PRODUCTIVITY COSTS AMONG PATIENTS WITH RHEUMATOID ARTHRITIS: 
THE INFLUENCE OF METHODS AND SOURCES TO VALUE LOSS OF 
PRODUCTIVITY

SMM Verstappen, A Boonen, H Verkleij, JW Bijlsma, E Buskens, and JWG Jacobs

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On behalf of the Utrecht Rheumatoid Arthritis Cohort Study group (SRU)

S.M.M. Verstappen, PhD, J.W.G. Jacobs, PhD, MD, and J.W.J. Bijlsma, Prof, PhD, MD; 
University Medical Center Utrecht, Utrecht, the Netherlands.
A. Boonen, PhD, MD, University Hospital Maastricht, Maastricht, the Netherlands.
H. Verkleij, PhD; National Institute of Public Health and the Environment, Bilthoven, the Netherlands.
E. Buskens, PhD, MD; Julius Centre for Health Sciences and Primary Care, UMC Utrecht, the Netherlands.

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Address correspondence and reprint requests to:

S.M.M. Verstappen, PhD
University Medical Center Utrecht
Dept. of Rheumatology & Clin. Immunol., F02.127
P.O. Box 85500
3508 GA Utrecht
The Netherlands
Tel: +31.30.2507357
Fax: +31.30.2523741
E-mail: S.Verstappen@azu.nl
ABSTRACT

Objective. To assess productivity costs due to rheumatoid arthritis (RA), comprising paid as well as household productivity costs, from a societal perspective using different methods.

Patients and methods. A questionnaire regarding productivity, including items of the Health and Labour Questionnaire, was completed by 576 RA-patients (mean disease duration 7 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 due to loss of paid productivity according to the FC-method were estimated to be €278 ± 1,559 and mean annual household productivity costs were €2,045 ± 3,882. When using the HC-method, mean annual costs increased to an average of €4,434 ± 9,957. When using the added value of production, average FC-costs increased from €455 to €540 among patients of working age.

Conclusion. Costs due to loss of household productivity in RA were seven times higher than costs due to 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 RA. Since the method of measuring and source of valuing productivity loss influence the costs importantly, consensus to standardize these issues is desirable.
INTRODUCTION

Among the RA-population of working age, substantial high sick leave and work disability rates have been found [1-5]. The work disability rates across studies vary importantly and are influenced by a large number of socio-demographic and disease-related factors [6]. In addition, differences in social security systems probably have an influence on the likelihood to become 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 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 partial work disabled it is possible to remain (part-time) working for pay. Loss of paid as well as household productivity has large socio-economic consequences for the patient and an important economic impact on his or her family, and the society. The economic consequences are expressed as productivity costs and 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 due to work disability. However, the real paid production loss to society is likely lower. In case of long-term absence, the work can be done by someone drawn from the ranks of the unemployed or by reallocating employees over the jobs. 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 that working organizations need to restore the original production level [8-10]. In addition to the method chosen to calculate productivity costs, the valuation of one unit lost paid productivity (e.g. working hour, working day) can be based on different sources such as personal wages, average national income, or a valuation of the national product (i.e. “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, since a general RA-population predominately includes females and persons of higher age. In this study, total productivity costs due to RA were estimated from a societal point of view including costs due to loss of paid productivity assessed by the FC-method and costs due to loss of household productivity. Furthermore, we evaluated the influence of different sources to value paid productivity by either using the gross national wage or the added value.

PATIENTS AND METHODS

Patients and assessments
Patients attending one of the seven outpatient clinics for rheumatology in the region of Utrecht, The Netherlands, collaborating in the Utrecht Rheumatoid Arthritis Cohort study group, were asked to participate in this study. These patients participated also in a study on direct costs and recruitment of patients has been described more extensively in that report [11]. In brief, patients had either been included in one of the two inception cohort studies consecutively carried out since 1990 by our study group (n=611, totally). These patients had a disease duration between 0.2 and 10 years at time this study was conducted. To assure a representative sample of patients with RA at all stages of the disease, patients 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 (HL-Q) [12] and utility was determined by the EuroQol-5D questionnaire. Half the group of 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 on radiographic damage of patients participating in one of the two cohorts have been well-documented in databases and for this study the most recent data were used (0-6 months prior to mailing of the questionnaire). Of patients with longstanding RA, clinical data were assessed at the outpatient visit prior to filling out the questionnaire.

**Assessment of productivity losses**

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

**Paid productivity.** Patients with a paid job completed the HL-Q. Respondents indicated whether the previous two weeks they had been absent from work because of RA or because of other health reasons. In our analysis, we only included the number of days on sick leave because of RA to calculate indirect costs. If patients were absent because of RA 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 past 2 weeks was multiplied by 26. In case the patient reported absence that exceeded the period of 2 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, 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 of 1999, which depends on the level of unemployment and on the flexibility of the labour market to match labour demand and supply (iMTA Rotterdam, the Netherlands).

**Household productivity.** Household productivity losses were defined as housekeeping tasks which had to be performed by formal (e.g. paid housekeeper) or informal (e.g. family) caregivers, if the patient was unable to perform these tasks due to RA. The reported hours during the last two weeks were extrapolated to a period of one year.

**Sources to value loss of paid and household productivity**

**Paid productivity.** In this study, as a reference (herein further referred as reference case) the FC-method was chosen to estimate costs of lost paid productivity. This was done because the FC-method better 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 gender 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 Appendix for cost calculations).

**Household productivity.** One hour of formal or informal help was valued by applying the market equivalent (i.e. €8.53 = gross wage of home help per hour). In case 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 gender 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 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, gender, and QoL as independent variables, we used multiple logistic regression, applying backward procedure ($P < 0.05$). All statistical analyses were performed using SPSS 9.0.

Sensitivity analyses
Sensitivity analyses for paid productivity costs were applied to the group of patients of working age (<65 years). The 95% CI of the differences in costs between groups or between methods were calculated by the 95% percentile interval after 1,000 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; i.e. measuring both productivity costs owing to sick leave and costs due to 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 RA-population without work disability in our study (i.e. 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 gender and age (1998 iMTA, the 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 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. Since some patients reported extreme number of hours of (in)formal help [range 0.5 – 70 hrs/wk], this raised some doubt on the validity of these self-reported data. Therefore we performed sensitivity analyses on loss of household productivity. The individual self-reported hours were replaced by the median number of self-reported hours categorized according to gender and age (<65 years, ≥65 years).

RESULTS

Of the 738 patients to whom a questionnaire was sent, a total of 576 (78%) completed it. The demographic and clinical characteristics of these 576 patients are shown in Table 1. Age, gender and disease duration were similar for those patients who did not respond with those who did.

Loss of paid and household productivity
Paid productivity. A total of 142 patients (40% of those younger than 65 years) was participating in paid labour force at time of filling out the questionnaire. These patients were on average 46 ± SD 10 years of age, had a mean disease duration of 5 ± SD 4 years, and 65% was female. Twenty-three (16%) patients reported that they were on sick leave due to RA in the previous two
weeks, of whom 14 stated that the episode of sick leave had started more than two weeks before filling out the questionnaire. The duration of this episode exceeded the friction period (i.e. 123 calendar days) in eight patients. Based on an eight hours working day, patients with a paid job (n = 142) were on average 22 (SD 62, range 0 – 260) working days per year absent due RA, 28 days for men and 19 days women. In our RA-population, mean number of days on sick leave differed significantly between partial work disabled patients in labour force and patients who were working without disability (41 versus 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 RA for a significantly shorter duration than patients without sick leave (n = 119) (mean 2.8 vs 5.2 years, P = 0.012), higher Thompson joint count (mean 80 vs 39, P = 0.030), higher ESR values (mean 31 vs 16 mm/hr\textsuperscript{1st}, P < 0.001), less functional ability (mean 1.2 vs 0.7, HAQ, P = 0.001), and less radiological damage (median 4 vs 11 Sharp/van der Heijde units, 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 higher (albeit not statistically significantly) in the group of patients with sick leave (30%) compared to the group of patients 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 (SD 9.2) hours and female patients 3.8 (SD 7.5) hours of informal care per week. Formal care was required for an average of 0.3 (SD 2.5) and 1.4 (SD 2.9) hours per week by male and female RA-patients, respectively. Patients receiving (in)formal care were more likely to be women (OR: 6.0 95%CI 3.5-10.2) and to be patients with more functional disability (OR: 6.2 95%CI 4.3 – 8.8) at time of filling out the questionnaire, after adjusting for disease duration, QoL, and age. Figure 1 presents the HAQ-score for male and female patients who required (in)formal help and for male and female patients who did not require (in)formal help.

**Paid and household productivity costs**
Productivity costs for the total study population are summarized 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 cost due to 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 costs estimated in the reference case (Table 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 compared 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% (i.e. 31 days), the estimated costs of the reference case decreased approximately by 12% and a similar extension of the friction period increased costs approximately by 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 substantially be less, i.e. €921 for men and €1,366 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 RA-related productivity costs from a societal perspective due to loss of paid productivity by means of the friction cost method as well as household work were €2,332 per patient per year. An important finding in our study were the high costs due to inability to perform household work. The annual costs for (in)formal care exceeded the costs for loss of paid productivity by 7 times. A study from the US, estimated mean total productivity costs (HC-method) at $3,372 per patient per year including costs due to loss of paid work and costs due to loss of usual activities because of RA [3]. In a Spanish cohort, taking only informal care for homemakers into account (1,159 Euro per patient per year), these costs comprised 36% of total indirect costs [16]. In another US study, mean average costs for home and child care were estimated to be $204 per year among patients with RA [17]. Compared to the latter two studies, absolute costs of lost household productivity in our study were much higher. We included both costs for formal and informal care in our cost estimate which might partly explain the difference, since 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 be depended on general distribution of household tasks between patient and spouse in the Netherlands. Although we asked patients specifically to report (in)formal care due to RA, it is possible that some patients might have had formal care because of high age since some patients reported a high number of hours for formal help.

The FC-method was used as reference case to estimate paid productivity loss. Health economists increasingly agree that the FC-method better reflects the true societal costs of paid productivity. Among female patients with SLE it was already shown that average annual productivity costs ranged from $1,424 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 AS, in whom mean friction costs for the Dutch patients were 557 Euro and mean HC total costs 8,862 Euros [19]. As far as we know there is only one other study comparing the productivity costs according to the FC-method with those estimated according to the HC-method among patients with RA [20]. For a group of patients with a disease duration until three years, no such a large difference in costs between the HC-method and the FC-method were found, as we did. 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 mean disease duration was 7 years. This phenomenon was seen in two German studies in which the distribution of total productivity costs, i.e. 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 additionally calculated to enhance comparability with other studies and because this method allows to reflect the impact of work disability in monetary terms from a patients’ point of view. FC-costs were more than 15 times lower than estimated HC-costs. In literature, total productivity costs according to the HC-method varied across studies from $1,200 to $21,000. The differences between studies are partly due to type of productivity losses included (e.g. sick leave, work disability, and reduced work capacity),
and sources used to value lost productivity (e.g. gross national wage, individual income), 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 reported paid and unpaid productivity losses were extrapolated to one year losses. The HL-Q which was used to assess the number of paid working days in the past two weeks was validated by comparing sick-leave obtained by the HL-Q and data on sick leave of the Dutch population provided by the Dutch Bureau of Statistics. In addition, data on sick leave due to migraine have been compared with data on sick leave in a UK study. It was concluded that the questionnaire provides valid data on the group level [28,12].

Overall, there are several controversies when calculating the paid productivity costs one of which is the source to value loss of paid productivity. This issue has also been addressed in a previous study which reported lower paid productivity costs when using individual data on wages opposed to national wages [20]. In our study, no individual reported wages were available and we used the national gross wage by age and gender to value the production loss as a reference case. Some health economist recommend the use of the “added value of productivity”, because it reflects more accurately the true production of labour. The gross national hourly wage theoretically provides the true opportunity costs of the productivity of the individual patient, but it is discussed whether the use of individualised wages is ethical since it would discriminate in full economic analyses patients with lower incomes. The use of the gross national hourly wage compared to the use the added value of productivity has not been compared in the literature until now. Not surprisingly, the productivity costs based on the added value of national productivity was higher than when based on the national hourly wages but more pronounced in men compared to women. The added value of productivity was not provided as hourly wage, but as cost per friction period per gender 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 higher 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 the Dutch females while male RA-patients who reported sick leave worked on average 32.6 hours compared with 35 hours per week in the Dutch male population.

Since in most countries “the added value of productivity” is not routinely available at this time, it is not yet recommended to apply this source to value production loss as a reference case. More international comparative research is needed to explore its value in comparison to the gross national wage. This latter source also renders better comparability with other studies. Since we observed important differences in results by 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 due to loss of household productivity among Dutch RA-patients were seven times higher than costs due to loss of paid productivity assessed by the FC-method and were associated with more functional disability and with female gender. 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 RA to participate in paid labour. The methods and sources used to value lost productivity can influence importantly the estimated productivity costs and thus there is need for international standardization.
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REFERENCES


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.

<table>
<thead>
<tr>
<th>Method</th>
<th>Assessment of productivity losses</th>
<th>Sources to value loss of productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Friction cost (FC)</td>
<td>- H&amp;L-Q assessing work days lost in the past two weeks.</td>
<td>1. Gross national wage in Euro per hour provided by the Dutch Bureau of Statistics. Wages were assessed by gender and 10 distinct categories of age.</td>
</tr>
<tr>
<td></td>
<td>In case the patient reported absence that exceeded the period of 2 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.</td>
<td>2. Added value of productivity for one friction period by gender and 10 categories of age, provided by the Institute of Medical Technology Assessment at the Erasmus University, Rotterdam, The Netherlands.</td>
</tr>
<tr>
<td>Human capital (HC)</td>
<td>- H&amp;L-Q to assess working days on sick leave for those with a paid job.</td>
<td>1. Gross national wage in Euro per hour provided by Dutch Bureau of Statistics. Wages were assessed by gender and 10 distinct categories of age.</td>
</tr>
<tr>
<td></td>
<td>- Socio-demographic questionnaire regarding working status and % of work disability.</td>
<td>2. Added value of productivity for one friction period by gender and 10 categories of age and provided by the institute of Medical Technology Assessment at the Erasmus University, Rotterdam, The Netherlands.</td>
</tr>
</tbody>
</table>

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 two 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 realized 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. Therefore, days absent had to be expressed as proportion of 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 health and labour questionnaire was limited to the past two weeks:

Number of working days absent in past 2 weeks * 26 weeks (to assess 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 Health and Labour Questionnaire 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 RA population without disability was 24 hours and it was 37 hours for the working male RA population. The HC costs due to 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.**

Difference between the present working hours per week and the presumed pre-morbid working hours per week * 52 * by 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 (i.e. one working day)* (365/260) * added value * elasticity factor.

- **Productivity costs because of work disability:**
  Since 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 RA 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.
Table 1. Demographic, clinical and working status characteristics of men, women, and all patients included in the study.

<table>
<thead>
<tr>
<th></th>
<th>Male patients</th>
<th>Female patients</th>
<th>All patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n = 159</td>
<td>n = 417</td>
<td>n = 576</td>
</tr>
<tr>
<td>Age, years</td>
<td>62 ± 12</td>
<td>58 ± 14</td>
<td>59 ± 14</td>
</tr>
<tr>
<td>Education, high vocational/university education</td>
<td>22 (14)</td>
<td>50 (12)</td>
<td>72 (13)</td>
</tr>
<tr>
<td>Marital status, married</td>
<td>135 (85)</td>
<td>270 (65)</td>
<td>405 (70)</td>
</tr>
<tr>
<td>Co-morbidities, ≥ 1 co-morbidity</td>
<td>82 (52)</td>
<td>221 (53)</td>
<td>303 (53)</td>
</tr>
<tr>
<td>Diseases duration, years</td>
<td>6.4 ± 5</td>
<td>7.2 ± 7</td>
<td>7.0 ± 6.8</td>
</tr>
<tr>
<td>Morning stiffness, minutes</td>
<td>44 ± 104</td>
<td>36 ± 63</td>
<td>38 ± 76</td>
</tr>
<tr>
<td>VAS general well being, mm</td>
<td>31 ± 25</td>
<td>35 ± 27</td>
<td>34 ± 26</td>
</tr>
<tr>
<td>VAS pain, mm</td>
<td>21 ± 25</td>
<td>27 ± 27</td>
<td>25 ± 26</td>
</tr>
<tr>
<td>Joint score, Thompson joint score</td>
<td>37 ± 64</td>
<td>51 ± 81</td>
<td>47 ± 77</td>
</tr>
<tr>
<td>ESR, mm/hr₁st</td>
<td>20 ± 17</td>
<td>23 ± 19</td>
<td>22 ± 18</td>
</tr>
<tr>
<td>Rheumatoid factor, positive</td>
<td>75 (69)</td>
<td>165 (60)</td>
<td>240 (63)</td>
</tr>
<tr>
<td>Radiological damage, Sharp/van der Heijde*</td>
<td>39 ± 42</td>
<td>33 ± 46</td>
<td>45 ± 45</td>
</tr>
<tr>
<td>Functional disability, HAQ</td>
<td>0.9 ± 0.8</td>
<td>1.3 ± 0.7</td>
<td>1.2 ± 0.8</td>
</tr>
<tr>
<td>Qol, EuroQol</td>
<td>0.67 ± 0.3</td>
<td>0.62 ± 0.3</td>
<td>0.63 ± 0.3</td>
</tr>
</tbody>
</table>

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 due to RA but working 11 (12) 15 (6) 26 (7)
- Work disabled due to RA and not working 23 (25) 65 (25) 88 (25)

Values are means ± SD, except for categorical variables which are presented as numbers (%).
Co-morbidity was defined as any disease or disorder apart from RA as reported by the patient.
Theoretical ranges for variables are as follows: early morning stiffness [0 - 720 minutes]; all three VAS scales [0 – 100 mm = worst score]; joint score [0 - 534]; ESR [2 – 140 mm/hr₁st]; functional disability [0 – 3 = worst score]; radiological damage [0 – 448]; and Qol [-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.
Table 2. Mean annual productivity costs in Euros per patient according to the reference case using the FC-method, according to the HC-method, and household productivity costs for men, women and for the total study population.

<table>
<thead>
<tr>
<th></th>
<th>Men</th>
<th>Women</th>
<th>Total study population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n = 159</td>
<td>n = 417</td>
<td>n = 576</td>
</tr>
<tr>
<td><strong>Paid productivity costs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FC-method, <em>reference case</em></td>
<td>473 ± 2,182</td>
<td>203 ± 1,237</td>
<td>278 ± 1,559</td>
</tr>
<tr>
<td></td>
<td>[0 – 14,223]</td>
<td>[0 – 12,455]</td>
<td>[0 – 14,113]</td>
</tr>
<tr>
<td>HC-method</td>
<td>7,750 ± 15,131</td>
<td>3,170 ± 6,654</td>
<td>4,434 ± 9,957</td>
</tr>
<tr>
<td></td>
<td>[0 - 42,020]</td>
<td>[0 – 18,683]</td>
<td>[0 – 42,020]</td>
</tr>
<tr>
<td><strong>Household productivity costs:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>formal help</td>
<td>153 ± 1,101</td>
<td>619 ± 1,306</td>
<td>491 ± 1,269</td>
</tr>
<tr>
<td>informal help</td>
<td>1,250 ± 4,109</td>
<td>1,670 ± 3,338</td>
<td>1,554 ± 3,569</td>
</tr>
<tr>
<td>Total costs for loss of household productivity</td>
<td>1,403 ± 4,499</td>
<td>2,289 ± 3,595</td>
<td>2,045 ± 3,882</td>
</tr>
<tr>
<td></td>
<td>[0 – 31,049]</td>
<td>[0 – 32,380]</td>
<td>[0 – 32,380]</td>
</tr>
<tr>
<td>Total productivity costs based on the FC-method</td>
<td>1,877 ± 4,982</td>
<td>2,492 ± 3,803</td>
<td>2,322 ± 4,166</td>
</tr>
<tr>
<td></td>
<td>[0 – 31,049]</td>
<td>[0 – 32,380]</td>
<td>[0 – 32,380]</td>
</tr>
<tr>
<td>Total productivity costs based on the HC-method</td>
<td>9,153 ± 16,893</td>
<td>5,469 ± 7,826</td>
<td>6,479 ± 1,331</td>
</tr>
<tr>
<td></td>
<td>[0 – 72,968]</td>
<td>[0 – 42,635]</td>
<td>[0 – 72,968]</td>
</tr>
</tbody>
</table>

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.
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.

<table>
<thead>
<tr>
<th></th>
<th>Men n = 91</th>
<th>Women n = 261</th>
<th>Total study population n = 352</th>
</tr>
</thead>
<tbody>
<tr>
<td>FC method, gross national wage *</td>
<td>827 (306 ; 1,435)</td>
<td>325 (158 ; 536)</td>
<td>455 (263 ; 686)</td>
</tr>
<tr>
<td>Duration friction period 25% longer</td>
<td>936 ± 3,343</td>
<td>348 ± 1,641</td>
<td>500 ± 2,220</td>
</tr>
<tr>
<td>Duration friction period 25% shorter</td>
<td>706 ± 2,331</td>
<td>292 ± 1,426</td>
<td>399 ±1,712</td>
</tr>
<tr>
<td>FC method, added value of productivity</td>
<td>1,084 (426 – 1,819)</td>
<td>349 (175 – 547)</td>
<td>539 (327 – 806)</td>
</tr>
<tr>
<td>HC method, gross national wage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sick leave, mean [range]</td>
<td>1,172 [0 – 28,630]</td>
<td>482 [0 – 24,679]</td>
<td>660 [0 –28,630]</td>
</tr>
<tr>
<td>Work disability and reduced working hours, mean [range]</td>
<td>1,648 [0 – 29,091]</td>
<td>157 [0 – 8,518]</td>
<td>542 [0 – 29,091]</td>
</tr>
<tr>
<td>Work disability, mean [range]</td>
<td>9,978 [0 – 39,865]</td>
<td>4,487 [0 – 18,863]</td>
<td>5,906 [0 – 39,865]</td>
</tr>
<tr>
<td>Total *</td>
<td>12,798 (9,419 ; 16,278)</td>
<td>5,125 (4,136 ; 6,052)</td>
<td>7,109 (5,971 ; 8,388)</td>
</tr>
<tr>
<td>HC method, added value</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sick leave, mean [range]</td>
<td>1,463 [0 – 31,631]</td>
<td>497 [0 – 21,922]</td>
<td>747 [0 – 31,631]</td>
</tr>
<tr>
<td>Work disability and reduced working hours mean [range]</td>
<td>1,699 [0 – 28,243]</td>
<td>133 [0 – 6,677]</td>
<td>537 [0 – 28,243]</td>
</tr>
<tr>
<td>Work disability, mean [range]</td>
<td>10,706 [0 – 44,404]</td>
<td>5,473 [0 – 23,150]</td>
<td>6,826 [0 – 44,405]</td>
</tr>
<tr>
<td>Total *</td>
<td>13,878 (10,148 ; 17,605)</td>
<td>6,102 (4,909 ; 7,205)</td>
<td>8,110 (6,834 ; 9,543)</td>
</tr>
</tbody>
</table>

Difference FC with gross national wage compared with added value of productivity * 257 (62 ; 529) 24 (-28 ; 85) 85 (17 ; 165)

Difference FC and HC method applying the gross national wage * 11,972 (8,547 ; 15,530) 4,800 (4,778 ; 5,058)) 6,654 (5,536 ; 7,913)

Values are mean ± SD costs except for total costs and differences in costs (*) which are mean values (95%CI, estimated with bootstrapping).
**LEGENDS**

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

Values are means ± SD, except for categorical variables which are presented as numbers (%). Co-morbidity was defined as any disease or disorder apart from RA as reported by the patient. Theoretical ranges for variables are as follows: early morning stiffness [0 - 720 minutes]; all three VAS scales [0 – 100 mm = worst score]; joint score [0 - 534]; ESR [2 – 140 mm/hr]; functional disability [0 – 3 = worst score]; radiological damage [0 – 448]; and QoL [-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.

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**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.

Values are mean ± SD costs except for total costs and differences in costs (*) which are mean values (95% CI, estimated with bootstrapping).

**Figure 1.** Mean ± SD functional disability (HAQ) score for patients who required (in)formal home care (black bars) and for patients who did not (grey bars).
Figure 1. Mean (SD) functional disability (HAQ) score for patients who required (in)formal home care (black bars) and for patients who did not (grey bars).