Critical analysis of economic tools and economic measurement applied to rheumatoid arthritis

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ABSTRACT

Rheumatoid arthritis (RA) is chronic, progressive systemic inflammatory disease that if uncontrolled may lead to significant joint damage, dysfunction, work disability and other sequelae that result in large economic losses. A rich literature estimating the economic burden of RA, has been intensified recently, driven by costly biologic agents that have had a notable effect improving the outcomes of patients with RA. In order to optimally assess the value of therapies, it is best to take a comprehensive approach, considering all related costs of illness. This includes direct costs (e.g. the costs of the medications themselves and the monitoring required), indirect costs (e.g. loss of productivity, such as employment due to uncontrolled disease) and intangible cost (e.g. effects on pain and quality of life). Indirect costs constitute a substantial part of total cost in the patient with RA. In order to help assess the impact of RA on productivity, various tools for measuring productive loss like absenteeism and presenteeism have been introduced. No single tool reflects the entire spectrum of the productive loss clearly, as other factors such as use of a human capital approach or friction cost approach affect the valuation of productive loss monetarily. Although favourable outcomes are achieved with the use of biologic agents, their higher acquisition costs, as compared to traditional disease-modifying anti-rheumatic drugs (DMARDs) remain a barrier to their use. Assessments of the cost effectiveness of novel therapies are critically important, but published results have been contradictory, in some measure due to the heterogeneity of instruments utilised. While the various instruments appear to be valid and reliable, correlations between instruments has been modest, driven by factors such as differences in recall times, attribution and other confounders.

Introduction

Rheumatoid arthritis (RA) is chronic, progressive systemic inflammatory disease that when uncontrolled leads to joint damage. Patients usually experience functional disability, which results in reduced capacity to perform activities of daily living, including work. Work disability represents a substantial economic loss to patients, their families and society. Previous studies showed that more than half of employed patients with RA experienced work loss due to RA during the course of their disease (1). Since the introduction of novel therapies, particularly biologic agents, outcomes for patients with RA have improved. Biologic agents suppress disease activity, retard progression of joint destruction and improve joint function and quality of life. However, the higher cost of biologic agents as compared to traditional disease-modifying anti-rheumatic drugs (DMARDs) presents important challenges.

A large body of literature addresses the economic burden of RA, and impact of biologic agents on health care budgets. Given their higher costs but more favourable outcomes in appropriate patients, the value of biologic agents has been addressed in a number of cost effectiveness studies. In this paper, we undertook a review of the literature to identify the pharmacoeconomic instruments that have been used in RA.

Cost related to illness

Generally, the costs related to illness may be classified in 3 categories: 1) direct costs include the costs directly attributed to health care, including the acquisition costs of the medication fees, as well as inpatient and outpatient clinic costs related to treatment 2) indirect costs reflect productivity costs, usually monetarily measured as regards paid work outside the home by either the human capital approach and

friction cost approach, and 3) intangible costs related to the costs of suffering like pain and disability (2).

In a paper that systematically reviewed 26 cost-of-illness or cost effectiveness studies, overall mean total cost of RA was approximate €14,906 per year and indirect productivity costs constituted the largest part of the total cost (3). Another analysis showed that the total costs of RA to society in 2006 were estimated at €45.3 billion in Europe and €41.6 billion in the US (4). The mean annual cost per patient was estimated at around €13,500 in Europe. The mean annual cost per RA patient in the United States has been suggested to be higher (€21,000) than that of the Europe (4). Using the claim data of 2005, the societal cost of RA in the US was $19.3 billion and $39.2 billion without and with intangible costs, respectively. Direct societal cost was estimated at $8.4 billion (44%) and indirect cost was $ 10.9 billion (56%) (5).

The introduction of biologic agents resulted in substantial changes in the cost of RA, mostly regarding direct costs (2), as reported in several studies (6, 7). One study was conducted before the introduction of biologic agents, but in another study 27% of patients were treated biologic agents. The annual direct cost in the former study were on average €4,003 per patient year and the proportion of that related to medication costs was 13% of total direct cost (6, 7). In the latter study, the annual direct costs per patient were €11,757; medication costs of €4,406, represented approximately 37% of total direct costs (6, 7).

Indirect productivity costs

Indirect costs relate mostly productivity loss and constitute a substantial part of the total cost of RA. Productivity costs refer to the value of the time lost from productive work at paid employment or at home, related to the impact of the disease. It can be subdivided into discrete measures such as (1) absenteeism: absent workdays due to health reason (2) presenteeism : reduced or impaired performance at work due to health reason (3) inability to participate in leisure activity (4) loss of productivity in unpaid work activity such has household work, shopping and childcare and (5) loss of time and wages by spouse and caregiver (8).

Many studies have focused on work disability related job loss and absenteeism rather than the other components like presenteeism and occupational change because of the greater difficulty quantifying the latter (8). In a systematic review of arthritis studies on work productivity, 36%~ 84% of employed RA patients missed work or took short term disability within the previous year. The median duration of work loss was 39 days (1). A longitudinal study showed that work disability rate increased over time in RA patients (9). Of note, the introduction of biologic agents coincided with a decrease in disability pension in Sweden related to RA over the past twenty years. These trends also may reflect earlier, more aggressive treatment with conventional use of DMARDs and escalation of treatment of DMARDs in various combination (10).

Presenteesim is less frequently measured in the studies; although the number of studies on absenteeism outweighed that of presenteeism, reduced performance during working rather than the absenteeism might be the more important cause of productivity losses and indirect costs (11, 12). In one study of the indirect cost of patient with arthritis, presenteeism accounted for 41% loss of productivity compared to 12% due to absenteeism (11).

Depending on the health status, workers could move between absenteeism and presenteeism. In order to provide a complete view of the impact of arthritis on work, both absenteeism and presenteeism should be measured concurrently. Since both of these components are part of a continuum, Outcome Measures in Rheumatology (OMERACT) has called for a single unifying outcome that would combine assessments of absenteeism and presenteeism (13).

A recent paper systematically reviewed effects of biological agents on participation in paid work among patients with RA (14). Nineteen studies, including randomised controlled trials, as well as controlled and uncontrolled cohort studies, in which patients were treated with biologic agents were included, having met the quality standard used by the authors. Employment status improved in four out of the 14 studies in which it was measured. Absenteeism was the outcome that most frequently showed a favourable effect. Among ten studies quantifying effects of biological agent on absenteeism, all showed the reduction in absence from the work. Presenteeism was improved in seven out of nine studies in which it was measured. Beneficial effects of biological agents on both absenteeism and presenteeism may offer an opportunity to offset the higher acquisition costs by accruing savings in indirect costs (14). Such achievement of very low levels of disease activity may be required to demonstrate this, particularly in the shorter term. In a study assessing the combination of methotrexate and etancercept in patients with early RA, achievement of clinical remission or major improvement might be necessary to significantly impact work outcomes (15). In a 5-year prospective study of patients with early and clinical active RA, remission during first year was good indicator of maintenance of work capacity. None of the 44 patients in remission at either 6 months or 12 months experienced RA permanent disability work (16) .

The results of studies evaluating the impact of biologic agents on employment included important differences that can affect their results, including differences in the study population (*e.g.* early *vs.* established), study duration, and importantly, differences in the measurement tool used (17). Various instruments differ as regards perspective, recall period, attribution, and confounding. Although the instruments have been shown to be valid and reliable, the differences are seen when various instruments are applied in clinical research; further work may provide consensus in the future.

Quantification of productivity loss

Many instruments have been developed to measure productivity. Table I shows various tools that measure presenteeism and/or absenteeism (18). The instruments are different in concept and some measure different domains. Some instruments directly calculate time loss (*e.g.* Health and Labor Questionnaire

Table I. Instrument for measuring productivity loss.

Instrument			Concept
EWPS (31)	Endicott Work Productivity scale	A/P	Number of hours missed and frequency of encountering reduced work productivity
HLQ (32)	Health and Labor Questionnaire	A/P	Number of working days lost and proportion of time experiencing decreased performance
HRPQ-D (33)	Health related Productivity Questionnaire Diary	A/P	Number of work hours missed from paid employment , at home , and at school
HWQ (34)	Health and Work Questionnaire	P	Quality, quantity , and efficiency of work and impact on well-being
LFQ (35)	Life Functioning Questionnaire	A/P	Number of days of missed from work
OST (36)	Osterhaus technique	A/P	Number of days of work missed and % effectiveness at doing job while symptomatic
ORQ (37)	Occupational Role Questionnaire	P	Degree of interference with job
QQ (38)	Quantity and Quality method	P	Number of hours of reduced productivity
RA WIS (39)	Rheumatoid Arthritis Work Instability Scale	P	The extent of any mismatch between functional incapacity and work demands and its potential impact on job retention and security
RA-WPS (40)	RA specific Work Productivity Survey	A/P	Number of days of reduced productivity , degree of interference with work
SPS 13(41)	Stanford Presenteeism Scale	A/P	Number of hours away from work and proportion of time encountering a difficulty
WALS (42)	Work Activity Limitation Scale	P	Amount/level of difficulty in doing specific work related tasks
WHI (43)	Work and Health Interview	A/P	Number of hours missed for any reason and proportion of time encountering a work limitation.
WHO-HPQ (44)	Health and Work Performance Questionnaire	A/P	Number of hours missed on full days being absent and proportion of time having difficulty, overall work performance
WIS (39)	Work Instability Scale	P	Number of difficulties encountered
WLQ 25 (45)	Work Limitation questionnaire	P	Frequency and proportion of time having difficulty
WPAI-GH (46)	Work Productivity and Activity impairment-General Health	A/P	Number of hours missed from work and degree of impairment
WPSI (47)	Work Productivity Short Inventory	A/P	Number of days missed from work
WRF/WL26 (48)	Work Role functioning	P	Proportion of time having difficulty

A: absenteeism; P: presenteeism.

(HLQ); others estimate the percent of time loss (*e.g*. Quantity and Quality (QQ) questionnaire, Work Productivity and Activity Impairment Questionnaire (WPAI), Osterhaus method). Some are multidimensional questionnaires (*e.g*. the Work Limitations Questionnaire (WLQ)). To date there is no single instrument that is clearly superior in measuring the entire spectrum of productive loss; Thus further assessment, more experience and careful interpretation will be needed (18).

When various tools applied to same patient with RA, the correlation between the instruments has not been consistent. Some tools like QQ questionnaire and Work Productivity and Activity Impairment Questionnaire General Health (WPAI-GH) modestly correlated with each other, the HLQ correlated poorly with the other instruments (19). Beaton *et al*. tested 5 different tools like Workplace Activity Limitations Scale (WALS), 6-item Stanford Presenteeism Scale (SPS-6), Endicott Work Productivity Scale (EWPS), RA Work Instability Scale (WIS), and WLQ for the patients with RA and Osteoarthritis. Although this study showed WALS and RA WIS as superior instruments for measuring at-work productivity loss in workers with arthritis, it is not apparent that one specific tools is clearly superior to others (20). Because different instruments using different scales were applied to across many studies, it is difficult to compare and interpret productive loss precisely between the different studies.

The OMERACT group identified measurements that were designed to assess and combine absenteeism and presenteeism; HLQ, WHO Health and Work Performance Questionnaire (WHO-HPQ), Health related Productivity Questionnaire Diary (HRPQ-D), Osterhaus method, SPS 13, Work and Health review (WHI), WPAI-GH, Work Productivity Short Inventory (WPSI) and RA specific Work Productivity Survey (RA-WPS) (21). Among various tools described in Table I, six measurements met the OMERACT filter based on evidence: these include WALS, WIS,WLQ-25, WPAI,RA-WPS and Health Productivity Questionnaire (HPQ) (21).

The value of productivity

There are two main monetary valuation methods for productivity loss among the employed (22, 23). The human capital method takes the patient's perspective. It counts any hour not worked as an hour lost and calculates produc-

tivity costs as the product of those total lost hours with the hourly wage. In the human capital method, every hour not worked is an hour lost, and it could be continued until the affected person reaches retirement age. 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 duties. In the view of the friction cost method, productivity falls only for limited time until a substitute worker replaces the sick worker. In case of substitution for other workers, there is no productivity loss anymore at the societal level (22, 23). Therefore, results from the human capital method tend to be higher than the friction cost method.

Most economic evaluations have used the human capital method to value productivity. The human capital method has been criticised for overestimating productivity losses and the friction cost method has been criticised for underestimating productivity loss (22, 24) . When both methods applied to same patients to evaluate productive cost of RA, productive cost based on human capital approach were 3~10 times higher than the friction cost approach (3).

Cost effectiveness studies

Since a substantial burden of biologics could be the financial burden of RA care, cost effectiveness studies of biologics agent versus traditional DMARDs have been performed. The patients' health benefits are qualified using quality adjusted life years (QALY). USA dollars $ 50, 000–$100, 000 per QALY has been regarded the threshold in the medical literature to decide whether or not an intervention may be cost effective. It has been suggested that costs are definitely acceptable below $20,000 per QALY, are acceptable up to $50,000 per QALY, and are possibly acceptable up to $100,000 per QALY (25, 26). The incremental cost effectiveness ratio (iCER) weighs the difference in costs between the new drugs versus traditional drugs, against the difference in effects (2). The effects in treatment can be quantified with QALYs, based on the ability of a therapy to improve patients' quality of life. When two treatment options are compared, one is preferred, or 'dominates' in pharmacoeconomic parlance, if it has lower costs per QALY than another option. The decision models employed to estimate the costs and benefits of one agent over other therapies have used modelling that has included simple decision tree, Markov models, and individual sampling models (27).

A systematic review derived from eighteen cost effectiveness studies showed that biologic agents were not cost effective compared to DMARDs at a cost effectiveness threshold of $50,000 per QALY(28). In patients who had failed methotrexate monotherapy, biologic combination therapy was cost effective at a willingness to pay threshold $100,000 per QALY for the payer and societal perspective (28). In a model to estimate cost-effectiveness for US Medicare patients with of RA, use of etanercept or adalimumab in place of infliximab as first-line biologic agent was considered cost effective (29) .

In Behandel-Strategieen treatment strategies' (BeSt) trials for early RA, initial combination therapy with infliximab resulted in significantly better quality of life than other strategies (30). Using the friction cost method, costs of initial combination therapy with infliximab were generally considered too high, and initial combination therapy with prednisone would be more cost effective. However, under the human capital method, the value of productivity after initial infliximab combination therapy resulted in only €22,000 per QALY which is an acceptable cost effectiveness ratio. In early RA, the productivity costs could compensate for the cost of biologic agent depending on the method used to calculate the productivity losses.

Conclusion

Recently, there has been a marked increase in studies attempting to estimate the economic burden of patients with RA, and the value of various treatment strategies. Although biologic agents had greater impact on improving the signs and symptoms as well as the progression of RA, their high acquisition costs have affected their use. Indirect costs, related to productivity loss, constitute a substantial part of total costs in the patient with RA. Various tools for measuring productivity loss have been introduced, but there is no single 'best' instrument. The validation of these tools and the consistency between tools needs to be further evaluated. Results of the cost effectiveness studies with the biologic agent have been somewhat contradictory, but as has been shown in systematic reviews, the use of biologic agent appears to be pharmacoeconomically favourable in certain patients.

References

1. BURTON W, MORRISON A, MACLEAN R, RUDERMAN E: Systematic review of studies of productivity loss due to rheumatoid arthritis. *Occup Med* (Lond) 2006; 56:18-27.
2. FAUTREL B, VERSTAPPEN SM, BOONEN A: Economic consequences and potential benefits. *Best Pract Res Clin Rheumatol* 2011; 25: 607-24.
3. FRANKE LC, AMENT AJ, VAN DE LAAR MA, BOONEN A, SEVERENS JL: Cost-of-illness of rheumatoid arthritis and ankylosing spondylitis. *Clin Exp Rheumatol* 2009; 27 (Suppl .55): S118-23.
4. LUNDKVIST J, KASTANG F, KOBELT G: The burden of rheumatoid arthritis and access to treatment: health burden and costs. *Eur J Health Econ* 2008; 8 (Suppl. 2): S49-60.
5. BIRNBAUM H, PIKE C, KAUFMAN R, MARYNCHENKO M, KIDOLEZI Y, CIFALDI M: Societal cost of rheumatoid arthritis patients in the US. *Curr Med Res Opin* 2010; 26: 77-90.
6. GUILLEMIN F, DURIEUX S, DAURES JP *et al*.: Costs of rheumatoid arthritis in France: a multicenter study of 1109 patients managed by hospital-based rheumatologists. *J Rheumatol* 2004; 31: 1297-304.
7. KOBELT G, WORONOFF AS, RICHARD B, PEETERS P, SANY J: Disease status, costs and quality of life of patients with rheumatoid arthritis in France: the ECO-PR Study. *Joint Bone Spine* 2008; 75: 408-15.
8. ZHANG W, ANIS AH: The economic burden of rheumatoid arthritis: beyond health care costs. *Clin Rheumatol* 2011; 30 (Suppl. 1): S25-32.
9. LACAILLE D, SHEPS S, SPINELLI JJ, CHALMERS A, ESDAILE JM: Identification of modifiable work-related factors that influence the risk of work disability in rheumatoid arthritis. *Arthritis Rheum* 2004; 51: 843-52.
10. HALLERT E, HUSBERG M, BERNFORT L: The incidence of permanent work disability in patients with rheumatoid arthritis in Sweden 1990-2010: before and after introduction of biologic agents. *Rheumatology* (Oxford) 2012; 51: 338-46.
11. LI X, GIGNAC MA, ANIS AH: The indirect costs of arthritis resulting from unemployment, reduced performance, and occupational changes while at work. *Med Care* 2006; 44: 304-10.

12. COLLINS JJ, BAASE CM, SHARDA CE *et al*.: The assessment of chronic health conditions on work performance, absence, and total economic impact for employers. *J Occup Environ Med* 2005; 47: 547-57.
13. TANG K, ESCORPIZO R, BEATON DE *et al*.: Measuring the impact of arthritis on worker productivity: perspectives, methodologic issues, and contextual factors. *J Rheumatol* 2011; 38: 1776-90.
14. TER WEE MM, LEMS WF, USAN H, GULPEN A, BOONEN A: The effect of biological agents on work participation in rheumatoid arthritis patients: a systematic review. *Ann Rheum Dis* 2012; 71: 161-71.
15. ZHANG W, SUN H, EMERY P *et al*.: Does achieving clinical response prevent work stoppage or work absence among employed patients with early rheumatoid arthritis? *Rheumatology* (Oxford) 2012; 51: 270-4.
16. PUOLAKKA K, KAUTIAINEN H, MÖTTÖNEN T *et al*.: Early suppression of disease activity is essential for maintenance of work capacity in patients with recent-onset rheumatoid arthritis: five-year experience from the FIN-RACo trial. *Arthritis Rheum* 2005; 52: 36-41.
17. VERSTAPPEN SM, FAUTREL B, DADOUN S, SYMMONS DP, BOONEN A: Methodological issues when measuring paid productivity loss in patients with arthritis using biologic therapies: an overview of the literature. *Rheumatology* (Oxford) 2012; 51: 216-29.
18. ESCORPIZO R, BOMBARDIER C, BOONEN A *et al*.: Worker productivity outcome measures in arthritis. *J Rheumatol* 2007; 34: 1372-80.
19. BRAAKMAN-JANSEN LM, TAAL E, KUPER IH, VAN DE LAAR MA: Productivity loss due to absenteeism and presenteeism by different instruments in patients with RA and subjects without RA. *Rheumatology* (Oxford) 2012; 51: 354-61.
20. BEATON DE, TANG K, GIGNAC MA *et al*.: Reliability, validity, and responsiveness of five at-work productivity measures in patients with rheumatoid arthritis or osteoarthritis. *Arthritis Care Res* (Hoboken) 2010; 62: 28-37.
21. BEATON D, BOMBARDIER C, ESCORPIZO R *et al*.: Measuring worker productivity: frameworks and measures. *J Rheumatol* 2009; 36: 2100-9.
22. VAN DEN HOUT WB: The value of productivity: human-capital versus friction-cost method. *Ann Rheum Dis* 2010; 69 (Suppl. 1): i89-91.
23. ZHANG W, BANSBACK N, ANIS AH: Measuring and valuing productivity loss due to poor health: A critical review. *Soc Sci Med* 2011; 72: 185-92.
24. BOJKE L, SPACKMAN E, HINDE S, HELLIWELL P: Capturing all of the costs in NICE appraisals: the impact of inflammatory rheumatic diseases on productivity. *Rheumatology* (Oxford) 2012; 51: 210-5.
25. UBEL PA, HIRTH RA, CHERNEW ME, FENDRICK AM: What is the price of life and why doesn't it increase at the rate of inflation? *Arch Intern Med* 2003; 163: 1637-41.
26. SHIROIWA T, SUNG YK, FUKUDA T, LANG HC, BAE SC, TSUTANI K: International survey on willingness-to-pay (WTP) for one additional QALY gained: what is the threshold of cost effectiveness? *Health Econ* 2010; 19: 422-37.
27. MARRA CA, BANSBACK N, ANIS AH, SHOJANIA K: Introduction to economic modeling for clinical rheumatologists: application to biologic agents in rheumatoid arthritis. *Clin Rheumatol* 2011; 30 (Suppl. 1): S9-18.
28. VAN DER VELDE G, PHAM B, MACHADO M *et al*.: Cost-effectiveness of biologic response modifiers compared to disease-modifying antirheumatic drugs for rheumatoid arthritis: a systematic review. *Arthritis Care Res* (Hoboken) 2011; 63: 65-78.
29. WAILOO AJ, BANSBACK N, BRENNAN A, MICHAUD K, NIXON RM, WOLFE F: Biologic drugs for rheumatoid arthritis in the Medicare program: a cost-effectiveness analysis. *Arthritis Rheum* 2008; 58: 939-46.
30. 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.
31. ENDICOTT J, NEE J: Endicott Work Productivity Scale (EWPS): a new measure to assess treatment effects. *Psychopharmacol Bull* 1997; 33: 13-6.
32. VAN ROIJEN L, ESSINK-BOT ML, KOOPMANSCHAP MA, BONSEL G, RUTTEN FF: Labor and health status in economic evaluation of health care. The Health and Labor Questionnaire. *Int J Technol Assess Health Care* 1996; 12: 405-15.
33. KUMAR RN, HASS SL, LI JZ, NICKENS DJ, DAENZER CL, WATHEN LK: Validation of the Health-Related Productivity Questionnaire Diary (HRPQ-D) on a sample of patients with infectious mononucleosis: results from a phase 1 multicenter clinical trial. *J Occup Environ Med* 2003; 45: 899-907.
34. SHIKIAR R, HALPERN MT, RENTZ AM, KHAN ZM: Development of the Health and Work Questionnaire (HWQ): an instrument for assessing workplace productivity in relation to worker health. *Work* 2004; 22: 219-29.
35. ALTSHULER L, MINTZ J, LEIGHT K: The Life Functioning Questionnaire (LFQ): a brief, gender-neutral scale assessing functional outcome. *Psychiatry Res* 2002; 112: 161-82.
36. OSTERHAUS JT, GUTTERMAN DL, PLACHETKA JR: Healthcare resource and lost labour costs of migraine headache in the US. *Pharmacoeconomics* 1992; 2: 67-76.
37. KOPEC JA, ESDAILE JM: Occupational role performance in persons with back pain. *Disabil Rehabil* 1998; 20: 373-9.
38. BROUWER WB, KOOPMANSCHAP MA, RUTTEN FF: Productivity losses without absence: measurement validation and empirical evidence. *Health Policy* 1999; 48: 13-27.
39. GILWORTH G, CHAMBERLAIN MA, HARVEY A *et al*.: Development of a work instability scale for rheumatoid arthritis. *Arthritis Rheum* 2003; 49: 349-54.
40. OSTERHAUS JT, PURCARU O, RICHARD L: Discriminant validity, responsiveness and reliability of the rheumatoid arthritis-specific Work Productivity Survey (WPS-RA). *Arthritis Res Ther* 2009; 11: R73.
41. TURPIN RS, OZMINKOWSKI RJ, SHARDA CE *et al*.: Reliability and validity of the Stanford Presenteeism Scale. *J Occup Environ Med* 2004; 46: 1123-33.
42. GIGNAC MA, BADLEY EM, LACAILLE D, COTT CC, ADAM P, ANIS AH: Managing arthritis and employment: making arthritis-related work changes as a means of adaptation. *Arthritis Rheum* 2004; 51: 909-16.
43. STEWART WF, RICCI JA, LEOTTA C, CHEE E: Validation of the work and health interview. *Pharmacoeconomics* 2004; 22: 1127-40.
44. KESSLER RC, BARBER C, BECK A *et al*.: The World Health Organization Health and Work Performance Questionnaire (HPQ). *J Occup Environ Med* 2003; 45: 156-74.
45. LERNER D, AMICK BC, 3RD, ROGERS WH, MALSPEIS S, BUNGAY K, CYNN D: The Work Limitations Questionnaire. *Med Care* 2001; 39:72-85.
46. REILLY MC, ZBROZEK AS, DUKES EM: The validity and reproducibility of a work productivity and activity impairment instrument. *Pharmacoeconomics* 1993; 4:353-65.
47. GOETZEL RZ, OZMINKOWSKI RJ, LONG SR: Development and reliability analysis of the Work Productivity Short Inventory (WPSI) instrument measuring employee health and productivity. *J Occup Environ Med* 2003; 45:743-62.
48. AMICK BC, 3RD, LERNER D, ROGERS WH, ROONEY T, KATZ JN: A review of health-related work outcome measures and their uses, and recommended measures. *Spine* (Phila Pa 1976) 2000; 25: 3152-60.