RHEUMATOLOGY

Rheumatology 2012;51:375–384
doi:10.1093/rheumatology/ker385
Advance Access publication 16 December 2011

Original article

Factors associated with absenteeism, presenteeism and activity impairment in patients in the first years of RA

Nick Bansback[1,2], Wei Zhang[1,2], David Walsh[3], Patrick Kiely[4], Richard Williams[5], Daphne Guh[1], Aslam Anis[1,2] and Adam Young[6]

Abstract

Objectives. To understand the impact of the early years of RA on all aspects of work productivity, and determine how this is related to clinical markers. Previous research on work productivity has examined predominantly early retirement and absenteeism. The impact of reduced work performance (presenteeism) and activity impairment is less well understood in early RA populations.

Methods. Working patients enrolled in an RA inception cohort were recruited into a nested study. A questionnaire incorporating the Work Productivity and Activity Impairment (WPAI) instrument was administered with a number of clinical outcomes, including the Multidimensional Health Assessment Questionnaire (MD-HAQ) and scales for pain, fatigue and patient assessment of disease patient global assessment (PtGA).

Results. Analysis included 150 RA patients, with the mean age at onset being 48 years (S.D. 10 years) and disease duration from symptom onset being 49 months. Patients had relatively mild disease: MD-HAQ (0.6), pain (3.6), PtGA (3.6) and fatigue (4.6). Of the 92% patients working for pay, 19% reported missing work (absenteeism) in the past week due to their health, accounting for 46% of their working time. Even while at work, ~25% of actual hours was lost due to poor health, while outside work 33% of patients' regular daily activities were prevented. In multivariate analyses, disease severity was associated with the presence of absenteeism, presenteeism and activity impairment. Patients able to self-schedule their work had lower presenteeism and activity impairment.

Conclusions. Productivity loss is common in patients in the first years of RA who are in paid work and was associated with work characteristics and adverse clinical outcomes.

Key words: rheumatoid arthritis, work disability, work productivity, absenteeism, presenteeism.

Introduction

The impact of RA through pain and functional disability substantially affects patients' daily lives, including their ability to work. There is substantive evidence demonstrating that patients with RA leave the workforce prematurely [1]. A majority of previous studies have focused on work disability, frequently interpreted as cessation from paid work. Predictors of work disability have been identified using longitudinal studies [2–5] and new instruments developed to identify patients at risk of work disability [6].

While convention has equated work disability with work cessation, this is a narrow view of the impact of disease on a patient's work. More recently, investigators have taken a broader perspective by also examining absenteeism. Absenteeism commonly refers to the number of missed workdays for employed people. However, the concept of absenteeism can be extended to cover the labour input loss attributable to employment status changes,

[1]Centre for Health Evaluation and Outcome Sciences, St Paul's Hospital, [2]School of Population and Public Health, University of British Columbia, Vancouver, [3]Academic Rheumatology, Arthritis Research UK Pain Centre, University of Nottingham, Nottingham, [4]Department of Rheumatology, St Georges Healthcare NHS Trust, London, [5]Department of Rheumatology, Hereford County Hospital NHS Trust, Hereford and [6]Department of Rheumatology, City Hospital, St Albans, UK.

Submitted 1 April 2011; revised version accepted 30 September 2011.

Correspondence to: Adam Young, Rheumatology Department, St Albans City Hospital, Waverley Road, St Albans AL3 5PN, UK.
E-mail: adam.young@whht.nhs.uk

including reduction in routine working time, job loss and early retirement [7]. Absenteeism usually precedes work cessation and thus is expected to be of great importance in RA [8–10]. Longitudinal studies comparing treatment regimens have found that patients with RA have considerable absenteeism [11, 12]. More recently, randomized clinical trials have included productivity as an outcome measure, with similar results [7, 13] even within the first year of disease [8].

However, even expanding the focus to include absenteeism ignores other important aspects that the disease might impact in a patient's work, notably presenteeism and activity impairment. Presenteeism refers to the reduced intensity of labour input due to health problems while working. Recent studies have shown that presenteeism might account for the largest component of total productivity losses for certain diseases [9, 14, 15]. Activity impairment usually refers to impairment in activities including household work, shopping, childcare, odd jobs and chores around house [10, 16].

This study describes the results of a survey conducted in a cohort of patients in the first years of RA. The results of the survey have previously been used to describe the construct validity of the Work Productivity and Activity Impairment – General Health (WPAI-GH) questionnaire [17]. This article describes the productivity outcomes of the WPAI, including absenteeism, presenteeism and activity impairment, with the objective of finding associations between patient's demographic, work and clinical characteristics with each of these productivity outcomes.

Methods

Patients

Patients were recruited from a UK-based registry of RA, the Early Rheumatoid Arthritis Network (ERAN), which is a group of centres in the UK and Eire with an interest in treatment patterns and outcome in patients with recently diagnosed RA in normal clinical settings. ERAN centres include a typical mix of mainly district hospital-type settings and a few medical school/tertiary care centres in rural, urban and inner city geographical areas in the UK. The cohort studied here was drawn from a similar mix of ERAN centres. A standardized data set including demographic, comorbidity, disease activity and outcome data is collected prospectively on newly diagnosed RA patients at first presentation (<3 years symptoms and before disease-modifying therapy) and yearly thereafter as previously described [18]. ERAN centres follow the British Society for Rheumatology guidelines for the management of early RA, although the choice of DMARD, use of steroids and models of care (i.e. follow-up frequency, thresholds to escalate therapy and access to the multidisciplinary team) are left entirely to the discretion of the individual centres.

Yearly follow-up assessments included recording major coexistent conditions and extra articular features of RA, which are listed on the case report form (CRF) according to chapters (organ systems) of the International Classification for Disease (ICD)-10. These were completed at baseline and at yearly visits, based on patient self-report and medical records, and then coded using ICD-10. In addition, medical conditions were scored according to the Charlson comorbidity index that weights 18 medical conditions based on their predictive strength (1–6) of 1-year mortality in medical inpatients [19]. Although RA receives a weighting of 1 according to the scoring algorithm, this was not applied since it was the primary condition in this study. Neither method measures the severity of a coexistent condition, for which there are few validated tools.

The design was a nested and cross-sectional study of the ERAN cohort. The sample size required was calculated for validating the WPAI questionnaire. It was based on the correlation between WPAI outcomes and clinical and health outcomes. For an expected correlation of 0.2 at $\alpha = 0.05$ and power = 0.8, 194 subjects are required; for a correlation of 0.3, 85 subjects are required. Therefore we intended to recruit a sample of between 100 and 200 patients. The selection criteria were whether the patient had reported they were in work at their most recent follow-up and whether they were linked to one of the centres. Eligible patients were identified and, after gaining consent, invited to complete a set of questionnaires. The study was conducted in 2008–09. Ethical approval was obtained from Trent Ethics Committee, Derby, UK.

Productivity outcomes

Productivity was measured using the WPAI-GH questionnaire, which is a validated instrument to measure loss of work productivity [20]. It consists of six questions. The first asks whether the respondent is working for pay. If yes, the respondent then answers two questions on absenteeism (number of hours missed due to health and separately for other reasons), presenteeism (how much health affected productivity at work on a scale of 0–10), activity impairment (how much health affected regular activities on a scale of 0–10), and the number of hours worked, all in the past seven days. It has been widely used to quantify work productivity loss for numerous diseases such as asthma, psoriasis, irritable bowel syndrome and AS [20–23], and has recently been validated in RA as part of this study [17]. In addition, the WPAI questionnaire is useful to compare productivity loss between treatment groups in randomized clinical trials and observational studies, or between subjects with and without disease. Primary productivity outcomes generated from the WPAI include (i) the work time missed due to health (absenteeism); (ii) percentage impairment while working due to health (presenteeism); and (iii) percentage activity impairment due to health.

Work characteristics

Patients' jobs were classified into physical and non-physical jobs according to job title and job categories based on the European Union variant of the International Standard Classification of Occupations (ISCO88). Jobs under the categories of legislators, senior officials and

managers, professionals, technicians and associate professionals, and clerks were classified as non-physical jobs and those under the categories of service workers and shop and market sales workers, skilled agricultural and fishery workers, craft and related trades workers, plant and machine operators and assemblers, elementary occupations and armed forces were physical jobs. The work type was also classified into (i) usually sit, (ii) stand or work, (iii) light loads and (iv) heavy loads. Full-time employment was defined as $\geqslant$35 h/week. The other work characteristics include whether patients were self-employed, a supervisor, on shift work, whether their work can be postponed and whether they self-schedule their work.

Clinical and health outcomes

A battery of questionnaires were used to assess self-reported clinical and health outcomes. The Multidimensional Health Assessment Questionnaire (MDHAQ) [24] was used to assess functional disability, pain and patient global health estimate (PtGE). It enables the calculation of the patient activity scale (PAS) [based on (the mean of 10 activity of daily living scores + pain visual analogue scale (VAS) + PtGE VAS)/3]. A fatigue VAS and a patient global assessment (PtGA) of disease activity were also included. We assumed a PtGA of disease activity >40 indicated high disease activity following other studies [25]. All the VAS scales were presented as 21 circles to facilitate scoring without a ruler and an arithmetic scale of 0–10 in 0.5 U increments was printed below the circles.

Analysis

Regression models were fitted to measure the association between clinical marker, work characteristics and work productivity outcomes. Since a majority of patients had no absenteeism, logistic regression was used to assess the probability of missing work (>0 days versus = 0). Multiple regressions were used for outcomes of percentage impairment while working due to health and percentage activity impairment due to health. Linearity was checked between each of the continuous variables and the outcome variable (log OR for missing from work). If a linear relationship was rejected, the continuous variables were categorized into two or three groups based on the relationship plots.

For each outcome, univariate analysis was first conducted for each variable. The variables with $P = 0.3$ were selected for further investigation. Secondly, stepwise regression was conducted with entry level $P = 0.3$ and stay level = 0.35 within three blocks of independent variables (i) demographics, (ii) clinical and health outcomes and (iii) work characteristics [26]. In the clinical and health outcomes block, the composite score PAS instead of its components, function, pain and patient global estimate, was used in the model selection because the PAS was calculated directly from the three components. In addition, since PtGA and PAS both assessed disease activity from a patient's perspective, we only included the one that was first selected into the model. Third, the final multivariate regression was constructed only among the variables selected at the second step and age and gender were included as default. A stepwise selection method was used with entry level $P = 0.1$ and stay level = 0.2. Residual plots, Hosmer and Lemeshow goodness-of-fit test and concordance index were used to assess the model fit of the logistic regression model. For multiple regression models, residual plots were examined to check the assumption of normality while R^2 was reported for model fit. Statistical analysis was performed using SAS 9.2.

Results

Characteristics

Of the 354 patients who were employed at the most recent follow-up of the routine ERAN study visit were contacted for the study. Of these, 186 (53%) agreed to take part and were sent the questionnaires. A completion rate of 81% was observed (150 patients) and was included in this analysis. On average, patients were 48 years old at RA onset and 72% were females (Table 1). The median disease duration was 46 months (interquartile range 33–60) since the onset of symptoms and 36 months (24–51) since the first rheumatology visit. Just over half of the patients worked in full-time jobs, with 13% of patients self-employed and 47% in supervisory roles. In terms of the type of jobs patients were employed in, 23% required the lifting of heavy or light loads, whereas 39% required some standing or walking around.

Some 19% of the 137 patients who were working for pay reported missing work (absenteeism) in the past week due to their health. In these patients, their absence accounted for 46% of their working time. For patients at work, 24% of their actual work was impaired due to their health problems (presenteeism). Only 28% of these patients reported no such loss. In addition, 33% of the patients' regular daily activities had been prevented due to their health problems.

Absenteeism

Table 2 reports the associations between demographic, work and clinical characteristics and the probability of any absence from work using the logistic regression model. Patients with a disease duration since onset of symptoms >46 months had over twice the odds of an absence compared to patients with a shorter disease duration, confirmed to be an independent association in the multivariate analysis [odds ratio (OR) = 2.7, $P = 0.046$]. Function, pain, PtGE, fatigue and PtGA were all associated with absences in the univariate analysis ($P < 0.1$). Of the PAS, fatigue and PtGA, only the PAS remained statistically significant in the multivariate analysis. Interestingly, the combination of function, pain and PtGE led to a stronger association than each of the variables alone. Compared with patients with a PAS of $\leqslant$3, patients with a PAS between 3 and 5 and >5 were associated with an OR of 3.8 and 10.7 for an absence, respectively (both $P < 0.05$).

Table 1 Patient characteristics ($n = 150$)

Variables	*n* (missing/NA)	Mean (S.D.)	Median (Q1–Q3)
Demographics			
Age (at RA onset), years	150 (0)	48.1 (10.0)	48.0 (42.0–55.0)
Female	150 (0)	108 (72.0)	
Post-secondary education, *n* (%)	148 (2)	89 (60.1)	
Work characteristics			
Physical job, *n* (%)	140 (10)	58 (41.4)	
Work habit, *n* (%)			
Usually sit	135 (15)	51 (37.8)	
Stand or walk	135 (15)	53 (39.3)	
Light loads	135 (15)	20 (14.8)	
Heavy loads	135 (15)	11 (8.1)	
Self-employed, *n* (%)	138 (12)	18 (13.0)	
Full time (=35 h/week), *n* (%)	139 (11)	73 (52.5)	
Supervisor, *n* (%)	133 (17)	62 (46.6)	
Work can be postponed, *n* (%)	133 (17)	88 (66.2)	
Always self-schedule work, *n* (%)	134 (16)	53 (39.6)	
Work irregular hours or in shifts, *n* (%)	132 (18)	49 (37.1)	
Clinical outcomes			
Duration since onset of symptoms, months	150 (0)	48.6 (23.2)	45.9 (32.9–59.9)
Duration since first rheumatology visit, months	137 (13)	37.4 (18.3)	35.6 (23.6–50.8)
Number of DMARDs			
0	150 (0)	7 (4.7)	
1	150 (0)	82 (54.7)	
2	150 (0)	35 (23.3)	
$\geqslant 3$	150 (0)	26 (17.3)	
Total number of major comorbidities			
0	150 (0)	100 (66.7)	
1	150 (0)	37 (24.7)	
$\geqslant 2$	150 (0)	13 (8.7)	
Charlson's index			
0	150 (0)	113 (75.3)	
1	150 (0)	24 (16.0)	
$\geqslant 2$	150 (0)	13 (8.6)	
PAS (0–10)[a]	150 (0)	2.8 (2.0)	2.6 (1.1–4.1)
Function (0–3)	150 (0)	0.6 (0.5)	0.5 (0.2–0.9)
Pain VAS	150 (0)	3.6 (2.5)	3.0 (1.5–5.5)
PtGE VAS	150 (0)	3.0 (2.4)	2.5 (1.0–5.0)
Fatigue VAS	150 (0)	4.6 (2.9)	5.0 (2.0–7.0)
PtGA VAS	150 (0)	3.6 (2.6)	3.0 (1.5–5.5)
WPAI			
Working for pay, *n* (%)	149 (1)	137 (91.9)	
Missed from work due to health, *n* (%)	136 (14)	26 (19.1)	
Percentage of work time missed due to health	136 (14)	8.7 (25.2)	0.0 (0.0–0.0)
Percentage of work time missed due to health among those who missed work	26 (0)	45.5 (41.2)	18.0 (12.0–100.0)
Actually worked, *n* (%)	136 (14)	123 (82.0)	
Percentage impairment while working due to health	122 (28)	24.0 (22.7)	20.0 (0.0–40.0)
Percentage activity impairment due to health	150 (0)	33.3 (27.6)	30.0 (10.0–60.0)

[a]PAS was calculated based on the formula (the mean of 10 ADL scores + pain VAS + PtGE VAS)/3. Function: 10 activities of daily living (ADL) were scored 0–3, 0 = without any difficulty, 1 = with some difficulty, 2 = with much difficulty and 3 = unable to do. To be consistent with the HAQ score, the sum of 10 ADL scores was divided by 10 to give a score of 0–3. NA: not applicable.

None of the demographic or work variables were found to be associated with an absence.

Presenteeism

The results of the multiple regression analysis for presenteeism are shown in Table 3. There was some indication that older patients had less presenteeism. In contrast to absenteeism, many of the work characteristics had coefficients of logical sign and statistical significance in the univariate analysis. Patients in physical jobs or, more specifically, jobs requiring standing or walking or lifting loads were associated with a higher percentage of

TABLE 2 The association of demographic, work and clinical characteristics with presence of absenteeism

Independent variables	Univariate		Multivariate ($n = 136$)	
	OR (95% CI)	*P*	OR (95% CI)	*P*
Demographics				
Age (at RA onset), years	1.00 (0.95, 1.04)	0.834	1.00 (0.95, 1.06)	0.878
Female *vs* male	1.57 (0.54, 4.55)	0.402	1.29 (0.38, 4.31)	0.684
Education level				
Secondary education	1			
Post-secondary education	0.59 (0.25, 1.39)	0.228		
Work characteristics				
Physical job	1.29 (0.54, 3.04)	0.567		
Work habit				
Usually sit	1			
Stand or walk	0.86 (0.32, 2.33)	0.764		
Light loads	1.17 (0.32, 4.34)	0.813		
Heavy loads	0.41 (0.05, 3.59)	0.420		
Self-employed	0.60 (0.13, 2.81)	0.513		
Full time (= 35 h/week)	1.54 (0.64, 3.70)	0.331		
Supervisor	1.68 (0.71, 4.01)	0.240		
Work can be postponed *vs* never	0.65 (0.27, 1.57)	0.342		
Always self-schedule work	0.78 (0.32, 1.90)	0.579		
Work irregular hours or in shifts	0.71 (0.28, 1.79)	0.469		
Clinical outcomes				
Duration since onset of symptoms (>46 months)	2.27 (0.93, 5.52)	0.072	2.70 (1.02, 7.12)	0.046
DMARDs				
<2	1			
2	1.81 (0.66, 4.95)	0.246		
>2	2.00 (0.66, 6.10)	0.223		
Total number of major comorbidities				
0	1			
1	0.39 (0.11, 1.42)	0.154		
⩾2	1.22 (0.30, 4.92)	0.783		
Total number of major comorbidities				
0	1			
⩾1	0.59 (0.22, 1.60)	0.301		
Charlson's index				
0	1			
1	0.96 (0.29, 3.18)	0.953		
⩾2	0.75 (0.15, 3.63)	0.716		
PAS				
3	1		1	
3–5	3.23 (1.12, 9.26)	0.030	3.79 (1.26, 11.42)	0.018
>5	10.00 (2.99, 33.44)	0.000	10.69 (3.08, 37.09)	0.000
Function				
0.5	1			
0.5–1	2.94 (0.96, 9.02)	0.059		
>1	7.27 (2.48, 21.29)	0.000		
Pain				
<4	1			
4–7	3.10 (1.11, 8.65)	0.030		
7	8.00 (2.41, 26.57)	0.001		
Health global estimate				
4	1			
4–6	2.78 (0.98, 7.86)	0.054		
<6	9.14 (2.73, 30.62)	0.000		
Fatigue				
<6	1			
6–8	2.64 (0.93, 7.51)	0.069		
8	5.88 (1.92, 18.07)	0.002		
Patient global assessment				
<4	1			
4	4.82 (1.91, 12.15)	0.001		

Hosmer and Lemeshow goodness-of-fit test: chi-square statistic = 9.74, df = 8, $P = 0.28$. Concordance index $c = 0.758$.

TABLE 3 The association of demographic, work and clinical characteristics with percentage impairment while working due to health

Independent variables	Univariate		Multivariate ($n = 118$)	
	Estimate (95% CI)	*P*	Estimate (95% CI)	*P*
Demographics				
Age (at RA onset), years	−0.43 (−0.84, −0.03)	0.038	−0.20 (−0.46, 0.06)	0.134
Female *vs* male	8.41 (−0.66, 17.48)	0.072	−0.30 (−6.25, 5.66)	0.922
Education level				
Secondary education or less	0			
Post-secondary education	−6.53 (−14.81, 1.75)	0.125		
Work characteristics				
Physical job	5.93 (−2.32, 14.17)	0.161	4.76 (−0.55, 10.06)	0.082
Work habit				
Usually sit	0			
Stand or walk	3.34 (−5.95, 12.64)	0.482		
Light loads	11.66 (−1.24, 24.56)	0.079		
Heavy loads	11.79 (−3.73, 27.31)	0.139		
Self-employed	−8.70 (−20.57, 3.17)	0.153		
Full time ($\geqslant$35 h/week)	0.43 (−7.67, 8.52)	0.918		
Supervisor	3.81 (−4.28, 11.89)	0.358		
Work can be postponed *vs* never	−5.44 (−14.24, 3.37)	0.228		
Always self-schedule work	−9.31 (−17.46, −1.16)	0.027	−4.30 (−9.47, 0.87)	0.106
Work irregular hours or in shift	1.28 (−7.00, 9.56)	0.762		
Clinical outcomes				
Duration since onset of symptoms (>46 months)	−1.02 (−9.10, 7.07)	0.806		
DMARDs				
<2	0			
2	3.98 (−5.70, 13.66)	0.422		
>2	12.34 (1.62, 23.05)	0.026		
Total number of major comorbidities				
0	0			
1	−2.34 (−12.02, 7.34)	0.636		
$\geqslant$2	−2.03 (−16.42, 12.36)	0.783		
Total number of major comorbidities				
0	0			
$\geqslant$1	−2.26 (−10.86, 6.35)	0.608		
Charlson's index				
0	0			
1	−4.28 (−15.82, 7.27)	0.469		
$\geqslant$2	−1.76 (−15.03, 11.51)	0.796		
PAS	9.52 (8.18, 10.87)	<0.0001	9.26 (7.97, 10.56)	<0.0001
Function	29.66 (23.21, 36.12)	<0.0001		
Pain	6.88 (5.74, 8.03)	<0.0001		
Health global estimate	7.36 (6.10, 8.61)	<0.0001		
Fatigue	5.05 (3.97, 6.14)	<0.0001		
Patient global assessment	6.91 (5.85, 7.97)	<0.0001		

Multivariate model: $R^2 = 0.67$.

presenteeism. Patients that were able to schedule their work, through being self-employed or choosing to postpone work, had lower presenteeism. In the multivariate analysis, whether the job was physical ($\beta = 4.8$, $P = 0.08$) and whether the patient could self-schedule work ($\beta = -4.3$, $P = 0.11$) remained in the model, though $P > 0.05$.

While disease duration and comorbidities showed no association, all components of the PAS, fatigue and PtGA were statistically significant in the univariate analysis ($P < 0.001$). The PAS remained statistically significant in the multivariate analysis ($\beta = 9.3$, $P < 0.001$).

Activity impairment

Table 4 shows the associations between variables and the percentage with activity impairment. Patients that were self-employed had reduced activity impairment ($\beta = -17.7$, $P = 0.01$). However, the multivariate analysis suggests that being able to self-schedule work, a likely feature of being self-employed, had independent

TABLE 4 The association of demographic, work and clinical characteristics with percentage activity impairment due to health

Independent variables	Univariate		Multivariate ($n = 133$)	
	Estimate (95% CI)	*P*	Estimate (95% CI)	*P*
Demographics				
Age (at RA onset), years	−0.14 (−0.59, 0.31)	0.538	0.13 (−0.13, 0.38)	0.337
Female *vs* male	8.60 (−1.19, 18.38)	0.087	2.31 (3.65, 8.28)	0.449
Education level				
Secondary education	0			
Post-secondary education	−5.66 (−14.73, 3.41)	0.223		
Work characteristics				
Physical job	1.35 (−8.06, 10.76)	0.778		
Work habit				
Usually sit	0			
Stand or walk	5.29 (−5.56, 16.14)	0.341		
Light loads	6.20 (−8.40, 20.79)	0.407		
Heavy loads	2.92 (−15.46, 21.31)	0.756		
Self-employed	−17.69 (−31.23, −4.16)	0.012		
Full time (⩾35 h/weeks)	−4.32 (−13.58, 4.95)	0.363		
Supervisor	5.57 (−3.88, 15.01)	0.250		
Work can be postponed *vs* never	−7.31 (−17.19, 2.56)	0.149		
Always self-schedule work	−8.93 (−18.42, 0.56)	0.067	−6.08 (−11.18, −0.99)	0.021
Work irregular hours or in shift	−3.52 (−13.29, 6.24)	0.481		
Clinical outcomes				
Duration since onset of symptoms (>46 months)	−2.76 (−11.62, 6.11)	0.543		
DMARDs				
<2	0			
2	4.42 (−6.40, 15.23)	0.425		
>2	7.45 (−4.63, 19.53)	0.229		
Total number of major comorbidities				
0	0			
1	−3.63 (−14.09, 6.83)	0.498		
⩾2	3.79 (−12.24, 19.82)	0.644		
Total number of major co morbidities				
0	0			
⩾1	−1.70 (−11.11, 7.71)	0.724		
Charlson's index				
0	0			
1	1.40 (−10.85, 13.65)	0.823		
⩾2	−0.88 (−16.84, 15.08)	0.914		
PAS	11.62 (10.40, 12.83)	<0.0001	9.72 (7.97, 11.47)	<0.0001
Function	39.60 (33.35, 45.85)	<0.0001		
Pain	8.38 (7.26, 9.50)	<0.0001		
Health global estimate	8.69 (7.53, 9.85)	<0.0001		
Fatigue	6.36 (5.20, 7.52)	<0.0001	1.71 (0.47, 2.96)	0.008
Patient global assessment	8.26 (7.16, 9.37)	<0.0001		

Multivariate model: $R^2 = 0.74$.

association with reduced activity impairment ($\beta = -6.1$, $P = 0.02$) alongside the PAS ($\beta = 9.7$, $P < 0.001$) and fatigue ($\beta = 1.7$, $P = 0.01$). Similar to presenteeism, disease duration and comorbidities had no association with activity impairment.

Discussion

This study is one of the first to our knowledge to examine a comprehensive set of demographic, work and clinical features with productivity outcomes, including absenteeism, presenteeism and activity impairment in the first years of RA. Our main findings suggest that clinical variables, notably the PAS, which includes function, pain and global health, are strongly associated with all productivity outcomes. This function is related to absenteeism and presenteeism and confirms previous findings [26, 27]. However, the larger association when pain and global health are included with the function is a new finding and suggests their usefulness in understanding

productivity outcomes in patients. Due to the recruitment strategy and without a control arm of non-RA patients, the magnitude of productivity problems attributable to RA cannot be determined in this study.

An interesting finding is that patients able to schedule their own work had reduced presenteeism and activity impairment. One possible interpretation of this finding is that patients being able to choose to work when their symptoms are controlled not only improves their overall productivity, but enables wider benefits in terms of scheduling, for example, their household chores. This finding supports the importance of considering contextual factors in patients' treatments [28].

A limitation of the study is the absence of a control arm of non-RA patients. Patients without RA also have absences from work, presenteeism and unpaid work activity impairment. The magnitude of absenteeism, presenteeism and unpaid work activity impairment should consequently be interpreted with caution. Instead, this study uses a simple cross-sectional design to identify factors related to productivity. The strength of our cohort is that it includes patients that are representative of the RA population in the UK. We checked for non-response bias by comparing patient demographics and disease characteristics at the time of the study, including disease duration, DAS, HAQ and PGA. Except for gender, we found no statistically significant differences between patients who responded to the questionnaire ($n = 150$) and those who were eligible and contacted but did not respond ($n = 204$).

Patients often adapt to jobs that meet their capabilities and try to minimize work losses from arthritis and other comorbid conditions [29]. This may have weakened associations between work characteristics and comorbidities with productivity outcomes with this cross-sectional study design. This is also a potential explanation for why fatigue was not found to be associated with presenteeism, similar to previous studies [26], although fatigue could impact indirectly through disability (MD-HAQ). Other explanations for the lack of association with comorbidities includes the possibility that it is already captured by its effect on PAS, fatigue and/or PtGA. In addition, the current comorbidity tools do not indicate the severity of each comorbid condition, the exact date of diagnosis of the condition is not always known, and these patients had less severe RA. Relative to the complete ERAN data set as reported recently [30], the levels of disease activity measures were low in these patients, and most likely due to the selection criteria for this study, as patients in work tend to have less severe RA.

The cross-sectional design also limits us to study associations between clinical measures, not causal factors. Longitudinal measurement of productivity outcomes would enable predictors of patients at risk of absenteeism, presenteeism and activity impairment to be identified, though the statistical analysis for such studies is often complex and controlling for confounders is more difficult. While other measures such as the RA Work Instability Scale (WIS) [6] are useful for identifying patients at risk of losing their employment, the associations found in this study can be useful for identifying patients who might be suffering from more intermediate productivity outcomes. Personal factors such as coping and helplessness can affect work loss and reduced work hours, but were not included in ERAN or WPAI.

While the WPAI is a straightforward, low-burden questionnaire, its simplicity might confound the accuracy of measurement. Previous studies have shown wide differences in presenteeism outcomes depending on the questionnaire [31] and is suspected to be related to the way in which presenteeism is assessed. Since the WPAI uses a scale, patients tend not to report at the upper or lower anchors (end aversion bias), suggesting that presenteeism might be overestimated (it is rarely reported as zero). It is also possible that the wording of the question for presenteeism infer that patients consider wider aspects of their life not only relating to work output, but factors associated with their quality of life as well. This is one reason why using the WPAI to cost productivity impairments (known as indirect costs) is problematic. Consequently, new measures for presenteeism are suggested [32] and being developed [33, 34].

Further study is warranted to confirm these associations in a separate cohort of early RA patients and causal factors relating to productivity, and whether the WPAI has potential as a screening tool for work-related issues in the assessment of RA in routine settings. The longitudinal measurement of productivity using the WPAI would enable a richer set of analyses, examining changes in productivity over time and its related associations, along with more comprehensive prediction models. At present, the results of this study suggest that physicians should consider outcomes such as global health, fatigue and work characteristics in their treatment considerations.

Rheumatology key message

- In addition to absenteeism, patients with early RA also experienced reduced work performance (presenteeism) and activity impairment.
- Productivity loss was associated with work characteristics and adverse clinical outcomes in RA.
- Patients who could schedule their work themselves had lower presenteeism and activity impairment.

Acknowledgements

W.Z. is a recipient of a Canadian Institutes of Health Research Doctoral Research Award in the Area of Public Health Research and a Canadian Arthritis Network Graduate Award. ERAN is funded by the Health Care Commission, UK, and received an unconditional grant from Wyeth to distribute and collate the questionnaires.

ERAN clinicians and research nurses involved in this study were Annie Seymour (City Hospital, St Albans), Karina Blunn, Jackie McDowell and Heather Robinson (Hereford County Hospital), Dr Peter Prouse and Sheryl Andrews (North Hampshire Hospital), Deborah Wilson

(King's Mill Hospital), Dr Michael Webley and Jackie Hall (Stoke Mandeville Hospital), Dr Amanda Coulson (Withybush General Hospital), Dr Andrew Hassle and Michele Kirwan (Haywood Hospital), Francesca Leone (St George's Hospital), Dr Ciaran Dunne and Lindsey Hawley (Christchurch Hospital), Dr Paul Creamer, Julie Taylor, and Germaine Bath (Southmead Hospital), Dr Tom Palferman, Rebecca Rowland-Axe and Clare Buckley (Yeovil District Hospital), Dr S Clark and Dawn Simmons (Weston-Super-Mare General Hospital), Dr Joel David and Maureen Cox (Nuffield Orthopaedic Centre), Dr Marwan Bukhari and Bronwen Evans (Lancaster Royal Infirmary), Marie Hunt (ERAN Coordinator, City Hospital, St Albans).

Disclosure statement: The authors have declared no conflicts of interest.

References

1 Burton W, Morrison A, Maclean R, Ruderman E. Systematic review of studies of productivity loss due to rheumatoid arthritis. Occup Med 2006;56:18–27.

2 Eberhardt K, Larsson BM, Nived K, Lindqvist E. Work disability in rheumatoid arthritis–development over 15 years and evaluation of predictive factors over time. J Rheumatol 2007;34:481–7.

3 de Croon EM, Sluiter JK, Nijssen TF *et al*. Predictive factors of work disability in rheumatoid arthritis: a systematic literature review. Ann Rheum Dis 2004;63:1362–7.

4 Verstappen SM, Bijlsma JW, Verkleij H *et al*. Overview of work disability in rheumatoid arthritis patients as observed in cross-sectional and longitudinal surveys. Arthritis Rheum 2004;51:488–97.

5 Young A, Dixey J, Kulinskaya E *et al*. Which patients stop working because of rheumatoid arthritis? Results of five years follow up in 732 patients from the Early RA Study (ERAS). Ann Rheum Dis 2002;61:335–40.

6 Gilworth G, Chamberlain MA, Harvey A *et al*. Development of a work instability scale for rheumatoid arthritis. Arthritis Rheum 2003;49:349–54.

7 Anis A, Zhang W, Emery P *et al*. The effect of etanercept on work productivity in patients with early active rheumatoid arthritis: results from the COMET study. Rheumatology 2009;48:1283–9.

8 Merkesdal S, Ruof J, Schoffski O *et al*. Indirect medical costs in early rheumatoid arthritis: composition of and changes in indirect costs within the first three years of disease. Arthritis Rheum 2001;44:528–34.

9 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.

10 Zhang W, Bansbank N, Guh D *et al*. Short-term influence of adalimumab on work productivity outcomes in patients with rheumatoid arthritis. J Rheumatol 2008;35:1729–36.

11 Puolakka K, Kautiainen H, Mottonen T *et al*. Impact of initial aggressive drug treatment with a combination of disease-modifying antirheumatic drugs on the development of work disability in early rheumatoid arthritis: a five-year randomized followup trial. Arthritis Rheum 2004;50:55–62.

12 Bjork M, Thyberg I, Rikner K *et al*. Sick leave before and after diagnosis of rheumatoid arthritis–a report from the Swedish TIRA Project. J Rheumatol 2009;36:1170–9.

13 Bejarano V, Quinn M, Conaghan PG *et al*. Effect of the early use of the anti-tumor necrosis factor adalimumab on the prevention of job loss in patients with early rheumatoid arthritis. Arthritis Rheum 2008;59:1467–74.

14 Burton WN, Chen CY, Conti DJ *et al*. The association of health risks with on-the-job productivity. J Occup Environ Med 2005;47:769–77.

15 Goetzel RZ, Long SR, Ozminkowski RJ *et al*. Health, absence, disability, and presenteeism cost estimates of certain physical and mental health conditions affecting U.S. employers. J Occup Environ Med 2004;46:398–412.

16 van Roijen L, Essink-Bot ML, Koopmanschap MA *et al*. 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.

17 Zhang W, Bansback N, Boonen A *et al*. Validity of the work productivity and activity impairment questionnaire—general health version in patients with rheumatoid arthritis. Arthritis Res Ther 2010;12:R177.

18 Kiely P, Williams R, Walsh D, Young A. Early Rheumatoid Arthritis Network. Contemporary patterns of care and disease activity outcome in early rheumatoid arthritis: the ERAN cohort. Rheumatology 2009;48:57–60.

19 Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic co morbidity in longitudinal studies: development and validation. J Chronic Dis 1987;40:373–83.

20 Reilly Associates Health Outcomes Research. 2008. http://www.reillyassociates.net (date last accessed 28 March 2011).

21 Reilly MC, Bracco A, Ricci J-F *et al*. The validity and accuracy of the Work Productivity and Activity Impairment questionnaire—irritable bowel syndrome version (WPAI:IBS). Aliment Pharmacol Ther 2004;20:459–67.

22 Reilly MC, Gerlier L, Brabant Y, Brown M. Validity, reliability, and responsiveness of the work productivity and activity impairment questionnaire in Crohn's disease. Clin Ther 2008;30:393–404.

23 Reilly MC, Gooch KL, Wong RL *et al*. Validity, reliability and responsiveness of the Work Productivity and Activity Impairment Questionnaire in ankylosing spondylitis. Rheumatology 2010;49:812–9.

24 Pincus T, Swearingen C, Wolfe F. Toward a Multidimensional Health Assessment Questionnaire (MDHAQ): assessment of advanced activities of daily living and psychological status in the patient-friendly health assessment questionnaire format. Arthritis Rheum 1999;42:2220–30.

25 Kobelt G, Lindgren P, Lindroth Y *et al*. Modelling the effect of function and disease activity on costs and quality of life in rheumatoid arthritis. Rheumatology 2005;44:1169–75.

26 Geuskens GA, Hazes JM, Barendregt PJ, Burdorf A. Predictors of sick leave and reduced productivity at work

among persons with early inflammatory joint conditions. Scandinavian J Work, Environ Health 2008;34:420–9.

27 Geuskens GA, Hazes JM, Barendregt PJ, Burdorf A. Work and sick leave among patients with early inflammatory joint conditions. Arthritis Rheum 2008;59:1458–66.

28 Beaton D, Bombardier C, Escorpizo R *et al*. Measuring worker productivity: frameworks and measures. J Rheumatol 2009;36:2100–9.

29 Gignac MA, Badley EM, Lacaille D *et al*. Managing arthritis and employment: making arthritis-related work changes as a means of adaptation. Arthritis Rheum 2004;51:909–16.

30 Kiely P, Walsh D, Williams R, Young A. Outcome in RA patients with continued conventional therapy for moderate disease activity. The Early Rheumatoid Arthritis Network (ERAN). Rheumatology 2011;50:926–31.

31 Zhang W, Gignac MAM, Beaton D *et al*., on behalf of the Canadian Arthritis Network Work Productivity Group. Productivity loss due to presenteeism among patients with arthritis: estimates from 4 instruments. J Rheumatol 2010; 37:1805–14.

32 Escorpizo R, Bombardier C, Boonen A *et al*. Worker productivity outcome measures in arthritis. J Rheumatol 2007;34:1372–80.

33 Zhang W, Bansback N, Kopec J, Anis A. Measuring time input loss among patients with rheumatoid arthritis: validity and reliability of the Valuation of Lost Productivity questionnaire (VOLP). J Occup Environ Med 2011;53: 530–6.

34 Valuation of lost productivity questionnaire. www.thevolp .com (date last accessed 28 March 2011).