# The Prevalence and Incidence of Work Disability in Rheumatoid Arthritis, and the Effect of Anti-Tumor Necrosis Factor on Work Disability

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*ABSTRACT.* ***Objective.*** To determine the prevalence and incidence rates of work disability in rheumatoid arthritis (RA), and to determine the effect of anti-tumor necrosis factor (TNF) therapy on work disability.

***Methods.*** Participants with RA who were employed when RA was diagnosed (N = 8082) were evaluated for up to 5.5 years. Work disability incidence rates were determined in a subset (N = 4155) of those who stated they were currently employed, and the effect of anti-TNF therapy was determined by conditional logistic regression, after adjustment for covariates.

***Results.*** At a median of 12.8 years after RA onset, 56.2% were still employed and 43.8% were not working. Of those not working, 22.7% considered themselves disabled. In addition, 30.5% had stopped work over their lifetimes for health reasons and 20.6% were currently receiving Social Security disability benefits. The annualized incidence rate for self-reported disability was 2.5% and for Social Security disability 1.9%. The incidence rate for persons who stopped working and did not resume employment was 4.0%. Anti-TNF therapy was not associated with Social Security disability, but was associated with an increased risk of self-reported disability (odds ratio 1.6) after adjustment for covariates.

***Conclusion.*** Rates of self-reported disability were lower than noted in previous studies, perhaps reflecting overall improvement in RA therapy. We could not discern a positive effect of anti-TNF therapy on the risk of work disability. (First Release Sept 1 2007; J Rheumatol 2007;34:2211–7)

*Key Indexing Terms:*
RHEUMATOID ARTHRITIS WORK DISABILITY INCIDENCE BIOLOGICS

Almost 20 years have passed since the seminal report of Yelin, *et al* in which work disability for persons with rheumatoid arthritis (RA) was noted to be 50% 10 years after diagnosis[1]. Since that report, RA treatment has improved dramatically, first with the introduction of methotrexate (MTX) therapy, and more recently with the introduction and increasing use of anti-tumor necrosis factor (TNF) therapy. MTX has been shown to reduce mortality and improve functional status[2]. Anti-TNF therapy is superior to MTX in clinical trials, but data on its longterm effect on RA outcomes are not yet sufficient to understand its contribution to longterm improvement. We examined the effect of anti-TNF therapy on work disability, and defined rates of incidence of work disability and prevalence according to 2 definitions, receipt of US Social Security disability benefits (SS disability) and self-reported work disability (SR disability).

Using the dataset of this report, we recently reported incidence and prevalence rates for work disability using a definition of work that included any amount of work and defined work disability as any cessation of work, as well as work cessation due to arthritis[3]. These definitions provide an important measure of workplace participation and cessation. In this report we extend this previous work using alternative definitions that may be more germane to the assessment of treatment effect. In addition, we now provide measures that represent work activities sufficient that patients consider themselves to be employed. Using these definitions we used a longitudinal data bank to measure work disability and the effect of anti-TNF therapy.

## MATERIALS AND METHODS

Participants of the National Data Bank for Rheumatic Diseases (NDB) are recruited on a continuing basis from the practices of US rheumatologists, and are followed prospectively with semiannual, detailed, 28-page questionnaires, as described[4]. Participants in this study were 8082 members of the NDB longitudinal study of rheumatic arthritis outcomes. They were between ages 20 and 61 years, they were employed when they were diagnosed with RA, and they completed semiannual questionnaires between 2000 and the first half of 2006 (Table 1).

For incidence rate analyses, a subset of the 8082 participants was formed consisting of 4155 participants who were employed at study start and completed at least 2 questionnaires (Tables 2 and 3).

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*Table 1.* Work status of 8082 participants with RA who were employed at the onset of disease.

| Variable | Mean (SD) or n (%) |
|---|---|
| Demographic data | |
| Age, mean yrs | 51.2 (SD 8.54) |
| RA duration, median yrs | 12.8 |
| Men, % | 20.4 |
| Work status, n (%) | |
| Unemployed | 244 (3.0) |
| Paid work | 4539 (56.2) |
| Retired | 707 (8.8) |
| Housework | 710 (8.8) |
| Student | 46 (0.6) |
| Disabled | 1836 (22.7) |
| Total | 8082 (100.0) |
| Ever stop work for health reasons | 2496 (30.5) |
| Currently receiving Social Security disability | 1236 (20.6) |

For analyses of covariate and anti-TNF effects on work disability, a subset of the 8082 participants was formed consisting of 3866 patients either who were simultaneously employed and receiving anti-TNF therapy at their baseline observation (anti-TNF group), or who never received anti-TNF therapy, but were employed at their baseline observation (Tables 4–6). These participants completed at least 2 questionnaires.

Participants were considered to be employed if, in their questionnaires, they indicated that their "main form of work" was "employed." They were considered to be work-disabled by self-report (SR disability) if they indicated as their "main form of work" that they were "disabled." To be classified as being Social Security-disabled (SS disability), participants had to indicate receipt of Social Security disability benefits. We restricted the upper age limit of the study to 61 years to avoid confusion with retirement and Social Security payments made for retirement, which can occur as early as age 62. In addition, for compatibility with other definitions and studies, we also calculated the incidence rate of work stoppage, or discontinuation of work for any cause. The work disability definitions used in this study were for disability due to any cause, not just RA.

In general, to be eligible for Social Security disability insurance, workers must have worked and paid Social Security taxes for enough years to be covered under Social Security insurance; some of the taxes must have been paid in recent years; and workers must have filed an application. Disability is defined as the inability to engage in any "substantial gainful activity" because of a medically determinable physical or mental impairment that can be expected to result in death, or that has lasted or that can be expected to last for a continuous period of not less than 12 months. Earnings averaging over $860 a month (for the year 2006) generally demonstrate substantial gainful activity[5].

The diagnosis of RA was made by the patients' rheumatologists. About 22% of all patients, and of the incidence rate subset, were recruited as part of an infliximab safety registry. Anti-TNF treatment was defined as the receipt of infliximab, etanercept, or adalimumab. Patients were considered to be in the anti-TNF group regardless of whether they subsequently terminated that therapy (intention-to-treat analysis).

*Covariates*. We recorded all prior therapies at enrollment into the data bank. At each semiannual questionnaire assessment, we recorded demographic,

*Table 2.* Incidence of self-reported work disability among participants with RA employed at study onset.

| Characteristic | Cases, n | Exposure, patient-yrs | Rate per 100 patient-yrs | 95% CI |
|---|---|---|---|---|
| All | 281 | 11,199.5 | 2.5 | 2.2–2.8 |
| Sex | | | | |
| Female | 239 | 8783.0 | 2.7 | 2.4–3.1 |
| Male | 42 | 2416.5 | 1.7 | 1.3–2.3 |
| Age, yrs | | | | |
| 20–29 | 4 | 160.0 | 2.5 | 0.7–6.4 |
| 30–39 | 21 | 724.5 | 2.9 | 1.8–4.4 |
| 40–49 | 63 | 2617.0 | 2.4 | 1.8–3.1 |
| 50–59 | 163 | 5801.5 | 2.8 | 2.4–3.3 |
| 60–62 | 30 | 1896.5 | 1.6 | 1.1–2.3 |
| RA duration, yrs | | | | |
| 0–4 | 66 | 2505.0 | 2.6 | 2.0–3.4 |
| 5–9 | 66 | 3094.0 | 2.1 | 1.6–2.7 |
| 10–15 | 50 | 1941.0 | 2.6 | 1.9–3.4 |
| > 15 | 99 | 3659.5 | 2.7 | 2.2–3.3 |
| Ethnicity | | | | |
| Caucasian | 258 | 10,422.0 | 2.5 | 2.2–2.8 |
| African American | 14 | 312.0 | 4.5 | 2.5–7.5 |
| Asian | 1 | 115.0 | 0.9 | 0.0–4.8 |
| Native | 2 | 103.5 | 1.9 | 0.2–7.0 |
| Hispanic | 6 | 208.5 | 2.9 | 1.1–6.3 |
| Other | 0 | 38.5 | 0.0 | 0.0–9.6 |
| Education, yrs | | | | |
| 0–8 | 4 | 44.5 | 9.0 | 2.4–23.0 |
| 9–11 | 12 | 210.5 | 5.7 | 2.9–10.0 |
| 12 | 94 | 2991.0 | 3.1 | 2.5–3.8 |
| 13–15 | 90 | 3249.0 | 2.8 | 2.2–3.4 |
| ≥ 16 | 81 | 4704.5 | 1.7 | 1.4–2.1 |

*Table 3.* Incidence of Social Security disability among participants with RA employed at study onset.

| Characteristic | Cases, n | Exposure, patient-yrs | Rate per 100 patient-yrs | 95% CI |
|---|---|---|---|---|
| All | 217 | 11,331.0 | 1.9 | 1.7–2.2 |
| Sex | | | | |
| Female | 173 | 8895.0 | 1.9 | 1.7–2.3 |
| Male | 44 | 2436.0 | 1.8 | 1.3–2.4 |
| Age, yrs | | | | |
| 20–29 | 2 | 154.0 | 1.3 | 0.2–4.7 |
| 30–39 | 19 | 739.0 | 2.6 | 1.5–4.0 |
| 40–49 | 44 | 2594.5 | 1.7 | 1.2–2.3 |
| 50–59 | 120 | 5923.5 | 2.0 | 1.7–2.4 |
| 60–62 | 32 | 1920.0 | 1.7 | 1.1–2.4 |
| RA duration, yrs | | | | |
| 0–4 | 55 | 2540.0 | 2.2 | 1.6–2.8 |
| 5–9 | 47 | 3145.5 | 1.5 | 1.1–2.0 |
| 10–15 | 33 | 1960.5 | 1.7 | 1.2–2.4 |
| > 15 | 82 | 3685.0 | 2.2 | 1.8–2.8 |
| Ethnicity | | | | |
| Caucasian | 197 | 10,546.0 | 1.9 | 1.6–2.1 |
| African American | 11 | 317.5 | 3.5 | 1.7–6.2 |
| Asian | 2 | 113.5 | 1.8 | 0.2–6.4 |
| Native | 1 | 104.5 | 1.0 | 0.0–5.3 |
| Hispanic | 5 | 211.0 | 2.4 | 0.8–5.5 |
| Other | 1 | 38.5 | 2.6 | 0.1–14.5 |
| Education, yrs | | | | |
| 0–8 | 2 | 46.0 | 4.3 | 0.5–15.7 |
| 9–11 | 14 | 203.0 | 6.9 | 3.8–11.6 |
| 12 | 77 | 3030.0 | 2.5 | 2.0–3.2 |
| 13–15 | 66 | 3295.5 | 2.0 | 1.5–2.5 |

comorbidity, disease severity, and treatment data. Baseline RA disease severity variables used in this report included the lifetime cumulative number of disease modifying antirheumatic drugs (DMARD); the use of prednisone, nonsteroidal antiinflammatory drugs (NSAID), and analgesics; and the Health Assessment Questionnaire (HAQ)[6], Symptom Intensity Scale (SI Scale)[7], visual analog scale for pain, the presence or absence of a total joint arthroplasty, and the joint activity scale from the Rheumatoid Arthritis Disease Activity Index[8,9].

Baseline sociodemographic variables included age, duration of RA, marital status, ethnicity, education level, and lifetime cigarette smoking. The effect of comorbidity was assessed by a comorbidity score, which is the sum of 11 present or past comorbid conditions reported by the patient.

*Statistical analyses.* The cross-sectional data of Table 1 were obtained at a randomly selected observation for each participant. Incidence rates utilized Poisson confidence intervals. Exposure time (time in study) was calculated as the time from the end of the baseline observation through the last observation for patients without work disability, and to the time of work disability for patients meeting a disability criterion.

Baseline differences between TNF and non-TNF-treated patients (Table 4) were analyzed by t-tests and chi-square tests.

Because patients entered the study at different times and had potential differences in severity according to time, and because anti-TNF treatments differed in their availability at different calendar times, we used entry phase as a conditioning variable and performed conditional logistic regression to calculate odds ratios as estimates of the relative risk of anti-TNF therapy on work disability. Observation time was entered into the conditional logistic regression model as an offset. Phases represent consecutive 6-month assessment periods beginning in 1998. In these analyses, 14 phase-based groups were identified and used as the conditioning variable. We further adjusted for the demographic, comorbidity, and RA severity covariates (Tables 5 and 6). In sensitivity analyses (data not shown), we utilized a covariate propensity score. The study results did not differ with this method of analysis. Because we wanted to show effects of specific covariates (Tables 4 and 5), we chose not to utilize the propensity score method. In this dataset, conditional logistic regression offers advantages over analytic methods such as Cox and Poisson regression in controlling for time varying unobserved heterogeneity that might affect anti-TNF treatment likelihood or prescription and case severity. It does this, in part, by separately comparing patients with the same category of conditioning variable (phase).

Data were analyzed using Stata version 9.2 (Stata Corp., College Station, TX, USA). Statistical significance was set at the 0.05 level, confidence intervals were established at 95%, and all tests were 2-tailed. P values were not adjusted for multiple comparisons.

## RESULTS

Among the 8082 participants with RA who were employed at the onset of RA, 12.8 years after onset 56.2% were still employed and 43.8% were not working. Of those not working, 22.7% considered themselves disabled (Table 1). In addition, 30.5% had stopped work over their lifetime for health reasons and 20.6% were currently receiving SS disability benefits. The HAQ score for 8082 participants was 1.07 (SD 0.73). At the commonly used 10-year RA duration landmark, 57.7% were working, 42.3% were not working, 32.7% had stopped work for health reasons, 19.9% were receiving SS disability, and 22.4% had stopped work over their lifetime for health reasons.

The annualized incidence rate for those with SR disability was 2.5% (Table 2) among the 4155 patients who were employed at the first study observation. The rate was greater

*Table 4.* Baseline characteristics of patients treated with and without anti-TNF therapy.

| Variable | Anti-TNF, mean or % (SD) (N = 1986) | No Anti-TNF, mean or % (SD) (N = 1900) | p |
|---|---|---|---|
| Demographic data | | | |
| Age, mean yrs (SD) | 48.7 (8.4) | 49.8 (8.2) | < 0.001 |
| Men, % | 22.0 | 22.7 | 0.594 |
| Non-Hispanic Caucasian | 94.0 | 93.1 | 0.254 |
| Married or cohabiting, % | 78.4 | 77.2 | 0.356 |
| Education (yrs), % | | | |
| 0–8 | 0.5 | 0.6 | |
| 8–11 | 2.3 | 2.1 | |
| 12 | 28.3 | 28.6 | |
| 13–15 | 28.1 | 30.3 | |
| ≥ 16 | 40.8 | 38.3 | |
| RA duration, mean yrs (SD) | 12.5 (9.5) | 14.1 (10.8) | < 0.001 |
| Comorbidity | | | |
| Lifetime smoking, % | 50.7 | 49.1 | 0.346 |
| Comorbid conditions | 1.6 (1.5) | 1.8 (1.7) | < 0.001 |
| RA factors | | | |
| HAQ (0–3) | 0.87 (0.62) | 0.72 (0.62) | < 0.001 |
| SI scale (0–10) | 3.4 (2.2) | 3.1 (2.2) | 0.001 |
| Baseline DMARD (count) | 2.9 (1.6) | 1.8 (1.4) | < 0.001 |
| Baseline prednisone, % | 41.5 | 22.5 | < 0.001 |
| Joint score (0–48) | 11.2 (8.4) | 9.8 (7.8) | < 0.001 |
| Pain (0–10) | 3.4 (2.6) | 3.1 (2.6) | 0.003 |
| Total joint replacement, % | 7.6 | 6.5 | 0.028 |
| NSAID use, % | 71.5 | 74.2 | 0.063 |
| Analgesic use, % | 37.5 | 33.6 | 0.013 |

HAQ: Health Assessment Questionnaire, SI scale: Symptom Intensity scale.

in women (2.7% vs 1.7% in men), and had no clear pattern of increase with age or disease duration. The incidence rate fell with increasing education. The annualized rate for college graduates was 1.7% compared with 3.1% for those with only a high school education. The rate was greater in African Americans (4.5%; 95% CI 2.5 to 7.5), but there were too few African Americans for appropriate evaluation. Extrapolating the incidence rate to a 10-year cumulative SR disability rate, we estimated a rate of 22.4%. The SS disability annualized incidence rate was 1.9% (Table 3), and a similar pattern of association with education and ethnicity was noted. However, rates were similar for men and women (1.9% vs 1.85%, respectively). The estimated 10-year SS disability rate was 17.5%. Of those who considered themselves disabled, 50.2% received SS disability benefits.

We also calculated the incidence rate of work stoppage, or discontinuation of work for any cause. The annualized incidence rate was 8.7% (95% CI 8.1–9.3). However, when only persons who stopped working and did not start again were counted, the rate was 4.0% (95% CI 3.7–4.4). The estimated 10-year cumulative incidence rates for these definitions were 59.8% and 33.5%, respectively.

*Effect of covariates and anti-TNF therapy on work disability.* We studied 3886 subjects, including anti-TNF-treated (N = 1986) participants who were employed and receiving anti-TNF therapy at the baseline assessments and non-anti-TNF-treated participants (N = 1900) who were employed at the baseline assessment and who never received anti-TNF therapy. The 2 groups differed in many characteristics at the baseline evaluation (Table 4). Those treated with anti-TNF therapy were younger and had shorter duration of RA and fewer comorbid conditions. However, they had worse clinical characteristics. In particular, corticosteroid use was increased, 41.5% versus 22.5%, as was analgesic use, 37.5% versus 33.6%. The HAQ, pain, and SI scores were higher by 0.15, 0.3, and 0.3 units, respectively. Anti-TNF-treated patients had joint scores that were 1.4 units higher, the count of lifetime DMARD was 1.1 units greater, and 7.6% of anti-TNF participants had total joint replacements compared with 6.5% of those who did not receive anti-TNF therapy.

Almost all study variables were predictive of SR work disability, as shown in Table 5. Because results for SS disability were very similar, we present only SR disability predictors. Of particular interest among univariate predictors was the strong effect of a 1-unit change in HAQ score [risk ratio (RR) 6.1]. As expected, the strength of the predictors was reduced in the multivariable model. In this model, education had a strong protective effect, RR 0.4 for college graduates. The effect of comorbidity was seen only in those with 4 or more comorbid conditions. However, the lack of strong effect is explained by the correlation of comorbidity with HAQ score. The increased risk of SR work disability was clinically important in those who had ever smoked (RR 1.9). Among clinical variables, treatments with corticosteroids and analgesics were predictive of SR disability (RR 1.5); these variables are markers for clinical severity. Other variables with important effects included HAQ score (RR 3.4), SI scale (RR 1.1), joint score (RR 1.04), and total joint arthroplasty (RR 2.9). It should not be concluded that variables that were not significant in the multivariable model were unimportant, because the correlation between predictors absorbs some of the effect.

Table 6 shows the effect of covariates on the risk of work disability during 5.5 (median 2.5) years of semiannual assessment. The RR of SS disability in participants treated with anti-TNF was 1.6. Adjusting for the demographic and comorbidity variables shown in Table 5 increases the RR to 1.9. When adjusted further for RA severity, the RR decreases to 1.2 (95% CI 0.8 to 1.8, p = 0.441). A similar process was applied to SR disability, with similar trends: an increase in the RR when adjusted for demographic and comorbidity factors and a decrease when adjusted for RA severity. However, in this instance, treatment with anti-TNF therapy remained a significant predictor of SS disability.

## DISCUSSION

The ascertainment of work disability presents a number of difficulties[10]. Work disability may not be captured or be only incompletely captured for persons who worked but were

*Table 5.* Multivariable and univariable predictors of self-reported disability.

| Disability Predictor Variables | Multivariate Model, Odds Ratio (95% CI) | p | Univariate Model, Odds Ratio (95% CI) | p |
|---|---|---|---|---|
| Demographic data | | | | |
| Age (per 10-year increase) | 1.6 (1.2, 2.0) | 0.014 | 1.7 (1.4, 2.1) | < 0.001 |
| Male | 0.7 (0.4, 1.1) | 0.095 | 0.6 (0.4, 0.8) | 0.003 |
| Non-Hispanic Caucasian | 0.9 (0.5, 1.6) | 0.788 | 0.8 (0.5, 1.3) | 0.309 |
| Married or cohabiting | 0.5 (0.4, 0.8) | < 0.001 | 0.5 (0.4, 0.7) | < 0.001 |
| Education (yrs) | | | | |
| 0–8 | 4.9 (1.4, 17.6) | 0.014 | 4.4 (1.3, 15.0) | 0.017 |
| 9–11 | 1.4 (0.6, 3.2) | 0.424 | 2.2 (1.0, 4.7) | 0.044 |
| 12 (reference) | 1.0 | | 1.0 | |
| 13–15 | 0.7 (0.5, 1.0) | 0.073 | 0.7 (0.5, 1.0) | 0.039 |
| ≥ 16 | 0.5 (0.3, 0.7) | < 0.001 | 0.4 (0.3, 0.5) | < 0.001 |
| RA duration (per 10-year increase) | 1.1 (9.0, 1.3) | 0.215 | 1.2 (1.0, 1.3) | 0.002 |
| Comorbidity | | | | |
| Lifetime smoking | 1.9 (1.3, 2.5) | < 0.001 | 2.0 (1.5, 2.7) | < 0.001 |
| Comorbidity | | | | |
| No comorbid conditions (reference) | | | 1.0 | |
| 1 comorbid condition | 0.9 (0.6, 1.4) | 0.058 | 1.1 (0.7, 1.7) | 0.541 |
| 2 comorbid conditions | 0.9 (0.6, 1.5) | 0.804 | 1.4 (0.8, 2.1) | 0.158 |
| 3 comorbid conditions | 1.0 (0.6, 1.7) | 0.903 | 2.4 (1.5, 3.8) | < 0.001 |
| ≥ 4 comorbid conditions | 1.9 (1.2, 3.2) | < 0.011 | 4.9 (3.1, 7.7) | < 0.001 |
| RA factors | | | | |
| HAQ (0–3) | 3.4 (2.6, 4.5) | < 0.001 | 6.1 (4.8, 7.8) | < 0.001 |
| SI scale (0–10) | 1.1 (1.0, 1.2) | 0.057 | 1.4 (1.3, 1.5) | < 0.001 |
| Baseline DMARD (count) | 1.0 (0.9, 1.1) | 0.511 | 1.1 (1.0, 1.2) | 0.008 |
| Baseline prednisone | 1.5 (1.1, 2.1) | < 0.009 | 2.6 (1.6, 2.7) | < 0.001 |
| Joint score (0–48) | 1.0 (1.0, 1.1) | < 0.001 | 1.1 (1.1, 1.1) | < 0.001 |
| Pain (0–10) | 1.0 (0.9, 1.1) | 0.697 | 1.3 (1.2, 1.3) | < 0.001 |
| Total joint replacement | 2.9 (1.8, 4.6) | < 0.001 | 3.6 (2.6, 5.8) | < 0.001 |
| NSAID use | 1.1 (0.8, 1.6) | 0.471 | 1.0 (0.7, 1.4) | 0.976 |
| Analgesic use | 1.5 (1.1, 2.0) | 0.017 | 2.2 (1.6, 2.6) | < 0.001 |

*Table 6.* The effect of anti-TNF therapy on work disability (see Table 5 for covariate classification).

| Variables | Odds Ratio (95% CI) | p |
|---|---|---|
| Dependent variable: Social Security disability | | |
| Anti-TNF: no covariates | 1.6 (1.2, 2.3) | 0.006 |
| Anti-TNF: demographic covariates only | 1.9 (1.4, 2.8) | < 0.001 |
| Anti-TNF: demographic and comorbidity covariates | 1.9 (1.3, 2.8) | < 0.000 |
| Anti-TNF: full model (all covariates) | 1.2 (0.8, 1.8) | 0.441 |
| Dependent variable: self-reported work disability | | |
| Anti-TNF: no covariates | 2.1 (1.6, 3.0) | < 0.001 |
| Anti-TNF: demographic covariates only | 2.4 (1.7, 3.4) | < 0.001 |
| Anti-TNF: demographic and comorbidity covariates | 2.4 (1.7, 3.34) | < 0.000 |
| Anti-TNF: full model (all covariates) | 1.6 (1.1, 2.4) | 0.014 |

never employed (for example, homemakers), did not work for pay (for example, volunteers or those in some family businesses), did not return to work after childbirth, retired early, or worked limited hours. Work disability rates depend on social policies of different countries as well as on economic conditions. Work disability rates all depend on the definitions of work and of disability, and definitions differ widely across studies[10]. For example, definitions of work disability have encompassed "total cessation of employment," "left job because of arthritis and did not begin another job," "retired under Disability Pension Act," "permanent work disability due at least in part to RA," "work disabled due to RA," "stopped working," "stopped working at some point," "full or partial work disability due to RA," among other definitions[10]. In addition, work has been defined as "any work," work of at least a certain number of hours per week or year, or self-reported employment. Finally, assessment has been applied to workers of all ages or to restricted subpopulations (< 65, < 64, ≤ 62 years of age, for example). One global approach to the disability issue in RA is to measure functional limitations and relate them to productivity[11] or to measure valued life activities[12]. However, these methods do not address the issue of work disability directly.

Central to the issue of work disability in RA is the definition of being "employed," because being work-disabled depends on previously being employed. Employed persons, according to the Current Population Survey (CPS), are persons who "did any work at all (at least 1 hour)... for the purpose of economic gain"[13]. Using this definition, we recently reported that the annual incidence of work disability was

10%[3]. We also noted that 38% of persons who were disabled under this definition subsequently performed some work again. While this CPS definition helps to understand work disability issues in RA, it may not reflect common non-economic usage. In addition, some of the persons who worked but a few hours per week would be considered employed, and there are other definitions that may illuminate the disability issue.

The Social Security Administration *de facto* defines working ("employed") as earning, on average, over $860 a month (in 2006)[5], which is roughly equivalent to working 20 hours per week. Using that definition, 90% of persons describing themselves as employed in the current study would meet that SS definition. By contrast, only 13% of persons describing themselves as not employed work more than 20 hours per week. Another advantage to using the self-reported definition of employed is that it is a standard way of asking about work status and has been used in some other studies[10].

Similar issues arise concerning the definition of disability. Using the CPS definition, disability, *de facto*, means not working at all. In the current dataset, only 8% of persons describing themselves as disabled worked more than 20 hours per week. Therefore, in this study we adopted as one definition of disability, transferring from self-described employed status to self-described disabled status. We also used a second, more stringent definition: transferring from self-described employed status to SS disability. Limitations to the latter definition, with respect to measuring rates, are that some disabled persons are not eligible for SS disability for reasons other than work and disability status, and some people who are eligible do not apply[5]. The advantages of this definition are that there is a relatively standardized adjudication process for determination of disability, and that SS disability has a common meaning in all US studies.

A third definition that may be useful is the transition from employed to non-employed (and not returning to work) status, as persons may retire early or become homemakers or students because of illness-related work limitations. The limitation of this definition is that it also includes persons who leave the workforce for reasons not related to health. It is likely that the rate of work disability falls somewhere between the "disabled" and not employed-not returning to work definitions.

The results of our study suggest an improvement in the rate of RA work disability when work disability is defined as self-reported disabled status. Yelin, *et al* reported in 1987 that about 11 years after RA diagnosis 42% of patients self-reported that they were disabled and 49% were employed[1]. In the current study, 12.8 years after RA onset, 22.7% were disabled and 56.2% were employed.

Older clinical studies of work disability using various definitions of work and disability estimated work disability rates between 51% and 68%[1,14-16], and national samples reported rates of 64% and 72%[17,18]. By contrast, Wolfe and Hawley, in an 18-year clinical longitudinal study, noted a rate of work disability due to RA of 31.5% at 10 years and 50% at 20.9 years[19].

With respect to incidence analyzed, Yelin, *et al* reported an average incidence of work cessation of 6.25%[18]. Reisine, *et al* indicated an annualized rate of 11.7%[15]. We found that the annualized incidence rate for SR disability was 2.5% and for SS disability 1.9%. Among persons who stopped working, whether they reported being disabled or not, and did not return to work during the period of study observation, the annualized incidence rate was 4.0%. As indicated above, it is not known how many in this latter group stopped working for reasons unrelated to disability. If some stopped working for reasons entirely unrelated to RA, a rate of about 3.0% to 3.5% may be a true estimate of the incidence rate of RA work disability. At an incidence rate of 2.5%, using the SR disability definition, the expected prevalence at 12.8 years is 27.7% and the observed prevalence (Table 1) was 22.7%. Using the "stopped work and didn't return to work definition," the expected prevalence at 12.8 years was 40.7% and the observed prevalence (from Table 1) was 43.8%. These observations from prospectively acquired incidence rates and the cross-sectional data of Table 1 provided additional validation of the study results.

There are potential limitations to our results. First, the inclusion of patients from safety registries might have identified persons with more severe RA, therefore leading to increased rates of work disability. We examined this issue by comparing work status and SR disability for all study subjects and for study subjects with registry patients removed. We noted only slight differences. For all patients (Table 1) the SR disability rate was 22.7%; for non-registry patients it was 21.0%. The respective rates of working for these 2 groups were 56.2% and 57.4%. It is also possible that the better disability rates noted in this study were related to more education and less minority participation than is present in the general population, or that patients who did not participate in the NDB data collection would have had increased disability rates. Although we cannot be sure to what extent these factors influenced our results, analyses of Table 1 adjusted to reflect general population demographics and the slightly increased HAQ scores (approximately 0.03, calculated from non-enrollees and study nonparticipants) changed the results of Table 1 by less than 1%. Lastly, our sample was aged ≤ 61 years and therefore was slightly younger than samples used in other studies. The advantage of this definition is that the results are less likely to be influenced by "normal" retirement.

There are a number of possible reasons that the annualized incidence rate for SR disability was greater for women than for men (Tables 2 and 3). Such reasons might include differences in perception of disability, intrinsic functional limitation (women have higher HAQ scores), differences in SS disability eligibility because of the amount of previous work, type of work performed, and possible societal bias in the SS disability benefit awards. Our data are insufficient to investigate gender differences, but they have been the subject of extensive research[20-25].

We also addressed the issue of the effect of anti-TNF therapy on work disability. We did not find that anti-TNF therapy was associated with a reduction in work disability. Indeed, we noted a slightly increased risk for SR disability among anti-TNF-treated patients. However, the validity of our results depends on controlling for relevant covariates, because treatment groups differed significantly at baseline (Table 4). We adjusted for all of the Table 4 factors at baseline and, as shown in Table 6, these adjustments modified the anti-TNF risk substantially. The factors were major predictors of work disability, as shown in Table 5. However, data for joint counts and acute phase reactants were not available in our dataset, and it is uncertain if they would alter the observed results. In a previous study of work disability, single measurements of joint count and erythrocyte sedimentation rate were not significant multivariate predictors[19]. Experience with the current dataset analyses and the extent of existing covariate control leads us to suggest that a change in the odds ratio, had these variables been present, would likely have been small — perhaps 0.1 to 0.2 units. This would result in the anti-TNF effect being nonsignificant. Therefore we suggest that our study should not be interpreted as showing increased risk with anti-TNF therapy. Instead, we interpret the results as not showing a reduction in work disability with anti-TNF therapy in patients with established RA. Because of the possibility that the influx of patients taking infliximab that occurred as part of the NDB infliximab registry might have influenced the results, we removed all registry patients and recalculated the analyses. Anti-TNF therapy was still a significant predictor of SR disability.

In summary, of patients with RA who are employed, each year another 1.9% receive Social Security disability benefits, 2.5% consider themselves disabled, and 3.0% to 3.5% stop working for illness-related reasons. The overall disability rate is lower than that in previous studies, with 22.7% considering themselves disabled, 20.6% receiving SS disability benefits, and 56.2% employed a median of 12.8 years after onset of RA.

## REFERENCES


1. Yelin E, Henke C, Epstein WV. The work dynamics of the person with rheumatoid arthritis. Arthritis Rheum 1987;30:507-12.
2. Choi HK, Hernan MA, Seeger JD, Robins JM, Wolfe F. Methotrexate therapy and mortality in patients with rheumatoid arthritis: a prospective study. Lancet 2002;359:1173-7.
3. Allaire S, Wolfe F, Niu J, LaValley M. Contemporary prevalence and incidence of work disability associated with rheumatoid arthritis. Arthritis Care Res 2007;(submitted).
4. Wolfe F, Michaud K. Lymphoma in rheumatoid arthritis: the effect of methotrexate and anti-tumor necrosis factor therapy in 18,572 patients. Arthritis Rheum 2004;50:1740-51.
5. US Social Security Administration. The Red Book — Social security online. Baltimore: US Social Security Administration; 2006. Internet. Available from: http://www.socialsecurity.gov/redbook/eng/page18.htm#1. Accessed July 4, 2007.
6. Fries JF, Spitz PW, Kraines RG, Holman HR. Measurement of patient outcome in arthritis. Arthritis Rheum 1980;23:137-45.
7. Wolfe F, Rasker JJ. The Symptom Intensity Scale, fibromyalgia, and the meaning of fibromyalgia-like symptoms. J Rheumatol 2006;33:2291-9.
8. Fransen J, Langenegger T, Michel BA, Stucki G. Feasibility and validity of the RADAI, a self-administered rheumatoid arthritis disease activity index. Rheumatology Oxford 2000;39:321-7.
9. Stucki G, Liang MH, Stucki S, Bruhlmann P, Michel BA. A self-administered rheumatoid arthritis disease activity index (RADAI) for epidemiologic research. Psychometric properties and correlation with parameters of disease activity. Arthritis Rheum 1995;38:795-8.
10. 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.
11. Wolfe F, Michaud K, Choi HK, Williams R. Household income and earnings losses among 6,396 persons with rheumatoid arthritis. J Rheumatol 2005;32:1875-83.
12. Katz PP, Morris A, Yelin EH. Prevalence and predictors of disability in valued life activities among individuals with rheumatoid arthritis. Ann Rheum Dis 2006;65:763-9.
13. US Department of Labor. Labor force statistics from the Current Population Survey. Washington, DC: Bureau of Labor Statistics; 2006. Internet. Available from: http://www.bls.gov/cps/. Accessed July 4, 2007.
14. Yelin E, Meenan R, Nevitt M, Epstein W. Work disability in rheumatoid arthritis: effects of disease, social, and work factors. Ann Intern Med 1980;93:551-6.
15. Reisine S, Fifield J, Walsh SJ, Feinn R. Factors associated with continued employment among patients with rheumatoid arthritis: a survival model. J Rheumatol 2001;28:2400-8.
16. Callahan LF, Bloch DA, Pincus T. Identification of work disability in rheumatoid arthritis: physical, radiographic and laboratory variables do not add explanatory power to demographic and functional variables. J Clin Epidemiol 1992;45:127-38.
17. Pincus T, Mitchell JM, Burkhauser RV. Substantial work disability and earnings losses in individuals less than age 65 with osteoarthritis: comparisons with rheumatoid arthritis. J Clin Epidemiol 1989;42:449-57.
18. Yelin E, Callahan LF. The economic cost and social and psychological impact of musculoskeletal conditions. National Arthritis Data Work Groups. Arthritis Rheum 1995;38:1351-62.
19. Wolfe F, Hawley DJ. The long-term outcomes of rheumatoid arthritis: Work disability: a prospective 18 year study of 823 patients. J Rheumatol 1998;25:2108-17.
20. Choi NG. Determinants of stability and changes in self-reported work disability among older working-age populations. J Aging Soc Policy 2003;15:11-31.
21. Crimmins EM, Hayward MD. Workplace characteristics and work disability onset for men and women. Soz Praventivmed 2004;49:122-31.
22. De Roos AJ, Callahan LF. Differences by sex in correlates of work status in rheumatoid arthritis patients. Arthritis Care Res 1999;12:381-91.
23. Santiago AM, Muschkin CG. Disentangling the effects of disability status and gender on the labor supply of Anglo, black, and Latino older workers. Gerontologist 1996;36:299-310.
24. Stronks K, van de Mheen H, van den Bos J, Mackenbach JP. Smaller socioeconomic inequalities in health among women: the role of employment status. Int J Epidemiol 1995;24:559-68.
25. Fifield J, Reisine ST, Grady K. Work disability and the experience of pain and depression in rheumatoid arthritis. Soc Sci Med 1991;33:579-85.