EXTENDED REPORT

Productivity costs among patients with rheumatoid arthritis: the influence of methods and sources to value loss of productivity

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Objective: To assess productivity costs incurred by rheumatoid arthritis, comprising paid as well as household productivity costs, from a societal perspective, using different methods.
Methods: A questionnaire on productivity, including items of the Health and Labour Questionnaire, was completed by 576 patients with rheumatoid arthritis (mean disease duration seven years). The friction cost (FC) method using the gross national wage per hour was applied to estimate paid productivity, and the market equivalent was used to value loss of household productivity. Sensitivity analyses to estimate paid productivity costs among patients of working age included the human capital (HC) method and an alternative source, namely the ''added value'', to value loss of paid productivity.
Results: In the total study population, mean (SD) annual costs from loss of paid productivity according to the FC method were estimated to be €278 (€1559) and mean annual household productivity costs were €2045 (€3882). When using the HC method, mean annual costs increased to an average of €4434 (€9957). When using the added value of production, average FC costs increased from €455 to €540 among patients of working age.
Conclusions: Costs from loss of household productivity in rheumatoid arthritis were seven times higher than costs from loss of paid productivity, assessed by the FC method. The high paid productivity costs when using the HC method reflect the high work disability rate in rheumatoid arthritis. As the method of measuring and source of valuing productivity loss has an important influence on the costs, a consensus to standardise these issues is desirable.

High sick leave and work disability rates have been found among the rheumatoid arthritis population of working age.[1–5] The work disability rates across studies vary greatly and are influenced by a large number of sociodemographic and disease related factors.[6] In addition, differences in social security systems probably have an influence on the likelihood of becoming work disabled. In the Netherlands, employees can be on sick leave for one year without income loss. After one year, the individual can be entitled to a full or partial work disability pension if work disability has officially been approved. In case of full work disability, the disability pension is at least 70% of the last earned wage. For patients who are classed as partially work disabled it is possible to remain working part time for pay. Loss of paid as well as household productivity has major socioeconomic consequences for the patient and an important economic impact on their family and on society. The economic consequences are expressed as productivity costs and are defined as costs of lost resources for which no direct payment is made.[7]

Most studies have used the human capital (HC) method to estimate paid productivity costs. This method includes the overall paid productivity loss as a consequence of a disease, comprising also loss of income from work disability. However, the real paid production loss to society is likely to be lower. In the case of long term absence, the work can be done by someone drawn from the ranks of the unemployed or by reallocating existing employees. These considerations have led to the development of the friction cost (FC) method. The FC method is based on the idea that the amount of production loss as a result of a disease depends on the time required by working organisations to restore the original production level.[8–10] In addition to the method chosen to calculate productivity costs, the valuation of one unit of lost paid productivity (for example, a working hour, a working day) can be based on different sources, such as personal wages, average national income, or a valuation of the national product (that is, ''the added value''). Until now, this has not been sufficiently investigated.

In addition to the losses of paid productivity, the influence of disease on loss of household productivity is expected to be high, as a general rheumatoid arthritis population predominately includes women and persons of older age. In this study, total productivity costs of rheumatoid arthritis were estimated from a societal point of view including costs from loss of paid productivity assessed by the FC method and costs from loss of household productivity. We also explored the influence of different sources for valuing paid productivity by using either the gross national wage or the added value.

METHODS

Patients and assessments

Patients attending one of the seven outpatient clinics for rheumatology in the region of Utrecht, Netherlands, collaborating in the Utrecht Rheumatoid Arthritis Cohort study group, were asked to participate in the study. These patients also participated in a study on direct costs, and their recruitment was described more extensively in that report.[11]

Abbreviations: FC, friction cost; HAQ, Health Assessment Questionnaire; HC, human capital; H&L-Q, Health and Labour Questionnaire

Table 1 Demographic, clinical, and working status characteristics of men, women, and all patients included in the study

Variable	Male patients (n = 159)	Female patients (n = 417)	All patients (n = 576)
Age (years)	62 (12)	58 (14)	59 (14)
Education, high vocational/university education†	22 (14%)	50 (12%)	72 (13%)
Marital status, married†	135 (85%)	270 (65%)	405 (70%)
Comorbidities, ⩾1 comorbidity†	82 (52%)	221 (53%)	303 (53%)
Diseases duration (years)	6.4 (5.0)	7.2 (7.0)	7.0 (6.8)
Morning stiffness (min)	44 (104)	36 (63)	38 (76)
VAS general well being (mm)	31 (25)	35 (27)	34 (26)
VAS pain (mm)	21 (25)	27 (27)	25 (26)
Joint score (Thompson joint score)	37 (64)	51 (81)	47 (77)
ESR (mm/h^{1st})	20 (17)	23 (19)	22 (18)
Rheumatoid factor positive†	75 (69%)	165 (60%)	240 (63%)
Radiological damage (Sharp/van der Heijde*)	39 (42)	33 (46)	45 (45)
Functional disability (HAQ)	0.9 (0.8)	1.3 (0.7)	1.2 (0.8)
Quality of life (EuroQol)	0.67 (0.3)	0.62 (0.3)	0.63 (0.3)
Working status among patients of working age (<65 years, n = 352):			
Not working and not work disabled†	17 (19%)	105 (40%)	122 (35%)
Working and no work disability†	40 (44%)	76 (29%)	116 (33%)
Partially work disabled because of rheumatoid arthritis but working†	11 (12%)	15 (6%)	26 (7%)
Work disabled because of rheumatoid arthritis and not working†	23 (25%)	65 (25%)	88 (25%)

Values are means (SD), except for categorical variables (†) which are presented as n (%).
Comorbidity was defined as any disease or disorder apart from rheumatoid arthritis as reported by the patient.
Theoretical ranges for variables are as follows: early morning stiffness, 0–720 min; all three VAS scales, 0–100 mm = worst score; joint score, 0–534; ESR, 2–140 mm/h^{1st}; functional disability, 0–3 = worst score; radiological damage, 0–448; and QoI, −0.594 to 1 = best health status.
*Data on radiological damage were only available for those patients included in one of the two inception cohorts.
ESR, erythrocyte sedimentation rate; HAQ, Health Assessment Questionnaire; VAS, visual analogue scale.

In brief, the patients had been included in either of the two inception cohort studies consecutively carried out since 1990 by our study group (n = 611 overall). These patients had a disease duration of between 0.2 and 10 years at time the present study was conducted. To ensure a representative sample of patients with rheumatoid arthritis at all stages of the disease, those with a disease duration of more than 10 years were invited to participate in the present study (n = 127).

A postal questionnaire was designed to assess demographic characteristics, working status, functional disability (Health Assessment Questionnaire (HAQ), Dutch version). In addition, loss of paid and unpaid productivity was assessed using the Health and Labour Questionnaire (H&L-Q)[12] and utility was determined by the EuroQol-5D questionnaire. Half the patients received the postal questionnaire in October 1999 and the other half in April 2000, in order to correct for possible seasonal influences. Data on clinical variables and radiographic damage in patients participating in one of the two cohorts have been well documented in databases, and for this study the most recent data were used (obtained 0 to 6 months before mailing the questionnaire). In patients with longstanding rheumatoid arthritis, clinical data were assessed at the outpatient visit before filling out the questionnaire.

Assessment of productivity losses

Costs resulting from paid productivity and household productivity losses were estimated from a societal perspective.

Paid productivity

Patients with a paid job completed the H&L-Q. Respondents indicated whether in the previous two weeks they had been absent from work because of rheumatoid arthritis or for other health reasons. In our analysis, we only included the number of days on sick leave caused by rheumatoid arthritis to calculate indirect costs. If patients were absent because of rheumatoid arthritis during the entire two weeks, they were asked to indicate the start of this episode. When calculating the number of working days on sick leave in the past year, the working days absent in the previous two weeks were multiplied by 26. Where the patient reported absence that exceeded the period of two weeks, the annual sick leave was considered to be equal to the number of working days absent in the entire period. The maximum sick leave could not exceed 123 calendar days, this being the friction period at the time of our study. This is the period that employees need to restore the original production level, and the length of the friction period is based on the average vacancy duration for 1999, which depends on the level of unemployment and on the flexibility of the labour market to match labour demand and supply (iMTA Rotterdam, Netherlands).

Household productivity

Household productivity losses were defined as housekeeping tasks that had to be carried out by formal (such as a paid housekeeper) or informal (family) caregivers, if the patient was unable to perform these tasks because of rheumatoid arthritis. The reported hours during the last two weeks were extrapolated to a period of one year.

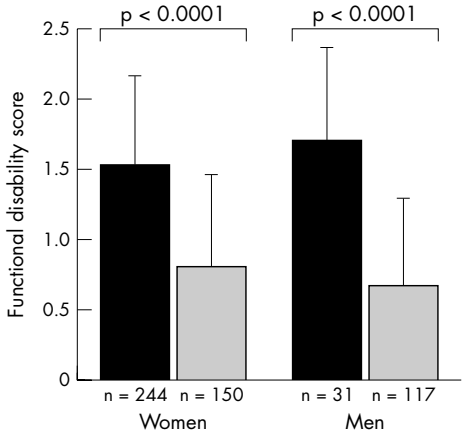

Figure 1 Mean functional disability (Health Assessment Questionnaire) score for patients who required (in)formal home care (black bars) and for those who did not (grey bars). Whiskers = SD.

Sources for valuing losses of paid and household productivity

Paid productivity

In this study, as a reference (herein further referred as the reference case) the FC method was chosen to estimate costs of lost paid productivity. This was done because the FC method reflects the true societal costs of paid productivity. To value one unit (hour) of production loss, the national gross wage per hour by age and sex was used.[13] To be able to apply the gross wage per hour, the reported days absent were converted to number of working hours per working day as reported by the individual patient (see the appendix for cost calculations).

Household productivity

One hour of formal or informal help was valued by applying the market equivalent (that is, €8.53, which is the gross wage of a home help per hour). When patients reported that they needed (in)formal help, but did not mention the number of hours of obtained help, the missing value was imputed by sex and age (<65 years or ⩾65 years) related means for that specific help.

Statistical analyses

Productivity costs were calculated for the total study population. Days of sick leave are presented as the mean for the population in paid labour. To evaluate whether the need for (in)formal care (yes or no) depended on disease duration, age, functional disability, sex, and quality of life as independent variables, we used multiple logistic regression, applying backward procedure ($p<0.05$). All statistical analyses were done using SPSS version 9.0. Values are given as mean (SD).

Sensitivity analyses

Sensitivity analyses for paid productivity costs were applied to the group of patients of working age (<65 years). The 95% confidence intervals (CI) of the differences in costs between groups or between methods were calculated from the 95% centile interval after 1000 bootstraps.[14 15]

Human capital method

To allow comparison with other studies and to express the important consequences of work disability in monetary terms, productivity costs were also calculated according to the HC method—that is, measuring productivity costs from both sick leave and work disability during one year. In our study, we did not ask the number of working hours before patients became work disabled; we assumed that it would be equal to the mean number of working hours reported by the working rheumatoid arthritis population without work disability in our study (that is, 24 hours for women and 37 hours for men).

Added value of productivity to value the loss of paid labour

Instead of using the national gross wage per hour to value production loss, another source—namely, the ''added value of productivity''—was used. This value is based on the total production of the nation and takes into account differences in productivity between sex and age (1998 iMTA, Netherlands). The fact that the decrease in labour productivity per year is not proportional to the reduction in annual labour time has led to the inclusion of a correction factor, called the elasticity factor, in the calculation of the added value (see the appendix). We converted the resulting production costs per friction period to 1999 values using the consumer price index for gross wages.

Length of the friction period

Because the length of the FC period differs depending on flexibility of the labour market, we varied the length of the friction period by a prolongation or reduction of 31 calendar days (~25% of the 1999 friction period).

Household productivity

As some patients reported extreme numbers of hours of (in)formal help (range 0.5 to 70 hours/week), this raised some doubt on the validity of these self reported data. We therefore carried out sensitivity analyses on loss of household productivity. The individual self reported hours were replaced by the median number of self reported hours categorised according to sex and age (<65 years, ⩾65 years).

RESULTS

Of the 738 patients to whom a questionnaire was sent, 576 (78%) completed it. The demographic and clinical characteristics of these 576 patients are shown in table 1. Age, sex, and

Table 2 Mean annual productivity costs in euros per patient, using the FC method (reference case) and the HC method, and the household productivity costs for men, women, and the overall study population

Variable	Men (n = 159)	Women (n = 417)	Total study population (n = 576)
Paid productivity costs			
FC method (reference)	473 (2182) [0 to 14 223]	203 (1237) [0 to 12 455]	278 (1559) [0 to 14 113]
HC method	7750 (15 131) [0 to 42 020]	3170 (6654) [0 to 18 683]	4434 (9957) [0 to 42 020]
Household productivity costs			
Formal help	153 (1101)	619 (1306)	491 (1269)
Informal help	1250 (4109)	1670 (3338)	1554 (3569)
Total costs for loss of household productivity	1403 (4499) [0 to 31 049]	2289 (3595) [0 to 32 380]	2045 (3882) [0 to 32 380]
Total productivity costs based on the FC method	1877 (4982) [0 to 31 049]	2492 (3803) [0 to 32 380]	2322 (4166) [0 to 32 380]
Total productivity costs based on the HC method	9153 (16 893) [0 to 72 968]	5469 (7826) [0 to 42 635]	6479 (1331) [0 to 72 968]

Values are mean (SD) [range] costs in euros per patient per year. The gross national wage was used to value loss of paid productivity in FC and HC methods. FC, friction cost; HC, human capital.

Table 3 Sensitivity analyses on the annual paid productivity costs for 352 patients of working age (<65 years), expressed in euros per patient per year and presented for male and female patients separately

Variable	Men (n = 91)	Women (n = 261)	Total study population (n = 352)
FC method, gross national wage*	827 (306 to 1435)	325 (158 to 536)	455 (263 to 686)
Duration friction period 25% longer (mean (SD))	936 (3343)	348 (1641)	500 (2220)
Duration friction period 25% shorter (mean (SD))	706 (2331)	292 (1426)	399 (1712)
FC method, added value of productivity	1084 (426 to 1819)	349 (175–547)	539 (327–806)
HC method, gross national wage			
Sick leave (mean)	1172	482	660
Range	0 to 28 630	0 to 24 679	0 to 28 630
Work disability and reduced working hours (mean)	1648	157	542
Range	0 to 29 091	0 to 8518	0 to 29 091
Work disability (mean)	9978	4487	5906
Range	0 to 39 865	0 to 18 863	0 to 39 865
Total*	12 798 (9419 to 16 278)	5125 (4136 to 6052)	7109 (5971 to 8388)
HC method, added value			
Sick leave (mean)	1463	497	747
Range	0 to 31 631	0 to 21 922	0 to 31 631
Work disability and reduced working hours (mean)	1699	133	537
Range	0 to 28 243	0 to 6677	0 to 28 243
Work disability (mean)	10 706	5473	6826
Range	0 to 44 404	0 to 23 150	0 to 44 405
Total*	13 878 (10 148 to 17 605)	6102 (4909 to 7205)	8110 (6834 to 9543)
Difference FC with gross national wage compared with added value of productivity*	257 (62 to 529)	24 (−28 to 85)	85 (17 to 165)
Difference FC and HC method applying the gross national wage*	11 972 (8547 to 15 530)	4800 (4778 to 5058))	6654 (5536 to 7913)

Total costs and differences in costs (*) are given as mean values (95% confidence interval), estimated with bootstrapping.
FC, friction cost; HC, human capital.

disease duration were similar in those patients who did not respond and those who did.

Loss of paid and household productivity

Paid productivity

In all, 142 patients (40% of those younger than 65 years) were participating in the paid labour force at time of filling out the questionnaire. These patients were on average 46 (10) years of age, had a mean disease duration of 5 (4) years, and 65% were female. Twenty three patients (16%) reported that they had been on sick leave because of rheumatoid arthritis in the previous two weeks; of these 14 stated that the episode of sick leave had started more than two weeks before they filled out the questionnaire. The duration of this episode exceeded the friction period (that is, 123 calendar days) in eight patients. Based on an eight hour working day, patients with a paid job (n = 142) were absent for an average of 22 (62) working days per year (range 0 to 260) because of rheumatoid arthritis (28 days for men and 19 days for women). In our rheumatoid population, mean number of days on sick leave differed significantly between partially work disabled patients in the labour force and patients who were working without disability (41 *v* 14 days, p = 0.01). At the time of the evaluation, patients who reported sick leave (n = 23; 16% of those with a paid job) had their disease for a significantly shorter period than patients without sick leave (n = 119) (mean 2.8 *v* 5.2 years, p = 0.012), a higher Thompson joint count (mean 80 *v* 39, p = 0.030), a higher ESR (mean 31 *v* 16 mm/h^{1st}, p<0.001), less functional ability (mean HAQ score 1.2 *v* 0.7, p = 0.001), and less radiological damage (median Sharp/van der Heijde units 4 *v* 11, p = 0.009). The latter result probably reflects the shorter disease duration. In addition, the proportion of patients having a blue collar job was slightly greater (though this was not statistically significantly) in the group of patients with sick leave (30%) than in the group without sick leave (21%) (p = 0.322).

Household productivity

Overall, 51% of the patients needed household help: 194 (34%) needed help from their relatives, 42 (7%) from friends, 69 (12%) from formal home assistance, and 88 (15%) from private household help. On average, male patients needed 2.8 (9.2) hours and female patients 3.8 (7.5) hours of informal care per week. Formal care was required for an average of 0.3 (2.5) and 1.4 (2.9) hours a week by male and female rheumatoid patients, respectively. Patients receiving (in)formal care were more likely to be women (odds ratio (OR) = 6.0 (95% confidence interval (CI), 3.5 to 10.2)) and have more functional disability (OR = 6.2 (4.3 to 8.8)) at the time of filling out the questionnaire, after adjusting for disease duration, quality of life, and age. Figure 1 presents the HAQ score for male and female patients who required (in)formal help and for those who did not require help.

Paid and household productivity costs

Productivity costs for the total study population are summarised in table 2. Household productivity costs contribute to 88% of the total productivity costs. The costs of informal help constituted the main part of total household productivity costs (76%). The proportion of total household productivity costs accounted for formal help was higher for female patients (27%) than for male patients (11%).

Sensitivity analyses

Paid productivity

As expected, productivity costs estimated according to the HC method were significantly higher than those estimated in the reference case (tables 2 and 3). When using the added value of productivity to calculate the FC costs for patients of working age (<65 years), costs were significantly higher than with the reference case for the total as well as for the male population but not for the female population (table 3). If the friction period was shortened by approximately 25% (that is, 31 days), the estimated costs of the reference case decreased

by approximately 12% and a similar extension of the friction period increased costs by approximately 10%.

Household productivity

Replacing the extreme values of paid productivity by the median reported hours instead of the individually reported hours, mean annual unpaid productivity costs for informal care would be substantially less—that is, €921 for men and €1366 for women. For formal care, annual unpaid productivity costs would decrease to €75 and €453 for men and women, respectively.

DISCUSSION

In this study, the rheumatoid arthritis related productivity cost from a societal perspective caused by loss of paid productivity estimated by the friction cost method together with household work was €2332 per patient per year. An important finding in our study was the high cost of inability to perform household work. The annual costs for (in)formal care exceeded the costs for loss of paid productivity sevenfold. A study from the USA estimated the mean total productivity costs (by the HC method) at $3372 per patient per year, including costs due to loss of paid work and costs due to loss of usual activities because of rheumatoid arthritis.[3] In a Spanish cohort, taking only informal care for homemakers into account (€1159 per patient per year), these costs comprised 36% of total indirect costs.[16] In another American study, mean average costs for home and child care were estimated to be $204 per year among patients with rheumatoid arthritis.[17] Compared with the latter two studies, absolute costs of lost household productivity in our study were much greater. We included costs for both formal and informal care in our cost estimate, which might partly explain the difference, as other studies primarily included informal care in their analyses. Even if we expect that part of the reported household tasks might have been done by others as daily household task, household productivity costs would still be higher in this Dutch study, which might also reflect the general distribution of household tasks between patient and spouse in the Netherlands. Although we asked patients specifically to report (in)formal care provided because of rheumatoid arthritis, it is possible that some patients might have had formal care because of old age, as some reported a large number of hours of formal help.

The FC method was used as the reference case to estimate paid productivity losses. Health economists increasingly agree that the FC method better reflects the true societal costs of paid productivity. Among female patients with systemic lupus erythematosus it has already been shown that average annual productivity costs ranged from $1424 when using the friction cost method to $22 604 when applying average male employment income.[18] The difference in productivity costs was also found among patients with ankylosing spondylitis, in whom mean friction costs for the Dutch patients were €557 and mean total HC costs were €8862.[19] As far as we know there is only one other study comparing the productivity costs derived by the FC method with those estimated using the HC method among patients with rheumatoid arthritis[20]; for a group of patients with a disease duration of up to three years, no such large differences in costs between the HC method and the FC method were found as were present in our study. However, more patients will become work disabled during the course of the disease and it is to be expected that the gap between productivity costs between the HC method and the FC method will increase, as shown in our study, in which the mean disease duration was seven years. This phenomenon was seen in two German studies in which the distribution of total productivity costs—that is, sick leave payments and work disability payments—changed with increasing disease duration.[2 21] Work disability payments contributed mainly to total indirect costs after a mean disease duration of 8.4 years.[21]

In our study, costs according to the HC method were calculated to enhance the comparability of this study with others and because this method reflects the impact of work disability in monetary terms from a patient's point of view. FC costs were more than 15 times lower than estimated HC costs. In published reports, total productivity costs according to the HC method varied across studies from $1200 to $21 000. The differences between studies partly reflect the type of productivity losses included (for example, sick leave, work disability, and reduced work capacity), and the sources used to value lost productivity (gross national wage, individual income), the study population, and disease duration.[2 16 22–27]

A limitation of our study was that the questionnaire was sent to the patients only once and the reported paid and unpaid productivity losses were extrapolated to one year losses. The H&L-Q, which was used to assess the number of paid working days in the preceding two weeks, was validated by comparing sick leave obtained by the H&L-Q and data on sick leave from the Dutch population provided by the Dutch Bureau of Statistics. Data on sick leave resulting from migraine were compared with data on sick leave in a study done in the United Kingdom, and it was concluded that the questionnaire provided valid data at a group level.[12 28]

Several controversial issues arise when the paid productivity costs are calculated, one of which is the contribution of paid productivity to value loss. This issue has also been addressed in a previous study which reported lower paid productivity costs when using individual data on wages as opposed to national wages.[20] In our study, no individual reported wages were available and we used the national gross wage by age and sex to evaluate the production loss as a reference case. Some health economist recommend the use of the ''added value of productivity'', because it reflects the true production of labour more accurately. The gross national hourly wage theoretically provides the true opportunity costs of the productivity of the individual patient, but it is controversial whether the use of individualised wages is ethical as it would identify patients with lower incomes in full economic analyses. The use of the gross national hourly wage compared with the use of the added value of productivity has not been compared in published reports up to now. Not surprisingly, the productivity costs based on the added value of national productivity were higher than when based on the national hourly wages but the difference was more pronounced in men than women. The added value of productivity was not provided as an hourly wage but as a cost per friction period related to sex and age, assuming that the national proportion of part time work in distinct categories is similar to that of the study population. This probably explains why the discrepancy between the sources in our study was greater in male than in female patients. Female patients who reported sick leave worked on average 24 hours per week, which is very similar to the average of 25.3 hours per week for Dutch women, while male rheumatoid patients who reported taking sick leave worked on average 32.6 hours compared with 35 hours per week for the Dutch male population.

As in most countries ''the added value of productivity'' is not at present routinely available, it is not yet recommended that this source is applied to evaluate production losses as a reference case. More international comparative research is needed to explore the value of this index in comparison with the gross national wage. This latter source also renders better comparability with other studies. As we observed important differences in our results when using different methods and

sources, we feel this is a crucial issue to consider for future studies on productivity costs.

Conclusion

This study shows that costs resulting from loss of household productivity among Dutch patients with rheumatoid arthritis were sevenfold higher than those resulting from loss of paid productivity assessed by the FC method, and were associated with more functional disability and with female sex. The productivity costs were significantly lower when using the FC method instead of the generally used HC method; the latter reflecting the large impact of rheumatoid arthritis on participation in paid labour. The methods and sources used to value lost productivity can have an important influence on the estimated productivity costs and thus there is need for international standardisation.

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APPENDIX

ESTIMATION OF PAID PRODUCTIVITY COSTS

Valuation of productivity costs was estimated separately for patients who reported a sick leave episode and for patients who reported sick leave intermittently during the previous two weeks (see table below).

PRODUCTIVITY COSTS ACCORDING TO THE FC METHOD (REFERENCE CASE)

(A1) Productivity costs according to the FC method using the gross national wage.

If sick leave limited to past 2 weeks:

Number of working days absent reported in the H&L-Q×26 weeks×number of self reported working hours per day×gross national wage per hour.

If sick leave longer than the past 2 weeks:

Working days absent during the period indicated in the H&L-Q but not exceeding a period of 123 calendar days×number of self reported working hours per day×gross national wage per hour.

(A2) Productivity costs according to the FC method using the added value of productivity.

It should be realised that the added value of productivity is only provided per friction period while the patient recorded in the Health and Labour Questionnaire the number working days absent at work. Thus days absent had to be expressed as a proportion of the total friction period. The added value of productivity per friction period takes into account the proportion of part time working subjects in the labour force.

The fact that the decrease in labour productivity per year is not proportional to the reduction in annual labour time the added value includes a correction factor called the elasticity factor, which is set at 0.8 in by iMTA.

If sick leave reported in the H&L-Q was limited to the past 2 weeks:

Number of working days absent in past 2 weeks×26 weeks (to asses number of working days absent per year)×365/260 (to correct working days for calendar days)/123 (to assess the proportion of a friction period absent from work×added value of productivity per friction period by sex and age category×elasticity factor.

If sick leave reported in the H&L-Q was longer than the past two weeks:

Number of calendar days on sick leave (with a maximum of 123 days)/123 days×added value× elasticity factor.

PRODUCTIVITY COSTS ACCORDING TO THE HC METHOD

Productivity costs due to sick leave:

Productivity costs were calculated as for the FC method except that no limit was set for the length of the period of prolonged sick leave.

Productivity costs for patients with partial work disability and a (part-time) paid job:

For both female and male patients who were partially work disabled and working, we calculated the difference in working hours between these patients and their working peers without disability. The average number of working hours per week in our female rheumatoid population without disability was 24 hours and 37 hours for the working male rheumatoid population. The HC costs caused by disability were calculated as follows:

(B1) Productivity costs according to the HC method using the gross national wages for patients with partial work disability and a (part time) job

Method	Assessment of productivity losses	Sources to value loss of productivity
Friction cost (FC)	H&L-Q assessing work days lost in the past two weeks	1. Gross national wage in Euro per hour provided by the Dutch Bureau of Statistics; wages were assessed by sex and 10 distinct categories of age
	If the patient reported absence that exceeded two weeks, the annual sick leave was considered to be equal to the number of working days absent in the entire period indicated by the patient but within a period of 123 calendar days, being the friction period at the time of our study	2. Added value of productivity for one friction period by sex and 10 categories of age, provided by the Institute of Medical Technology Assessment at the Erasmus University, Rotterdam, Netherlands
Human capital (HC)	H&L-Q to assess working days on sick leave for those with a paid job	1. Gross national wage in Euro per hour provided by Dutch Bureau of Statistics; wages were assessed by sex and 10 distinct categories of age
	Sociodemographic questionnaire regarding working status and per cent of work disability	2. Added value of productivity for one friction period by sex and 10 categories of age, provided by the Institute of Medical Technology Assessment at the Erasmus University, Rotterdam, Netherlands

H&L-Q, Health and Labour Questionnaire.

Difference between the present working hours per week and the presumed premorbid working hours per week×52× the gross national wage per hour.

(B2) Productivity costs according to the FC method using the added value of productivity for patients with partial work disability and a part time job

Difference in hours/8 (that is, one working day)×(365/260)×added value×elasticity factor.

Productivity costs because of work disability:

As the number of hours of paid work per week before work disability was not known, it was assumed that these patients had the same average number of working hours per week as the working patients included in the study without work disability.

(B1) Productivity costs according to the HC method using the gross national wages for patients with work disability and no paid job

Mean number of working hours per week reported by the working RA-population in our study without work disability * 52 * gross national wage per hour.

(B2) Productivity costs according to the HC method using the added value of productivity for patients with work disability and no paid job

Mean number of working hours per week in the working rheumatoid patients of this study×52 weeks×(365/260)/123 (to convert working days not working to number of periods of 123 calendar days not working)×the added value by gender and age per period of 123 calendar days×elasticity factor.

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