The Association of Low Income with Functional Status and Disease Burden in German Patients with Rheumatoid Arthritis: Results of a Cross-sectional Questionnaire Survey Based on Claims Data

Johanna Callhoff, Andres Luque Ramos, Angela Zink, Falk Hoffmann, and Katinka Albrecht

ABSTRACT. ***Objective.*** To assess the influence of income on self-reported disease and work productivity outcomes.

Methods. Persons with rheumatoid arthritis (RA) diagnosis (International Classification of Diseases, 10th ed. codes M05/M06) on health insurance claims data in at least 2 quarters of 2013 were randomly selected. They were mailed questionnaires covering RA diagnosis, household income, functional capacity [Hannover functional status questionnaire (FFbH), 0–100], RA Impact of Disease questionnaire (RAID; 0–10), self-reported swollen joint count (SJC; 0–48), tender joint count (TJC; 0–50), and effect of RA on work productivity (change of work, fewer working hours, sick leave, application for disability pension, and others). Weighted multivariable linear regression models were used to assess the association between income and disease outcomes.

Results. A total of 1492 persons of working age who confirmed RA diagnosis were available for analysis. The mean age was 55 years, 82% were women, and 74% were under rheumatologic care. A total of 27%, 52%, and 21% had a low (< €1500), medium (€1500–3200), and high monthly income (> €3200), respectively. Respondents with low income had the worst mean FFbH, RAID, SJC, and TJC values. This was confirmed in the regression model: mean FFbH low versus high income –8.65 (95% CI –9.72 to –7.58), RAID 0.73 (0.59–0.86), and SJC 3.47 (2.86–4.08). Sick leave (8.7%/3.5%/1.8%) and disability pension (18.1%/9.6%/6.9%) were more frequent in patients with low versus medium versus high income ($p < 0.05$).

Conclusion. The association of low income with a higher disease burden, more functional disability, and higher rates of work loss emphasizes the need to focus on these outcomes when choosing treatment strategies for patients in the lower income groups. (First Release April 15 2017; J Rheumatol 2017;44:766–72; doi:10.3899/jrheum.160966)

Key Indexing Terms:
RHEUMATOID ARTHRITIS EPIDEMIOLOGY HEALTHCARE DISEASE BURDEN

Rheumatoid arthritis (RA) is a chronic inflammatory disease that is accompanied by disability and a high disease burden in a considerable proportion of patients[1]. Education and social status are, even independently, associated with health in musculoskeletal diseases such as RA[2,3,4]. Low socio-economic status (SES) is known to be a risk factor for functional impairment and has a considerable effect on the physical and mental health, as well as on the quality of life of patients with RA[5,6,7]. Low SES has also been reported to be associated with a delay in the initiation of treatment with disease-modifying antirheumatic drugs (DMARD)[8]. The relationship between low SES and high disease activity is already present at disease onset in early RA cohorts[9,10], suggesting that low SES affects RA outcome more than RA affects the SES. Although several large studies have investigated the relationship of SES and RA[10,11,12], those studies recruited patients from rheumatology clinics, and thus failed to include patients with RA who were not in rheumatologic care.

The research network PROCLAIR (linking Patient-Reported Outcomes with CLAIms data for health services Research in rheumatology) was initiated to obtain patient-reported data from persons with rheumatic diseases who are not necessarily under rheumatologic care[13]. By using claims data to identify subjects, persons without contact with a rheumatologist can be included in the study population.

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Supported by the German Federal Ministry of Education and Research (01EC1405).

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Accepted for publication February 21, 2017.

The main objective of our study was to assess the effect of SES on self-reported disease burden and work productivity outcomes in this study population. Instead of a composite index, we chose income as an indicator of SES. Income is related to education and health behavior as well as the ability to pay for treatments and is therefore relevant to our analysis[14].

MATERIALS AND METHODS

Patients. A cross-sectional sample of members from a large statutory health insurance provider in Germany (BARMER GEK, 8.4 million insured persons) was drawn. Out of the 6.6 million insured persons in the age group of 18–79 years, 6600 persons with a diagnosis of RA [International Classification of Diseases, 10th ed. (ICD-10) code M05/M06] in at least 2 quarters of 2013 were randomly selected. This definition was used because it can be expected that a person with RA needs to see his or her general practitioner or any other specialist at least once in a quarter. The sample was stratified according to sex, ICD-10 diagnosis (M05/M06), and age (18–49, 50–64, and 65–79 yrs), resulting in 12 strata with 550 persons each. The sample size was determined so that mean effect sizes of 0.2 could be detected with a power of 80%, even if subgroups from certain age/sex/seropositivity strata were compared.

A questionnaire was developed that covered patient-reported data on RA diagnosis, clinical outcomes, disease burden, and effect of RA on social and working life. The insured persons were contacted through BARMER GEK in June 2015 and were asked to complete the questionnaire. The insurance identified persons who could not be contacted because they had changed their insurance or were dead. One reminder was sent to all the insured persons who had not answered within 8 weeks. The insured persons were asked to send the pseudonymized questionnaires to the German Rheumatism Research Centre to ensure confidentiality of the self-reported data. Only persons of working age (< 65 yrs) who confirmed their RA diagnosis in the questionnaire were included in our present analysis. In Germany, the statutory retirement age was slightly over 65 years in 2013, depending on the birth year. For reasons of comparability, we only included persons < 65 years. Figure 1 is a flow chart with the number of respondents included and excluded at each step of the inclusion procedure.

Ethical approval was obtained from the ethics committee of the Charité University Medicine in March 2015 (EA1/051/15). This research was conducted in agreement with the Helsinki statement. The study was performed within the research network PROCLAIR[13].

Data collection. Confirmation of RA diagnosis or reporting of a diagnosis other than RA and rheumatologic care (current/ever) was assessed by questionnaire.

Socioeconomic variables. Household monthly income categories were defined as low (< €1500), medium (€1500–3200), or high (> €3200). Formal education, corresponding to ≤ 8/9–10/> 10 years of school, were assessed as surrogates for SES.

Self-reported disease outcomes. Disability was assessed by the physical function questionnaire [Hannover functional status questionnaire (FFbH), range 0 = no to 100 = full functional capacity][15]. The effect of RA disease was ascertained by the Rheumatoid Arthritis Impact of Disease score (RAID; range 0 = no effect to 10 = highest effect)[16,17]. Tender and swollen joints were assessed by 50/48 joint counts (TJC and SJC, respectively) for swelling and tenderness in a question/mannequin format[18,19].

Work productivity outcomes. Those surveyed were asked about their occupational situation (employed/unemployed/retired/on disability pension/sick leave) and whether RA disease had an influence on their work situation (reduced work/sick leave > 6 weeks/work change/applied for disability pension).

Covariates. These factors were assessed as covariates: sex, age, body mass index (BMI; kg/m^2), smoking (ever), rheumatologic care, and treatment with conventional synthetic or biologic DMARD. DMARD prescriptions in 2015 were identified by the anatomical therapeutic chemical classification in the claims data[13].

Statistical analysis. The results were weighted (sampling weights are available from the authors on request). For each stratum, the weight was calculated as the inverse answer probability, i.e., the total number of insured persons with a claims data diagnosis of RA divided by the number of persons who responded in this stratum. Analyses for subgroups were performed with domain analyses, and the results for the domain of interest (e.g., persons who confirmed the diagnosis of RA) are shown. Percentages, mean, and median values with 95% CI were calculated. A comparison of percentages was performed with a Rao-Scott chi-square test.

Multivariable linear regression analyses were performed to assess the influence of household income on disease-related variables (FFbH, RAID, and SJC). Age, sex, BMI, and work productivity outcomes were included as confounders. Skewness of data was considered by fitting alternative multivariable models using log(SJC) and log(TJC). Because the results of these models did not differ substantially, original models are presented.

All analyses were conducted using procedures for complex survey samples in SAS/STAT software (Version 9.4, SAS Institute Inc.).

Missing data. Insured persons with divergent data regarding sex or age in the questionnaire and in the referring claims data were excluded from the analysis and counted as nonresponders (Figure 1). Persons without a self-reported RA diagnosis were also excluded from the analysis. Missing values for all other variables are reported in Table 1. For the regression models, missing data for RAID, BMI, FFbH, SJC, TJC, smoking, formal education, and household income were imputed using multiple imputation with 10 imputations and the SAS PROC MI procedure.

RESULTS

Random sample and response. The data of 98,963 persons aged 18–79 years with a diagnostic code of RA in at least 2 quarters of 2013 were available in the claims data. Of the 6193 insured persons who were contacted (original sample of 6600 minus those who had changed their insurance or died), 3184 answered the questionnaire (response rate 51%). The response rates were generally higher in insured persons with seropositive RA (M05) and among women, and ranged from 31% among men aged 18–49 years with an M06 diagnosis to 68% among women aged 18–49 with an M05 diagnosis. A total of 77.0% (95% CI 75.0–79.1) of the patients confirmed the diagnosis of RA. The remaining 23.0% reported diagnoses other than RA and were excluded from the analysis, including 4.2% who did not report their diagnosis (Figure 1).

Patient characteristics. A total of 1492 of the patients with RA were < 65 years old and were included in our analyses. They had a mean age of 54.9 years and 81.6% were women. The mean disease duration was 14 years. Seventy-four percent were in rheumatologic care and 52.1% were treated with DMARD. All patient characteristics are presented in Table 1. They had a mean FFbH of 73.2 and a mean RAID of 4.4. The proportions of persons with low, medium, and high incomes were 27.4%, 51.8%, and 20.7%, respectively. Of these, 69.1%, 75.1%, and 77.4% were in rheumatologic care and 47.2%, 52.8%, and 57% were treated with DMARD.

Association between household income and RAID, FFbH, SJC, and TJC values. In the unadjusted analysis, the RAID,

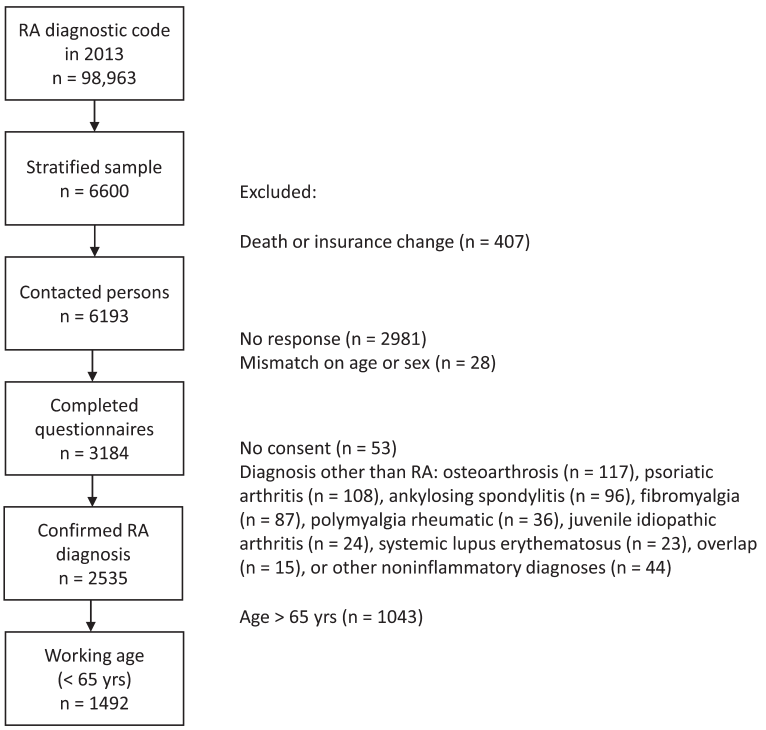

Figure 1. Flow chart of the study population. RA: rheumatoid arthritis.

Table 1. Patient characteristics and patient-reported outcomes. All values are weighted according to the stratification.

Variables	Total, n = 1492	Missing Values, n
Patient characteristics		
Age, yrs, mean (95% CI)	54.9 (54.6–55.3)	0
Female, %	81.6	0
Disease duration, yrs, mean (95% CI)	14 (13.3–14.7)	28
In rheumatologic care, %	74.1	8
DMARD therapy, %	52.1	20
BMI, kg/m^2, mean (95% CI)	26.8 (26.4–27.1)	16
Smoking, ever, %	43.7	17
Socioeconomic variables		
Household income, €, %		96
< 1500	27.4	
1500–3200	51.8	
> 3200	20.7	
Education, yrs, %		9
≤ 8	27.1	
9–10	48	
> 10	25	
Patient-reported disease outcomes		
FFbH, 0–100, mean (95% CI)	73.2 (71.8–74.6)	41
RAID, 0–10, mean (95% CI)	4.4 (4.3–4.6)	23
SJC, 0–48, mean (95% CI)	7.4 (6.7–8.2)	282
Median (95% CI)	3.2 (2.7–3.7)	
TJC, 0–50, mean (95% CI)	12.3 (11.4–13.1)	108
Median (95% CI)	7.8 (7–8.6)	

DMARD: disease-modifying antirheumatic drugs; BMI: body mass index; FFbH: Hannover functional status questionnaire; RAID: Rheumatoid Arthritis Impact of Disease; SJC: swollen joint count; TJC: tender joint count.

FFbH, SJC, and TJC all showed more favorable outcomes for persons with high income than for those with low or medium income (Figure 2).

Association between household income and work productivity outcomes. The variables that were reported to be affected by RA are shown in Table 2 by income categories. Persons with a low income had applied for a disability pension more often than those with a high income (18.1% vs 6.9%, p = 0.001). Persons with a low income were more often on sick leave > 6 weeks (8.7% vs 1.8%, p = 0.001). Fewer persons with low income reported that they were working fewer hours because of the RA than persons with high income (14.2% vs 17.3%, p = 0.42). No influence of RA was reported by 16.4%, 22.4%, and 30% (p = 0.009) of the respondents in the low, medium, and high income groups, respectively.

Influence of household income: results from multivariable regression models. Using the multiple imputed data, multivariable linear regression models were applied to assess which variables were associated with the RAID, FFbH, and SJC (Table 3). Compared with persons with high income, those with low household income had a RAID that was 0.73 units higher, an FFbH that was 8.65 units lower, and 3.5 more swollen joints. Work productivity variables, especially the application for disability pension and being on sick leave for more than 6 weeks, also had a strong effect on RAID, FFbH, and SJC values. Female sex was also associated with worse disease outcomes while being in rheumatologic care was not relevantly associated.

Persons with a low educational level also had a higher RAID (0.74, 95% CI 0.61–0.87) and a lower FFbH (–4.07, 95% CI –5.26 to –2.87) than those with a high educational level. Age had a significant influence only on the FFbH, but not on the RAID or the SJC. Respondents who had already applied for disability pension were less efficient at work or on sick leave for > 6 weeks, had higher RAID and SJC, and lower function than those who did not report these influences on their work.

DISCUSSION

The relationship between income and disease burden was investigated in persons with RA from all areas of Germany and of different age groups. Among the insured persons of a large statutory health insurance provider, more than 6000 persons with a claims data diagnosis of RA were contacted. A total of 51% of the insured persons responded, and 77% of those were confirmed to have RA. In this study population, 26% were not in current rheumatologic care.

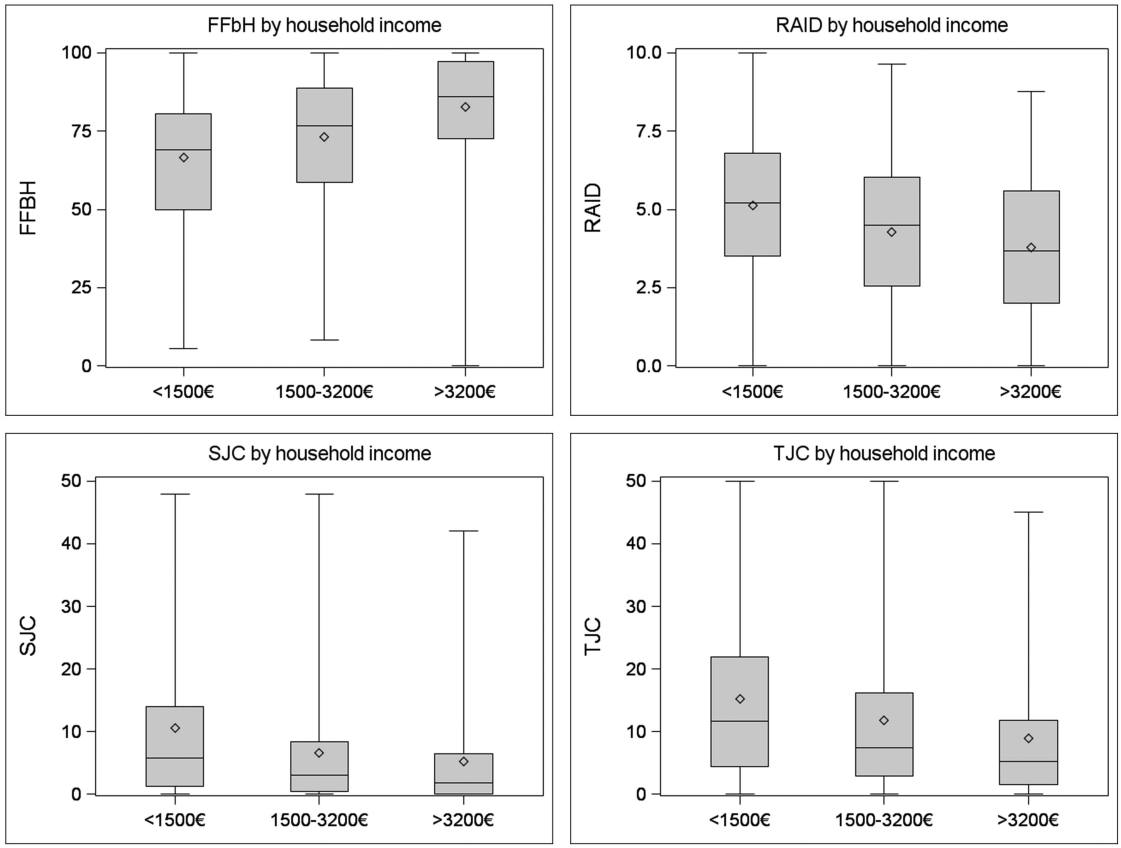

Figure 2. Unadjusted analysis of self-reported functional status (FFbH), disease effect (RAID), and joint status (SJC and TJC) by household income categories. FFbH: Hannover functional status (range 0–100); RAID: Rheumatoid Arthritis Impact of the Disease (range 0–10); SJC: swollen joint count (range 0–48); TJC: tender joint count (range 0–50).

Table 2. Effect of RA on work productivity outcomes, stratified by household income. All values are weighted according to the stratification. Values are % (95% CI).

Work Productivity Variables	Household Income, €		
	< 1500	1500–3200	> 3200
Having applied for disability pension	**18.1 (12.9–23.3)**	**9.6 (6.7–12.4)**	**6.9 (2.9–10.8)**
On sick leave for more than 6 weeks	**8.7 (4.8–12.7)**	**3.5 (1.6–5.4)**	**1.8 (0.2–3.4)**
Change of workplace	9.1 (5.3–13)	9.3 (6.5–12.2)	5.1 (2.5–7.7)
Less efficient at work	58.5 (51.6–65.5)	53.2 (48.3–58.1)	57 (49.6–64.4)
Fear of not being able to work until retirement	30.5 (24.3–36.8)	31.5 (26.9–36.1)	27.9 (21.2–34.6)
Working fewer hours	14.2 (9.4–18.9)	12.9 (9.3–16.4)	17.3 (11.2–23.4)
No influence of RA on professional activities*	**16.4 (11–21.7)**	**22.4 (18.4–26.3)**	**30 (23.2–36.9)**

* $p < 0.05$ in the Rao-Scott chi-square test comparing the proportion of persons in the income groups. For persons with low, medium, and high incomes, n = 22 (6.3%), 26 (3.6%), and 2 (0.7%), respectively, did not report on the influence of RA on their working life. Bold face indicates statistically significant influence on the outcome. RA: rheumatoid arthritis.

Table 3. Association between household income and self-reported disease outcomes: results from the multivariable linear regression models. All values are weighted according to the stratification. The models were mutually adjusted for all the variables in the table. Values are estimate (95% CI).

Variable	Reference	RAID	FFbH	SJC
Age, per 10 yrs	Per 10 yrs	–0.03 (–0.08 to 0.02)	**–2.43 (–2.79 to –2.06)**	**0.49 (0.30–0.67)**
Female	Male	**0.58 (0.50–0.66)**	**–6.19 (–6.96 to –5.43)**	**1.31 (0.91–1.72)**
BMI, kg/m^2	Per unit	**0.04 (0.04–0.05)**	**–0.54 (–0.61 to –0.47)**	**0.15 (0.11–0.19)**
Smoking, ever	Never	0.01 (–0.09 to 0.10)	–0.79 (–1.59 to 0.00)	**0.55 (0.14–0.96)**
Rheumatologic care, yes	No	0.04 (–0.07 to 0.15)	**–1.95 (–2.85 to –1.06)**	–0.01 (–0.48 to 0.46)
≤ 8 yrs of education	> 10 yrs	**0.74 (0.61–0.87)**	**–4.07 (–5.26 to –2.87)**	0.33 (–0.20 to 0.87)
9–10 yrs of education	> 10 yrs	**0.39 (0.28–0.50)**	**–2.89(–3.78 to –1.99)**	**0.50 (0.07–0.92)**
Household income < €1500	> € 3200	**0.73 (0.59–0.86)**	**–8.65 (–9.72 to –7.58)**	**3.47 (2.86–4.08)**
Household income €1500–3200	> € 3200	**0.28 (0.16–0.39)**	**–6.09 (–7.00 to –5.19)**	**0.70 (0.41–1.29)**
Applied for disability pension	No	**1.39 (1.23–1.55)**	**–18.11 (–19.59 to –16.64)**	**3.70 (2.90–4.50)**
On sick leave for > 6 weeks	No	**1.39 (1.18–1.60)**	**–13.47 (–15.37 to –11.58)**	**1.72 (0.59–2.84)**
Change of workplace	No	**0.16 (0.01–0.30)**	**–4.44 (–5.67 to –3.21)**	**1.93 (1.03–2.82)**
Less efficient at work	No	**1.13 (1.04–1.22)**	**–6.47 (–7.27 to –5.67)**	**2.38 (1.98–2.78)**
Fear of not being able to work until retirement	No	**0.99 (0.90–1.09)**	**–5.23 (–6.06 to –4.40)**	**1.21 (0.77–1.64)**
Working fewer hours	No	0.03 (–0.09 to 0.15)	0.26 (–0.84 to 1.35)	**–1.59 (–2.13 to –1.04)**

Bold face indicates statistically significant influence on the outcome. RAID: Rheumatoid Arthritis Impact of the Disease (0–10); FFbH: Hannover functional status questionnaire (0–100); SJC: swollen joint count (0–48); BMI: body mass index.

Our analyses showed that patients with RA with low income had a worse functional capacity, a higher disease burden, and more swollen and tender joints than patients with high income. The differences between the income groups were lower than the minimal clinically important difference for functional capacity and disease burden measured with the RAID. The joint counts are patient-reported and can be expected to be higher than rheumatologist-reported counts. Still, mean values are surprisingly high. Similarly, high scores on patient-reported outcomes such as the RAID indicate that this collective is not sufficiently treated.

There was evidence in our data that persons with low income had a greater burden with RA than wealthy and well-educated insured persons. Data from a Canadian early arthritis registry indicate that loss of income is already present in one-third of patients with early RA and demonstrate pain and physical disability as risk factors for financial loss[20]. Our results showed that patients with low income were disadvantaged from the start of the disease, supporting the results of Massardo, *et al*[9] and Yang, *et al*[10]. Possible reasons include different health behavior and more physically demanding jobs among patients with low SES. Jacobi, *et al* found a lower influence of the SES on disease activity with longer disease duration[6]. This was not found in our cross-sectional analysis where the association of income with disease burden and function was similarly high in patients with short and long disease durations.

Persons with low income reported an effect of RA on their

working life more often than those with high income. They also more often changed their workplace or applied for disability pension than persons with high income. This might be explained by the physically more demanding jobs of those with a low income. Because sickness benefits and disability pensions are substantially lower than regular incomes, there is no financial incentive for leaving the regular workforce. Information on the type of job was not available in our analysis.

Alternatively, the percentage of respondents working fewer hours because of RA was higher in persons with high income. We assume that, on the one hand, it is easier for persons in more qualified jobs to adjust their working hours to their capabilities, and on the other hand, that persons with lower income often cannot afford this because of higher financial pressure.

Income was used as a surrogate for SES because other indicators, such as job details, were not available. To confirm our results, we added education to the analysis. Education is a major component of SES and is related to the individual person rather than the person's household.

Persons with a low educational level had a higher disease burden and lower functional capacity than those with a high educational level. Patients with RA from Sweden who had a university education reported less pain than patients without a university degree. In those patients, the disease activity score (which includes TJC and SJC) was independent of the educational background[21]. This is in accordance with our observation that respondents with a low educational level had a higher RAID (which incorporates a measure for pain) and lower function than more educated persons, but the difference in the number of swollen joints was not statistically significant.

Strengths and limitations. In claims data, the proportion of persons with an ICD-10 diagnosis of RA will overestimate the proportion of clinically confirmed RA cases[13]. Because we were unable to obtain clinically validated diagnoses for our study, the self-reported diagnosis was used as a selection criterion for our analysis. However, all included persons had at least 2 physician-reported RA diagnoses in the claims data. The combination of patient- and physician-reported RA diagnosis, obtained with different methods and from different persons, very likely has a higher validity than claims data or patient-reported data alone.

Because ours is a cross-sectional analysis, we were only able to assess associations of income and measures of disease activity at a single timepoint. No causal relationships can be investigated with this design.

The main strength of our study is the large study population of randomly selected insured persons from the second largest statutory health insurance provider in Germany. Our study included persons from a wide range of age groups, and both sexes were equally represented. The stratification ensured that the results are also valid for less common subgroups, such as men < 50 years old with RA. Persons were included irrespective of the kind of treatment they received for their RA. Therefore, the results can be considered representative for all patients with RA with statutory health insurance in Germany.

The association of low income with a higher disease burden, more functional disability, and higher rates of work loss emphasizes the need to keep these variables in mind when choosing treatment strategies and assessing treatment outcomes in patients in the low-income group.

ACKNOWLEDGMENT

We thank Dr. Stefan Dudey, Janine Schwarz, and Joachim Saam, BARMER GEK, for their valuable and dedicated support of the project.

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