# The value of productivity: human-capital versus friction-cost method

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## ABSTRACT

Many cost-of-illness studies have investigated the impact of rheumatoid arthritis on productivity, invariably concluding that productivity costs are high. Different methods exist to value productivity. The human-capital method takes the patient's perspective and counts any hour not worked as an hour lost. By contrast, the friction-cost method takes the employer's perspective, and only counts as lost those hours not worked until another employee takes over the patient's work. Both methods can produce widely different results. Productivity costs have the potential to compensate for the costs of expensive biological agents, but only in early-onset disease when patients still have jobs and if productivity is given full weight by using the human-capital method. If productivity is given less weight by excluding productivity costs or by using the friction-cost method, then currently, biological agents are probably too expensive.

Health economic assessments deal with two objectives: first, to obtain best possible healthcare and health and second, to achieve lowest possible healthcare costs and insurance premiums. Whereas most people can deal with these topics separately at different points in time, both objectives are explicitly combined in cost-effectiveness analysis. In this way, it can be evaluated whether costs associated with medical treatments are justified by the value of associated effectiveness. Economic evaluations are more and more common in the medical literature and are particularly relevant for expensive biological agents, since their high costs can, and maybe should, be a barrier to their use.

## COST-UTILITY ANALYSIS

The preferred framework for economic evaluation is cost–utility analysis: costs of a new intervention are economically acceptable if they are compensated either by savings on other costs or by sufficiently large health benefits.

Within the cost–utility framework, the patients' health benefits are quantified using quality-adjusted life years (QALYs). The starting point for estimating QALYs is to estimate utility, which is the value of a patient's quality of life at a particular point in time. Quality of life is a multidimensional concept with many domains, but the value of that quality of life is measured in one dimension. It is anchored at 0 (as bad as dead) and 1 (as good as full health) and it may even be negative for quality of life worse than dead. Although utility is not an easy concept, several validated instruments exist to measure it such as time trade-off, standard gamble, visual analogue scales, EQ5D, SF6D and HUI.[1 2] Once utility values have been estimated through time, QALYs can be estimated as the area under the utility curve. They are a generic measure for the patients' disease burden, capturing both quality of life and length of life, and both intended and unintended effects of treatment. Moreover, they can be applied in many different diseases and treatments, which is a prerequisite for a general framework for economic evaluations.

For studies examining the broad allocation of resources, costs are preferably estimated from a societal perspective, regardless of who bears the costs.[3] This includes both short-term and long-term healthcare costs, but also non-healthcare costs such as informal care, homecare and costs to paid and unpaid productivity. For the evaluation of expensive biological agents, many of these cost categories are unlikely to have a relevant impact on differences in costs.[4] In the long run, more effective medication may lead to substantial savings on other medical costs. Also, savings on productivity may have a sizeable impact.

Cost–utility analysis is intrinsically two-dimensional. When comparing two treatment policies, one policy is clearly preferred if it has lower costs and better QALYs than the alternative. If one policy is preferred on QALYs and the other is preferred on costs, then a trade-off needs to be made to decide whether the more expensive policy is justified by its better effectiveness. Often-quoted thresholds consider costs up to $20 000 per QALY as very acceptable, costs up to $50 000 per QALY as acceptable and costs up to $100 000 per QALY as possibly acceptable.[5] These thresholds are not strict, however, because the economic aspect is rarely the only aspect relevant to decision-making.

## PRODUCTIVITY COSTS: HUMAN-CAPITAL OR FRICTION-COST METHOD

Although work loss due to rheumatoid arthritis (RA) seems to be decreasing owing to better treatment, cost-of-illness studies have invariably shown that productivity losses are high compared with medical costs.[6] There are many ways in which disease can lead to productivity costs, like absenteeism, job loss, or reduced productivity while at work (presenteeism). From a societal perspective, these productivity costs can all be included in economic evaluations. Unemployment benefits should not be counted as costs, because from a societal perspective they are just money transfers from one person to another. Basically, the amount of the productivity costs is equal to the value of the production that is lost, but different approaches have been used to value that loss. In particular, the

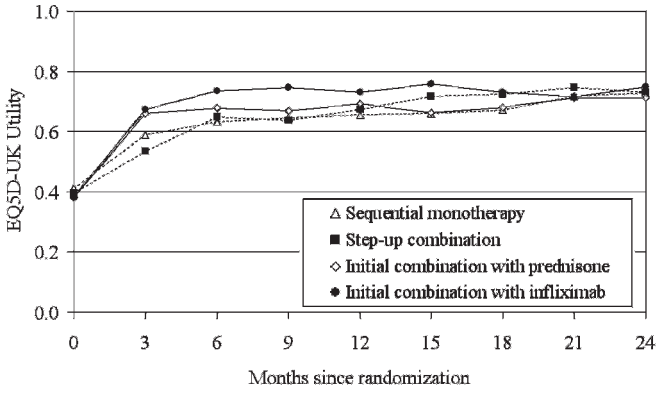


**Figure 1** Quality-adjusted life years.

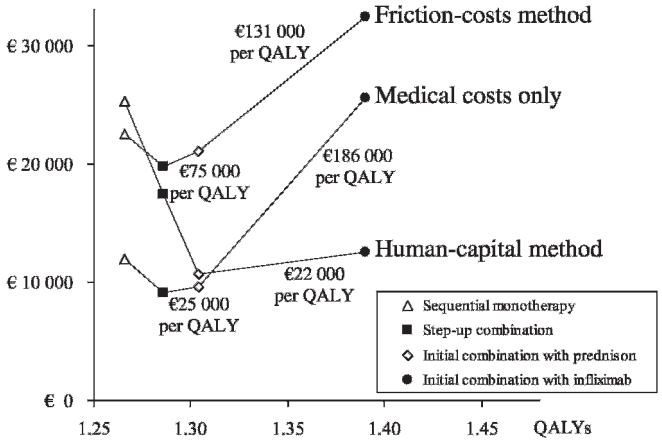


**Figure 2** Costs and quality-adjusted life years (QALYs), depending on perspective.

human-capital (HC) method and the friction-cost (FC) method can lead to very different results.[7]

Most cost-of-illness studies and economic evaluations have used the HC method to value productivity. The HC method considers the patient's hours of productivity that are lost and calculates productivity costs as the product of those total lost hours with the hourly wage. Every hour not worked is an hour lost, possibly until the patient's retirement age. Clearly, this can lead to very high costs. As a result, the HC method has been criticised for overestimating productivity losses and estimating potential costs, rather than actual costs.

Instead of the patient's perspective, the FC method takes the employer's perspective and only counts those hours until another employee takes over the patient's work.[8] Long-term absentees are replaced. Therefore, initial production levels are restored after some period of adaptation, called the friction period. The length of the friction period depends on the availability of labour—that is, the level of unemployment. Current guidelines set the friction period at 6 months. The FC method has been criticised for underestimating productivity losses, because it only considers a single friction period. Unless the new employee was previously unemployed, the initial vacancy creates a chain of vacancies each with their own friction period. Unfortunately, empirical evidence on this chain of vacancies is lacking and the debate on the validity of the HC and the FC method has subsided without a clear winner.

Since the HC and FC method count productivity losses over different periods of time, their results when applied in trials can differ considerably, but the difference depends on the type of absenteeism. In the case of short-term absenteeism (up to 6 months) both methods will render identical results, but for long-term absenteeism or (prevented) job loss the HC method will estimate higher cost differences than the FC method. In RA, job loss is typically postponed. According to the HC method, productivity costs are then proportional to the duration of the postponement. According to the FC method, postponing job loss does not reduce costs at all: with or without postponement, the productivity costs are equal to one friction period.

## ILLUSTRATION

In the BeSt study, four treatment strategies were compare in patients with recent-onset RA: sequential monotherapy, step-up combination therapy, initial combination therapy with prednisone and initial combination therapy with infliximab.[9] All four strategies were adaptive, intensifying or tapering type and dose of medication based on quarterly measurements of the Disease Activity Score. All patients could eventually receive infliximab.

Initial combination therapy with either prednisone or infliximab (strategies 3 and 4) resulted in a more rapid improvement of EQ5D utility values (fig 1), which was in line with other outcome measures. However, after 2 years the results for all four strategies were very similar. The initially higher EQ5D utility values resulted in significantly higher QALYs for initial combination therapy with infliximab (table 1), with an advantage of 0.09 QALYs compared with initial combination therapy with prednisone. Owing to the costs of infliximab, medical costs for initial combination therapy with infliximab were €16 000 higher. From a medical perspective, the cost–utility ratio was estimated at €186 000 per QALY (table 2). This ratio is generally considered too expensive, so from the medical perspective initial combination therapy with prednisone would be preferred.

**Table 1** Outcomes

| Strategy | QALYs*§ | Medical costs¶ (€) | Weekly hours worked†** | Friction-cost method†† (€) | Human-capital method‡‡ (€) |
|---|---|---|---|---|---|
| 1. Sequential monotherapy | 1.29 | 11 900 | 7.9 | 8700 | 11 400 |
| 2. Step-up combination | 1.31 | 9100 | 11.2 | 6300 | 3900 |
| 3. Combination with prednisone | 1.32 | 9600 | 12.7 | 7600 | −2800‡ |
| 4. Combination with infliximab | 1.41 | 25 600 | 14.3 | 6500 | −13 300‡ |

*According to UK EQ5D (ideally 2.0); †on average, over the entire group. Initially, 41% of patients had paid work; ‡negative costs are gains, because of worked hours above average.
§p = 0.02 (pairwise p<0.05 for group 4 compared with others); ¶p<0.001 (pairwise p<0.05 for group 4 compared with others);
**p = 0.002 (pairwise p<0.05 for 1 vs 3 and 1 vs 4);
††p = 0.40; ‡‡p<0.001 (pairwise p<0.05 for 1 vs 3, 1 vs 4, 2 vs 4 and 3 vs 4).
QALYs, quality-adjusted life years.

**Table 2** Cost effectiveness (compared with preceding strategy), depending on perspective

| Strategy | Medical perspective | Societal, FC method | Societal, HC method |
|---|---|---|---|
| 1. Sequential monotherapy | Dominated | Dominated | Dominated |
| 2. Step-up combination | Dominant over 1 | Dominant over 1 | Dominant over 1 |
| 3. Combination with prednisone | €25 000 per QALY | €75 000 per QALY | Dominant over 2 |
| 4. Combination with infliximab | €186 000 per QALY | €131 000 per QALY | €22 000 per QALY |

FC, friction costs; HC, human capital; QALY, quality-adjusted life year.

Also, non-medical costs were estimated, including productivity costs. Average weekly worked hours ranged from 7.9 h for sequential monotherapy to 14.3 h for initial combination therapy with infliximab (table 1). Using the HC method, this difference directly translates to a considerable difference in productivity costs, already during the 2-year study period: both initial combination therapies had above-average worked hours, leading to savings on productivity (negative costs). Using the FC method, the differences in worked hours hardly translated to any differences in productivity costs.

Figure 2 and table 2 show the cost–utility estimates for the four strategies from three different perspectives: medical perspective, societal perspective using the FC method and societal perspective using the HC method. The QALY estimates are identical for all three perspectives. The FC method rendered results very similar to the medical perspective: the level of costs was different, but it is the differences in costs that count. The cost–utility ratio for initial combination therapy with infliximab compared with prednisone somewhat decreased to €131 000 per QALY, which is still generally considered unacceptably high. Using the HC method, the value of sustained productivity after initial combination therapy with infliximab largely compensated for the extra medication costs, leading to an acceptable cost–utility ratio of only €22 000 per QALY.

## DISCUSSION

Whether and how productivity costs are taken into account can have a considerable impact on whether a particular treatment is cost effective for a particular patient group. In general, better health is associated with better productivity. As a result, from a societal perspective, healthcare is often more cost effective for patients with jobs than for those without. However, differences in cost effectiveness need not imply differences in access to care. In the BeSt study 59% of the patients did not have a job, but cost effectiveness was only reported for the entire group.[9] According to the HC method, the savings on productivity for the 41% of the patients with jobs was sufficient to justify the costs of biological agents for the entire group. Few would advocate defining access to care by individual economic characteristics. But would it be so much different if biological agents were considered economically acceptable in early-onset RA but not in advanced disease when fewer patients have jobs?

In conclusion, productivity costs have the potential to offset treatment costs in RA, although results so far have not been very convincing.[6] Even the costs of expensive biological agents may be compensated for, but only in early-onset disease when patients still have jobs and if productivity is given full weight by using the HC method. If productivity is given less weight by excluding productivity costs or by using the FC method, then currently, biological agents are probably too expensive.

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## REFERENCES

1. **Stiggelbout AM,** de Haes JC. Patient preference for cancer therapy: an overview of measurement approaches. *J Clin Oncol* 2001;**19**:220–30.
2. **Harrison MJ,** Davies LM, Bansback NJ, *et al*. The validity and responsiveness of generic utility measures in rheumatoid arthritis: a review. *J Rheumatol* 2008;**35**:592–602.
3. **Gold MR,** Siegel JE, Russell LB, *et al*. *Cost-effectiveness in health and medicine*. New York: Oxford University Press, 1996.
4. **Van den Hout WB.** Deficiencies in current evaluations of the cost-effectiveness of biologic agents for RA. *Nat Clin Pract Rheumatol* 2009;**5**:78–9.
5. **Ubel PA,** Hirth RA, Chernew ME, *et al*. What is the price of life and why doesn't it increase at the rate of inflation? *Arch Intern Med* 2003;**163**:1637–41.
6. **Vliet Vlieland TPM,** De Buck PDM, Van den Hout WB. Vocational rehabilitation programs for individuals with chronic arthritis. *Curr Opin Rheumatol* 2009;**21**:183–8.
7. **Yelin E.** Work disability in rheumatic diseases. *Curr Opin Rheumatol* 2007;**19**:91–6.
8. **Brouwer WB,** Koopmanschap MA. The friction-cost method: replacement for nothing and leisure for free? *Pharmacoeconomics* 2005;**23**:105–11.
9. **Van den Hout WB,** Goekoop-Ruiterman YP, Allaart CF, *et al*. Cost-utility analysis of treatment strategies in patients with recent onset rheumatoid arthritis. *Arthritis Rheum* 2009;**61**:291–9.

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## Notes