leisure opportunities, and divorce or separation from spouses.

Statistical analysis. Demographic and disease characteristics of the included patients were presented using descriptive statistics, as were health welfare status and intangible losses. Direct medical costs, direct nonmedical costs, indirect costs, and total costs were presented as mean and median values per patient per year in 2001 US dollars. We used the purchasing power parity estimates for the year 2000 for currency conversion (US\$1 = 11.88 Thai baht)²³. All cost data, if they were skewed, were log-transformed to obtain a more normal distribution pattern. Comparisons of log-transformed costs were undertaken by means of an independent sample t-test or one-way analysis of variance, to assess the influence of different discrete or continuous variables on log-transformed costs. Correlations between log-transformed costs and other variables were assessed using Pearson's correlation coefficients. Variables significantly associated with costs were analyzed as predictors of costs using linear regression analysis. Predictors of intangible costs were assessed using logistic regression models. The statistical software program used was SPSS for Windows version 10.0 (SPSS Inc., Chicago, IL, USA). Statistical significance was considered at p value of $<$ 0.05.

Sensitivity analysis. The sensitivity of the cost estimates in the main analysis according to the changes in the following variables was explored:

RA medication costs, laboratory test costs, hospitalization costs, and transportation costs were increased and decreased by 25%, which reflected the costs incurred by the private and public services, respectively.

Labor wages (for household helpers and income loss categories) were increased by 10%, which reflected the wages in urban society.

RESULTS

One hundred fifty-eight patients with RA provided data for this study. More than 90% of the studied patients were women. One hundred thirteen patients (71.5%) were residents of Bangkok or surrounding provinces. The remaining patients came from all parts of the country. Mean age at study entry was 53.2 years and mean disease duration was 10.3 years. Only 6 patients (3.8%) did not receive any DMARD. Prednisolone was prescribed in 59 patients (37.3%) with a mean daily dose of 1.9 mg. Mean HAQ-DI score was 0.69 at baseline. Forty-eight patients (30.4%) had a HAQ-DI of at least 1.0. Demographic characteristics, disease status, and treatment are shown in Table 1.

As for the patients' socioeconomic characteristics, 79.1% (117 of 148) had less than 12 years of education. Eighty-five patients (53.8%) were married. The number of patients without earnings was 81 (51.3%); of these, 26 patients (16.5%) were unemployed and 55 (34.8%) were housewives. Those with paid work were blue-collar workers (38 patients; 24.1%),

Table 1. Demographic characteristics, disease activity, and treatment of 158 RA patients in this study.

Female sex (%)	151 (95.6)
Mean \pm SD age, yrs (range)	53.2 \pm 12.2 (24–85)
Formal education \leq 12 yrs (%)	117/148 (79.1)
Mean \pm SD disease duration, yrs (range)	10.3 \pm 7.8 (0.3–35)
Positive rheumatoid factor (%)	109/151 (72.2)
Ritchie articular index, mean \pm SD (range)	2.6 \pm 3.9 (0–24)
Swollen joint count, mean \pm SD (range)	2.8 \pm 3.4 (0–16)
Pain level, mean \pm SD (range)	2.35 \pm 0.82 (0–4)
Patient global assessment, mean \pm SD (range)	2.32 \pm 0.76 (0–4)
Physician global assessment, mean \pm SD (range)	2.30 \pm 0.75 (0–4)
HAQ-DI, mean \pm SD (range)	0.69 \pm 0.75 (0–3)
ESR, mm/h, mean \pm SD (range)	47.6 \pm 29.3 (0–150)
Extraarticular manifestations (%)	20 (12.7)
DMARD treatment (%)	152 (96.2)
Single DMARD	87 (55.1)
Combined DMARD	65 (41.1)
Prednisolone treatment (%)	59 (37.3)
Daily dose of prednisolone, mean \pm SD mg (range)	1.9 \pm 3.1 (0.0–15.0)

RA: rheumatoid arthritis; DMARD: disease modifying antirheumatic drugs; HAQ-DI, Health Assessment Questionnaire Disability Index; ESR: erythrocyte sedimentation rate.

government employees (11 patients; 7%), vendors (11 patients; 7%), farmers (7 patients; 4.4%), retired government employees with pensions (6 patients; 3.8%), and businessmen/women (4 patients; 2.5%).

Average annual income of the patients was US\$6475 (median US\$5101). Eighty-four patients (53.2%) had full

healthcare coverage, while 74 (46.8%) did not have coverage or had coverage limited to other hospitals. These patients had to make their own payment for healthcare services at King Chulalongkorn Memorial Hospital. Among those with full healthcare coverage, government employees and their family members were the majority (57 patients; 36.1%). The remainder were patients benefiting from the social security health system (18; 11.4%), health insurance for low-income citizens (7; 4.4%), and private health insurance (2; 1.3%).

Societal costs. Table 2 shows the annual societal costs per patient averaged over the total number of patients (158). Since costs were skewed, medians and interquartile range of each cost category are also presented. Average direct cost was US\$2135 (median US\$1186) per patient per year. Mean direct medical cost was US\$1923 (median US\$1036) and mean direct nonmedical cost was US\$213 (median US\$89) per patient per year. Average indirect cost per annum was US\$547 (median US\$182) per patient. Mean total cost per patient was US\$2682 (median US\$1434) per year.

Direct costs accounted for 79.6% of the total costs (Table 2). Direct medical costs were the major component of the direct costs (71.7% of total costs) the largest proportion of which was due to hospitalizations (30.0% of total costs), incurred by only 19 patients (12.0%). RA medication costs accounted for 26.9% of the total costs. Costs of radiographs were low (US\$2721; 0.6% of total costs).

The average number of RA clinic visits was 4.0 (median 4.0) and the average number of visits to other clinics (rehabil-

Table 2. Annual healthcare resource use and societal costs of RA per patient in 2001 US dollars.

Resource Categories	Annual Healthcare Resource Use		Annual Societal Costs per Patient (n = 158)			
	Patients (%)	Mean (median)	Mean (SD) \$	Median (IQR) \$	Sum	% of Total Costs
Direct medical costs	158 (100)		1923 (3556)	1036 (1459)	303,755	71.7
Rheumatology clinic	158 (100)	3.95 (4) visits	218 (14)	221 (60)	34,411	8.1
Other clinics	43 (27.2)	2.44 (2) visits	30 (61)	0 (46)	4737	1.1
RA medications	158 (100)	6.23 (6) kinds	723 (740)	448 (695)	114,148	26.9
Non-RA medications	31 (19.6)	3.03 (2) kinds	34 (175)	0 (0)	5372	1.3
Aids/device/PT program	6 (3.8)	1.00 (1) aid	2 (12)	0 (0)	341	0.1
Laboratory tests	158 (100)	3.68 (4) times	74 (34)	73 (42)	11,746	2.8
Radiographs	28 (17.7)	1.39 (1) times	17 (81)	0 (0)	2721	0.6
Hospitalizations	19 (12.0)	10.84 (5) days	801 (3551)	0 (14)	126,567	30.0
OTC drugs	30 (19.0)	1.27 (1) kinds	16 (95)	0 (0)	2450	0.6
Alternative treatments	15 (9.5)	1.07 (1) kinds	8 (38)	0 (0)	1262	0.3
Direct non-medical costs	158 (100)		213 (617)	89 (122)	33,598	7.9
Household helpers	6 (3.8)		79 (598)	0 (0)	12,512	3.0
Transportations	157 (99.4)		79 (95)	53 (81)	12,506	3.0
Meals on clinic visits	147 (93.0)		17 (15)	13 (13)	2685	0.6
Health insurance premiums and social security payments	21 (13.3)		37 (117)	0 (0)	5895	1.4
Direct costs	158 (100)		2135 (3601)	1186 (1524)	337,366	79.6
Indirect costs (work absenteeism and productivity loss)	158 (100)	9.6 (4.7) days	547 (1449)	182 (413)	86,393	20.4
Total costs	158 (100)		2682 (4637) (95% CI 953–3411)	1434 (1818)	423,759	100

RA: rheumatoid arthritis; PT: physical therapy; OTC: over the counter.

itation, orthopedic, general medicine, ophthalmology, pulmonary clinics, and emergency room) was 2.4 (median 2.0) per patient per year. The unit cost of each clinic visit was multiplied by the number of visits per year to yield the costs of clinic visits for each patient. The costs of RA clinic visits were on average US\$218 per patient per year (median US\$221) and that of other clinics was US\$30 (median 0).

Two types of sensitivity analysis of the societal costs, one-way sensitivity analysis and extreme-scenario analysis, were performed. For the one-way sensitivity analysis, individual predetermined cost components were increased or decreased once at a time to yield different amounts of total costs, as shown in Table 3. Mean baseline total costs were US\$2682, which ranged from US\$2482 to US\$2882. For the extreme-scenario analysis, costs for the best-case and worst-case scenario were calculated. For the best-case scenario, total costs were calculated from a decrement of 25% in the RA medication costs, laboratory test costs, hospitalization costs, and transportation costs, while there was no change in the costs of labor wages. For the worst-case scenario, the RA medication costs, laboratory test costs, hospitalization costs, and transportation costs were increased by 25% and the costs of labor wages were increased by 10%. The lower extreme for the mean direct medical costs was US\$1523 and the upper extreme was US\$2322. For the mean direct nonmedical costs, the lower

extreme was US\$193 and the upper extreme was US\$240. Mean direct costs varied from US\$1716 to US\$2562 and mean total costs varied from US\$2263 to US\$3164 (Table 3).

Events affecting patients' personal life. Intangible losses incurred during the study period were descriptively assessed as events with an effect on patients' personal life due to RA (Figure 1). Out of 158 studied patients, 73 (46.2%) experienced at least one event. The most common events were lost leisure opportunities from RA, which were found in 58 patients (36.8%). None were separated or divorced from their spouses because of RA.

Of note, the number of patients with unpaid work increased significantly after onset of RA. Thirty-five patients (22.2%) were unemployed or worked as homemakers for their families before having RA. The number went up to 81 (51.3%) after the patients developed RA (Pearson chi-square = 21.35, $p < 0.0001$). However, these job changes occurred before the beginning of our study. None of the patients changed job during the study period.

Predictors of the cost data and intangible losses. Because all cost data were highly skewed, they were log-transformed to achieve a more symmetric distribution to fit the linear regression analysis model²⁴. The log-transformed medical costs, direct costs, and total costs correlated significantly with the HAQ-DI, Ritchie articular index, number of swollen joint, pain level, patient and physician global assessments, and the log-transformed indirect costs with the HAQ-DI, Ritchie articular index, education level, and healthcare coverage status, after adjustment for age and RA disease duration (data not shown). Multivariable regression analysis showed that the predictors of medical costs were HAQ-DI, having healthcare coverage, and the number of DMARD prescribed ($r^2 = 0.187$). Predictors of nonmedical costs and direct costs were HAQ-DI and having healthcare coverage ($r^2 = 0.118$ and 0.188 , respectively); predictors of indirect costs were education level and HAQ-DI ($r^2 = 0.188$); and determinants of total costs were having healthcare coverage, HAQ-DI, and presence of joint deformity ($r^2 = 0.221$). Predictors of intangible losses using logistic regression included the use of prednisolone and HAQ-DI ($r^2 = 0.118$; Table 4).

Table 3. Sensitivity analysis of the societal costs incurred in RA patients in 2001 US dollars.

One-way Sensitivity Analysis			
Cost Categories	Total Costs		
	- 25%	Baseline	+ 25%
RA medications	2501	2682	2863
Laboratory tests	2664		2701
Hospitalizations	2482		2882
Transportations	2662		2702
Extreme-scenario Analysis			
Cost Categories	Total Costs		
	Baseline	+ 10%	
Household helper's wages Patients, and their families' income loss	2682	2690 2737	
Extreme-scenario Analysis			
	Best-case*	Baseline	Worst-case**
Medical costs	1523	1923	2322
Nonmedical costs	193	213	240
Direct costs	1716	2135	2562
Indirect costs	547	547	602
Total costs	2263	2682	3164

* Decrement of RA medication, laboratory tests, hospitalization and transportation costs by 25% plus baseline values of household helpers' wages and total income loss. ** Increment of RA medication, laboratory tests, hospitalization and transportation costs by 25% plus increment of household helpers' wages and total income loss by 10%.

DISCUSSION

Our study shows that RA is a chronic disease with a substantial impact on patients, their families, and society in Thailand. Direct costs incurred for the management of RA amount to nearly 40% of patients' average income. The percentage of direct and indirect costs was 79.6% and 20.4%, respectively. Since the indirect costs took into account only the income loss and productivity loss incurred in patients during the study period, the percentage of income loss was very low.

Our study complements the findings from cost of illness studies conducted in Western countries, where both short-term and longterm studies have emphasized the continuing burden of RA^{7-14,25-27}. Unfortunately, the burden of RA is not con-

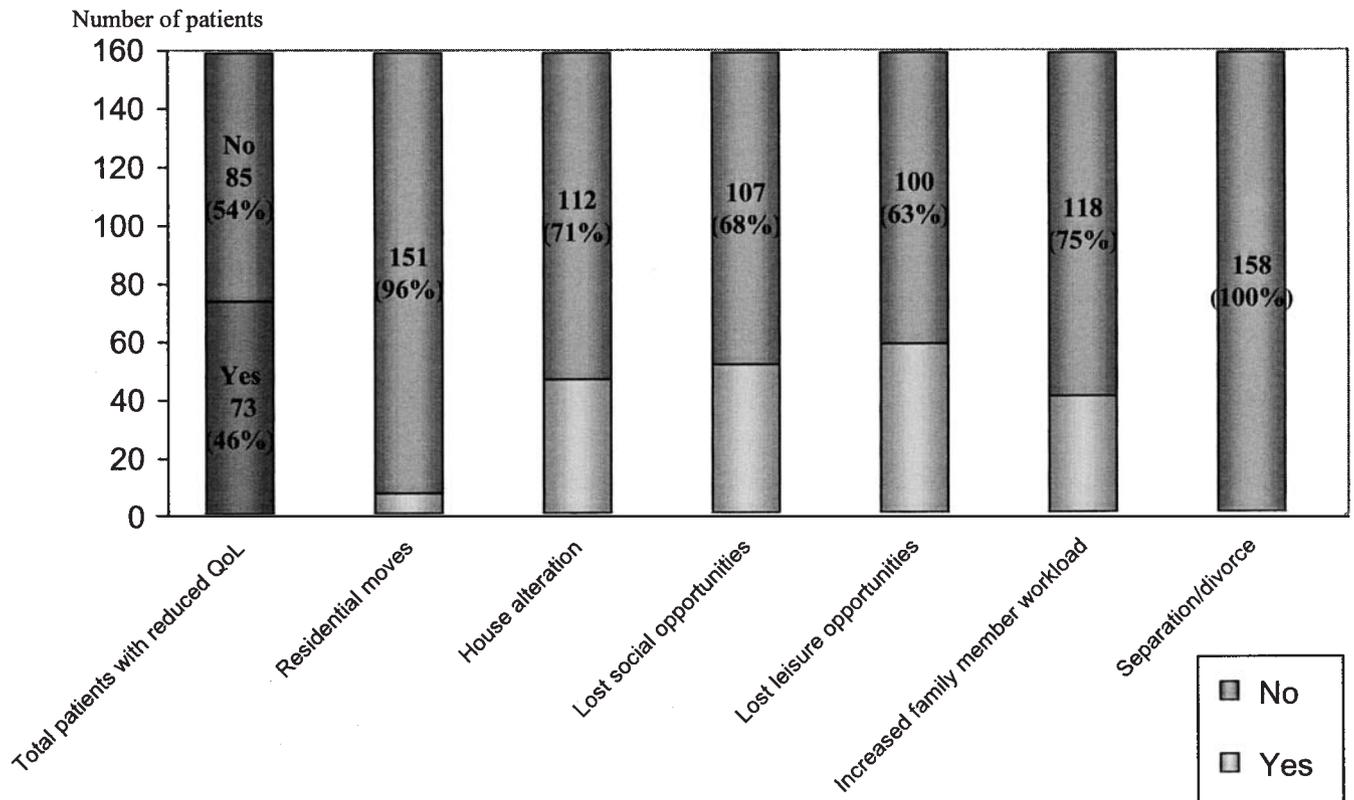


Figure 1. Number (%) of patients who experienced events with an effect on personal life due to RA (n = 158). QoL: quality of life.

sidered important or is even neglected in developing countries. RA is “non-fatal” and cannot produce an immediate impact on society like “fatal” diseases, such as coronary heart disease, cancer, and AIDS. In Thailand, government funding for the prevention and control of AIDS was US\$97.6 million in 2001²⁸. This accounted for 2% of the total budget of the Ministry of Public Health. There has never been a specific budget for the prevention and control of musculoskeletal conditions, although the prevalence of these conditions was reported to be as high as 17.6% in rural Thailand²⁹.

We analyzed the costs of RA in patients being followed at a tertiary care hospital and medical school. From the demographic characteristics, RA disease activity, and functional status of the studied patients, our cohort consisted of a heterogeneous group, with disease ranging from mild to severe, with different socioeconomic status, except for the preponderance of women.

The percentage of indirect costs from the societal perspective in our study was lower than in reports from Western countries, which were 30%–75% of the total costs^{25–27,30}. This may be explained by the differences in the characteristics of the studied patients, the components of costs included in the indirect costs, and the high healthcare costs that are disproportionate to the patients’ income. Studies conducted before the availability of biologic therapies estimated indirect costs from work absenteeism and productivity loss to be a major cost

component incurred by RA. Indirect costs were estimated to potentially outweigh the medical and nonmedical costs^{10–14}, although direct costs were claimed to be the main contributor of total costs in several other studies^{10,26,27}.

Direct medical costs increased considerably after the introduction of biologic agents for RA treatment^{9,30}. In Thailand, biologics are accessible to only a very few patients. Although our study was conducted before the availability of biologics, it is unlikely that our conclusions would change had costs of biologic agents contributed to the patients’ direct costs. It is more likely that the observed relative contribution of direct and indirect costs persists currently. Although it is claimed that the use of biologic agents will increase productivity and thus reduce indirect costs^{31–34}, it appears likely that such an effect on indirect costs will be more pronounced in Western societies where such costs make up a higher share of the overall cost of RA.

The majority of the patients with health insurance in our study were government employees. Although health insurance for low-income citizens theoretically allows basic healthcare coverage for all individuals, practically there are some limitations, so the patients have to make their own payment to get continuous treatment at our center. We found a significant difference in costs between patients with public or private-sector health insurance and those with health insurance for low-income citizens. Patients with public or private-sector health

Table 4. Regression analysis model of RA societal costs (n = 158).

Linear Regression Model with Natural log-transformed Cost Data			
Ln (medical costs)	Beta Coefficient	t	p
HAQ-DI (≥ 1)	0.301	4.100	< 0.0001
Healthcare coverage (yes)	0.264	3.557	< 0.0001
No. of DMARD used (≥ 2)	0.157	2.125	0.035
$r^2 = 0.187$			
Ln (nonmedical costs)	Beta Coefficient	t	p
Healthcare coverage (yes)	0.280	3.686	< 0.0001
HAQ-DI (≥ 1)	0.223	2.930	0.004
$r^2 = 0.118$			
Ln (direct costs)	Beta Coefficient	t	p
Healthcare coverage (yes)	0.327	4.474	< 0.0001
HAQ-DI (≥ 1)	0.310	4.243	< 0.0001
$r^2 = 0.188$			
Ln (indirect costs)	Beta Coefficient	t	p
Education level (> 12 yrs)	0.226	2.953	0.004
HAQ-DI (≥ 1)	0.214	2.788	0.006
$r^2 = 0.188$			
Ln (total costs)	Beta Coefficient	t	p
Healthcare coverage (yes)	0.336	4.676	< 0.0001
HAQ-DI (≥ 1)	0.301	4.135	< 0.0001
Joint deformity (yes)	0.156	2.151	0.033
$r^2 = 0.221$			
Binary Logistic Regression Model of Significant Life Events			
	Odds Ratio	95% CI	p
Prednisolone use (yes)	1.90	1.01, 4.42	0.046
HAQ-DI (≥ 1)	4.27	2.03, 8.99	0.001
$r^2 = 0.118$			

RA: rheumatoid arthritis; DMARD: disease modifying antirheumatic drugs; HAQ-DI: Health Assessment Questionnaire Disability Index.

insurance might have a better chance to get access to a more costly treatment option than those without such insurance. In addition, the income loss incurred in patients with private-sector health insurance was also higher, which might be explained by their higher salaries.

When the direct medical costs were considered, hospitalization costs were the main component of the total costs (30.0%). These costs were incurred by a small number of patients (12%), but were the largest contributor of the direct and total costs. This finding was comparable to the data from previous studies^{8,10,25,27}.

The direct nonmedical costs in our study are certainly underestimated due to the lack of data on transportation costs and insurance premiums in Thailand. Further studies are needed to establish these costs from the societal perspective.

The mean total cost of RA was US\$2682 per patient per year, which exceeded 50% of Thailand's national income per capita (US\$5069 for the year 2001)³⁵. The prevalence of RA in rural Thailand was reported to be 0.12% of the general population²⁹ and we estimated the prevalence of RA in urban communities to be 0.3%^{36,37}. The total number of patients with RA in Thailand would thus range from 74,400 to 186,000. The annual costs of RA might be as high as US\$501 million, which accounted for 0.12% of Thailand's gross domestic product in 2001³⁵. A sensitivity analysis of societal cost using an extreme-scenario analysis would estimate the overall national cost of RA in Thailand between US\$421 million and US\$590 million per year. This stresses the economic burden of RA on the developing societies.

Several variables were associated with the costs of RA. HAQ-DI was the common variable that predicted all costs in our study, although at a smaller magnitude than in previous studies^{7-9,25}. Differences in the disease activity and severity, patients' characteristics, work status, and incomes might explain this discrepancy. Our results confirmed the evidence that HAQ-DI is a major predictor of costs in patients with RA^{7-9,25}. Early and timely detection and treatment of RA will definitely reduce the functional disability and costs of RA. Prednisolone use was a predictor of important life events in our patients. Prolonged steroid use was related to a number of complications that significantly affected the patient's life in the long term.

The limitation of our study was that the data were collected from patients with RA in a tertiary care hospital and medical school, which might not be representative of the RA population in Thailand. However, ours is the first study to present cost estimates for patients with RA. These estimates will need to be put in perspective by further community-based studies that assess the burden of RA in a representative sample of patients in Thailand.

Our study shows that the average annual cost of RA was US\$2682 per patient. RA is a major burden to the developing societies, resembling the industrialized countries. The impact of RA on the functional disability and future costs should be emphasized to decision makers and society. There should be increasing awareness of the burden of RA on the community, and government budgets should be reallocated to RA in order to prevent and control disability in patients with this disease.

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