Performance of a Rheumatoid Arthritis Records-Based Index of Severity

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ABSTRACT. ***Objective.*** To assess the performance of a rheumatoid arthritis (RA) records-based index of severity (RARBIS) developed by a Delphi panel process in a cohort of patients with RA.

Methods. We reviewed the medical records of 120 RA patients from the New England Veteran's Administration (VA) Healthcare System and collected data on markers of RA disease severity. Markers were refined through a Delphi panel process before developing the RARBIS based on chart review. The RARBIS includes 5 subscales on surgery, radiography, extraarticular manifestations, clinical status, and laboratory values. Factors that were regarded by the Delphi panel as highly related to severity of RA were assigned higher points on the index. We assessed the validity of the RARBIS by comparing it to the intensity of the actual RA treatment that these patients received: low, neither biologic nor disease modifying antirheumatic drug (DMARD) use; moderate, therapy with DMARD such as hydroxychloroquine, gold, or sulfasalazine; high, treatment with stronger DMARD such as methotrexate, azathioprine, leflunomide, and cyclosporine; and very high, use of any biologics.

Results. The RARBIS had a range of 0 to 8. All subscales except extraarticular manifestations were statistically significantly related to intensity of RA treatment (chi-square test $p \leq 0.015$); the overall index was linearly correlated with intensity of RA treatment ($r = 0.35$, 95% CI 0.18–0.55). After adjusting for age and sex in a linear regression, the RARBIS was found to be an independent predictor of intensity of treatment (β for 1-point increase in score = 0.16, $p = 0.002$).

Conclusion. A medical records-based index of RA severity was developed with attention to face and criterion validity that correlated moderately with RA treatment intensity (construct validity) in a VA population. Further tests of the RARBIS are recommended before it can be used as a tool to adjust for RA disease severity in performing epidemiologic studies on the safety of drugs. (J Rheumatol 2005;32:1679–87)

Key Indexing Terms:
RHEUMATOID ARTHRITIS
DISEASE SEVERITY
EPIDEMIOLOGY
MEDICAL RECORDS

Rheumatoid arthritis (RA) is a systemic, chronic inflammatory disease that is manifested primarily in the joints[1]. The disease affects roughly 1% of the population and is 2 to 3 times more prevalent in women than men[2]. Long regarded as a nonfatal disease, numerous recent studies show that RA leads to increased morbidity and mortality. An increased risk for developing non-Hodgkin's and Hodgkin's lymphoma has been found among those with RA[3-6]. Patients with RA suffer premature death not only from their primary condition but also from comorbid conditions such as cardiovascular, gastrointestinal, respiratory, and infectious diseases[7–9].

Clinicians use a variety of drugs to reduce the underlying immunologic pathophysiology of RA, such as disease modifying antirheumatic drugs (DMARD) and biologic therapies. Epidemiologic studies have provided preliminary evidence that some DMARD may be associated with lymphoproliferative malignancies[4,10,11]. However, such studies have not properly adjusted for confounding by indication[12]. Failing to adjust for severity of RA might cause overestimation of the relationship between drug treatment and malignant outcomes such as lymphoma if patients with more severe RA are more likely to receive biologics, and advanced RA is also an independent predictor of lymphoma[4,5]. RA severity is thus a potential confounder that is

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Supported by Engalitcheff Arthritis Outcomes Initiative Grant, Arthritis Foundation, Atlanta, Georgia, USA.

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Accepted for publication April 1, 2005.

associated with both treatment choice and the incidence of specific outcomes such as lymphoma.

While doctors and patients know "severe RA" when they see it, it is not so clear how to define this based on medical records. There are well established markers of disease activity, such as tender or swollen joint counts. As well, there are indices for RA-related disability, such as the Health Assessment Questionnaire. Many consider RA severity to consist of elements of disease activity and disease disability. However, defining RA severity based on information from a medical record is not straightforward.

Use of large, automated databases would be ideal in studies of drug exposure and RA outcomes. Most RA endpoints, particularly lymphatic malignancies, are relatively rare, and there are numerous combination therapies in routine care that must be assessed, which makes large sample sizes necessary to study such associations. Because healthcare utilization data are primarily used for reimbursement and other administrative purposes, they do not contain information on clinical markers of RA severity. However, it is possible that healthcare claims such as surgical procedures, number of visits, and diagnoses for extraarticular manifestations may be useful surrogates for disease severity. To test this hypothesis, we needed to first develop a medical records-based RA severity index, so that clinical measures of severity in the medical records-based severity index can be compared with items in healthcare claims. In this report, we assess the performance of such an RA medical records-based index of severity (RARBIS), which was developed based on ratings of an expert Delphi panel[13] and which will be used in the creation of an administrative-based severity index for RA.

MATERIALS AND METHODS

Delphi panel and medical records-based severity index. An expert Delphi panel of 6 board-certified practicing rheumatologists from New England, USA, was convened to rate the relationship of 47 potential indicators to RA disease severity, compiled by 3 academic rheumatologists (DHS, JNK, MEW)[13]. The indicators were representative of 5 categories: radiologic and laboratory results, clinical and functional status measures, extraarticular manifestations, surgical history, and medications. Ratings for each indicator were based on a Likert scale: 0 = no relationship to severe RA, 1 = very weak relationship, 2 = weak relationship, 3 = moderate relationship, 4 = strong relationship, 5 = very strong relationship, and 6 = perfect relationship. The panel rated 28 of the 47 indicators as either strongly related or very strongly related to RA. Information on the Disease Activity Score (DAS) was not included in this rating, since the DAS is not typically found in medical records.

We incorporated items into the RARBIS that were identifiable in medical charts and were regarded by the panel as having strong or very strong associations with RA severity. Higher weights were assigned to categories, such as the surgical history category, that consisted of individual items that the Delphi panel rated as very strongly associated with severity of RA.

Study population. The study cohort consisted of patients from the New England Region of the Veteran's Administration (VA) Health System. To derive a source population who had RA and used the VA as the primary source of care, we sampled patients who had at least 2 visits coded with a diagnosis of RA (International Classification of Disease-9-CM 714.0) and at least 2 clinical visits recorded within VISN 1 (Veterans Integrated System Network), the New England area VA healthcare system, between July 1999 and June 2001. So that the source population consisted of patients with varying RA severity, we sampled patients from each of the following categories of medication use: (1) "low intensity treatment" — neither biologic nor DMARD use; (2) "moderate intensity treatment" — therapy with DMARD such as hydroxychloroquine, gold, or sulfasalazine; (3) "high intensity treatment" — treatment with stronger DMARD such as methotrexate, azathioprine, leflunomide, and cyclosporine; and (4) "very high intensity treatment" — use of a biologic such as etanercept, adalimumab, infliximab, or kineret.

To ensure adequate medical record information, we excluded patients who died in the first 6 months of the study period; had no mention of RA in their record; had another diagnosis, but not RA, that was made by a rheumatologist; moved outside New England during the study year; had care outside of the VA system; did not have visits during the study year; or lacked sufficient information to confirm a diagnosis of RA. The study period was June 30, 2000, to June 30, 2001.

Data collection procedures. Before conducting our medical chart reviews, approval for the study was obtained from the Institutional Review Board. The primary data collector was trained by a board-certified rheumatologist to identify a list of clinical manifestations of RA in medical charts. The data collector and rheumatologist then reviewed the same charts on 9 patients from the study population, and were in 96% agreement with each other.

The VA medical records served as the data source for our study. All records of patients for VISN 1 were accessible through a centralized electronic medical record. The comprehensive database included information on demographic characteristics, clinical and medication history, hospital discharge summaries, progress notes, laboratory test results, surgical procedures, and radiology reports.

Data on the potential markers of RA severity based on the work of our Delphi panel were gathered from early as possible, in most cases for about 10 years. Information was collected on demographic characteristics, clinical status indicators, medication use based on pharmacy records, extraarticular manifestations, surgeries, laboratory values, and radiographs (see Appendix 1 for a list of all possible indicators). Data on clinical status indicators and medication use were collected only for the study year. To determine if a patient ever had subcutaneous nodules and vasculitis, visit notes from the study year and at least 2 visit notes per year (including those of dermatology) for as long as the patient was in the VA system were examined. Surgeries and laboratory values were obtained for at least 10 years. Finally, radiology reports were reviewed for years prior to and including the study period.

If a patient's clinical status changed during the study period, the worst condition was recorded. If there was no mention of device or wheelchair use, the patient's ambulatory status was assumed to be independent. Similarly, the American College of Rheumatology functional status was assigned as Class I if there was no evidence of limitations in self-care, work, or hobbies.

Statistical analyses. Based on the findings of the Delphi panel, we created the RARBIS and applied it to the VA study population (Table 1). The RARBIS did not contain medication information, since eventually the index may be used as an independent covariate in models containing medication information. We examined the distribution of scores on the index. To assess the construct validity of the RARBIS, we tested the correlation between the summary score and its components and the intensity of RA treatment, another proxy measurement of RA severity. Spearman correlation coefficients were calculated and multivariate linear regression models were used with intensity of treatment as the dependent variable and the RARBIS as the independent predictor. The model also included age and sex. We assumed a gamma distribution for the errors of the dependent variable, to account for the skewed distribution of the intensity of RA treatment.

RESULTS

Sample population. Of the 269 medical charts reviewed, 149

Table 1. Rheumatoid arthritis records-based index of severity (RARBIS)

Subscale	Points
1. Surgery subscale	
C1–C2 fusion	3
Any hand joint	1
Any foot joint	1
Major joints (hips, knees shoulder, elbow)	1 point each (maximum of 2)
Maximum score for subscale	5
2. Radiograph subscale	
C1–C2 subluxation	3
Any erosions	1
Maximum score for subscale	4
3. Extraaticular manifestations subscale	
Vasculitis	1
Pulmonary nodule	1
Maximum score for subscale	1
4. Clinical status subscale	
Arthritis flares	
1	1
2 to 4	2
5+	3
Worst physician global rating: "doing poorly"	2
Functional status	
Unable to do hobbies	1
Unable to work	2
Unable to care of self	3
Hours of morning stiffness	
< 1	0
1 to 4	1
> 4	2
Maximum score for subscale	3
5. Laboratory subscale	
Rheumatoid factor titer > upper limit of normal	1
ESR > age/2 or CRP > upper limit normal or platelets > 450,000	1
Maximum score for subscale	2
Summary score for primary index	Maximum 15 points
6. Optional medication subscale	
Any of the following medications: hydroxychloroquine, gold, sulfasalazine	1
Any of the following medications: methotrexate, leflunomide	2
Any of the following medications: cytoxan, azathioprine, cyclosporine, kineret, adalimumab, etanercept, infliximab	3
Maximum score for subscale	3
Summary score for extended index	Maximum 18 points

(55.4%) were excluded based on our predefined exclusion criteria. Thirteen people (4.83%) moved elsewhere during the study year, 15 (5.58%) had no mention of RA in their medical records, 9 (3.35%) had no visit notes during the study year, 58 (21.56%) were excluded since they did not meet criteria for RA as determined by a rheumatologist, 40 (14.87%) were seen by physicians outside the VA or obtained radiographs or laboratory tests elsewhere, and 14 (5.20%) did not have enough information to confirm RA. The characteristics of the 120 study patients are shown in Table 2. The study group was an older population, with mean age of 71 years. This VA cohort was predominantly male (91%). Thirty-two patients (27%) were in the low medication-intensity category, 29 (24%) moderate intensity, 44 (37%) high intensity, and 15 (13%) very high intensity. During the study year, about one-third of patients experienced a flare and had ≥ 1 hour of morning stiffness. Swollen joints and joint erosions were common RA manifestations, while vasculitis, C1–C2 subluxation, and pulmonary nodules were rare.

RARBIS. The frequency distributions of the individual subscales and the summary scores on the index are shown in Figures 1 and 2, respectively. The summary score has a mean of 3.03 (± 1.85) and range of 0 to 8. No patient

Table 2. Patient characteristics.

	N(%) or mean (± SD)
Age, yr	70.6 (11.1)
No. of rheumatology visits	3.0 (2.1)
Male	109 (91)
ACR functional classification†	
Class I (no limitation)	93 (78)
Class II (self-care, working, no hobbies)	8 (7)
Class III (self-care, not working, no hobbies)	6 (5)
Class IV (limited self-care, bed-bound)	4 (3)
Ambulatory status††	
Independent	79 (66)
With device	25 (21)
Wheelchair	5 (4)
Morning stiffness, h	
<1	70 (58)
1 to 4	25 (21)
> 4	8 (7)
Flares	
0	65 (54)
1	22 (18)
1 to 4	11 (9)
5+	3 (3)
Hospitalized	7 (6)
Swollen joints	64 (53)
Rheumatoid nodules*	41 (34)
Vasculitis *	1 (1)
Physician global: poor	7 (6)
Patient global: poor	11 (9)
Employed out of home	10 (8)
Received intraarticular injections	11 (9)
Received intramuscular injections	1 (1)
Presence of C1–C2 subluxation*	2 (2)
Joint space narrowing	74 (62)
Joint erosions*	61 (51)
Pulmonary nodule*	11 (9)

*Results are prior to and including the study year. †If there is no evidence of limitation in self-care, work, or hobbies, assumed no limitation.
†† If there is no evidence of device or wheelchair use, assumed dependent.

reached the maximum possible summary score of 15 points.

Correlations with intensity of medication use. All components of the summary score, except for the surgery and extraarticular manifestation subscales, had moderate linear relations to intensity of medication use, as indicated by the Spearman correlation coefficient (Table 3). The summary score showed a moderate to good linear relation with RA treatment intensity (r = 0.35, 95% CI 0.18–0.55). After adjusting for age and sex in a linear regression, the RARBIS was an independent predictor of intensity of treatment (β for 1-point increase in score = 0.16, p = 0.002; Table 4). Those patients with summary scores of 6 to 8 had 0.9 point higher intensity of treatment compared to patients with summary scores of 0 to 2 (p = 0.04; Table 4).

DISCUSSION

When studying the association of RA with adverse events from medication, it is necessary to develop an adequate method to adjust for RA severity. We created the RARBIS from the ratings of an expert panel of rheumatologists[13]. This index was applied to a cohort of 120 patients with RA identified in the VA system and showed a reasonable association with the intensity of RA treatment.

Others have recognized the necessity for an accurate measure for RA disease severity. Another group has developed a severity index for RA that is based on the Duke Severity of Illness Checklist, the RADUSOI[14]. The researchers validated the RADUSOI by comparing it to some elements that are part of our severity score, such as physician global rating, presence of joint deformities, and the laboratory values for erythrocyte sedimentation rate and rheumatoid factor. Our severity index thus gains face validity as it records elements used by others as gold-standard

Table 4. Age and sex adjustment linear regression analyses of summary score with intensity of RA treatment.

Parameter	ß-Coefficient	p
Model 1*: Summary score as a continuous variable		
Summary score, per point	0.16	0.002
Age, per year	–0.02	0.03
Sex (reference male)	–0.39	0.1
Model 2*: Summary score categorized		
0–2 points on index	Reference group	
3–5 points on index	0.52	0.007
6–8 points on index	0.90	0.04
Age	–0.02	0.03
Sex	–0.32	0.2

* Assuming gamma distribution of errors.

Table 3. Relation between scores and intensity of RA treatment (intensity of RA treatment is defined in the text).

Subscale	Spearman Coefficient	95 % CI	chi-square	p
Clinical	0.27	0.09–0.46	23.6	0.0049
Radiograph	0.21	0.02–0.40	17.5	0.0075
Surgery	0.05	0–0.23	22.8	0.0067
Extraarticular manifestations	0.02	0–0.21	1.2	0.7473
Laboratory	0.25	0.07–0.44	16.2	0.0128
Summary score	0.35	0.18–0.55	31.2	0.0704

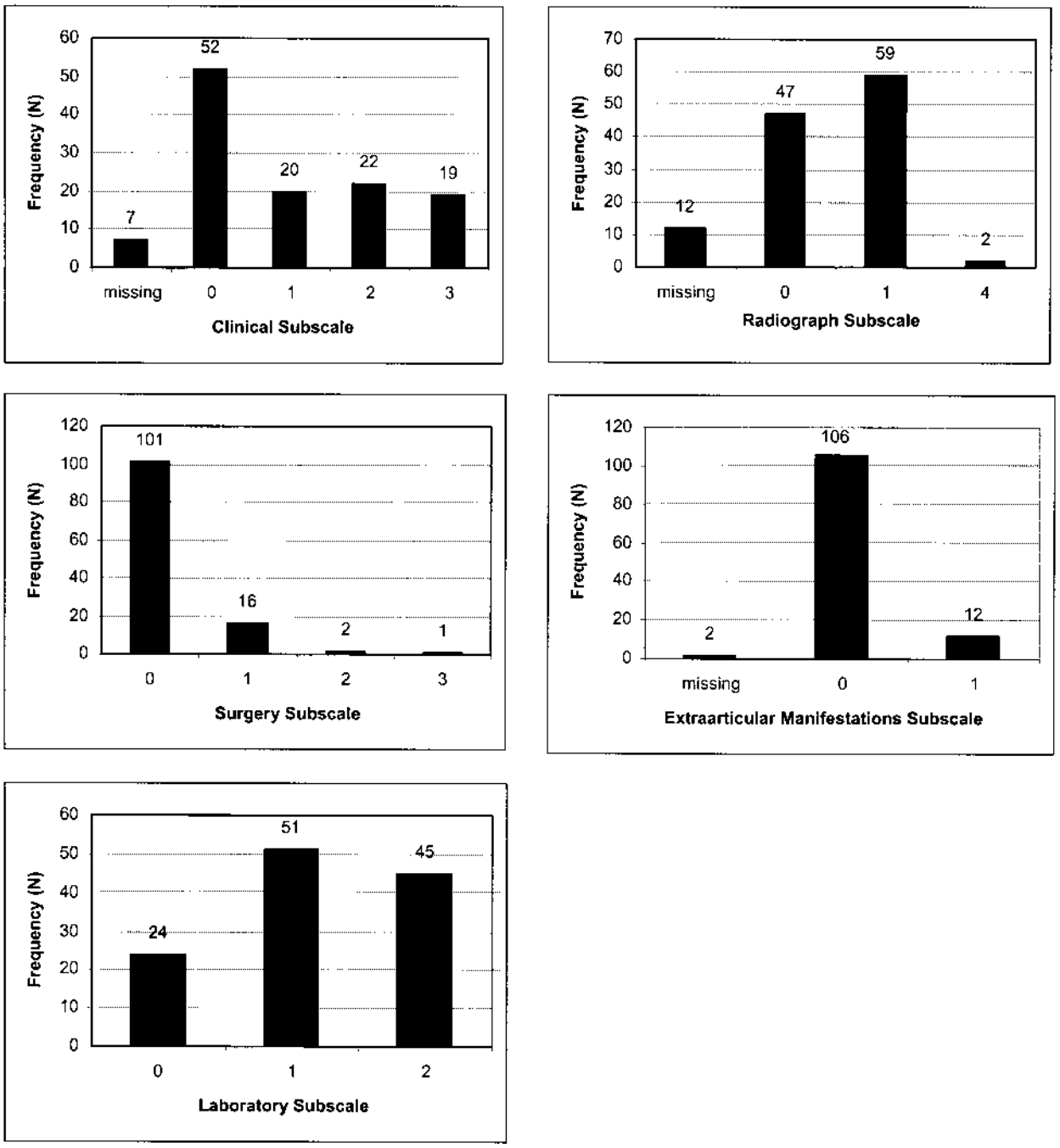

Figure 1. Distributions of scores on subscales of RARBIS.

markers of RA disease severity. Unlike the RADUSOI, the DUSOI requires a physician assessment and is thus not as useful for retrospective studies. While medical records are understood not to be perfect representations of physician-patient encounters, they are readily available, and are therefore utilized in this study. It is important to note that at this stage, the RARBIS is not yet validated. The next step to validating the RARBIS is to compare it against a reference standard, such as the DAS.

Missing data compromised the performance of the medical records-based severity score in our study. A limitation in our data source was that information for some variables was not always available in medical charts. However, the subscales each consist of several fields on similar information; thus, variables that are more accessible in medical records can substitute for missing information in the same subscale. It can also be argued that missing data in medical records are informative. A number of patients, for example, did not have a cervical spine radiograph. It is reasonable to assume that the majority of patients without cervical radiographs do not

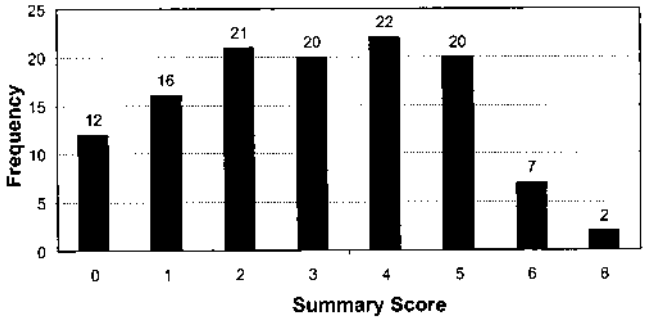

Figure 2. Distribution of summary scores of RARBIS.

have clinically apparent C1–C2 subluxation. Because our study was conducted in the regional VA system, men constituted the majority of the population. This overrepresentation of men, however, should not compromise the internal validity of this study. The rheumatologists who were part of our Delphi panel and developed the RARBIS all practice in the New England area. Thus, the RARBIS might not be sensitive to geographical differences in physician classification of disease severity, if such variation exists. Similarly, our categories for intensity of RA treatment may not reflect the practice of all rheumatologists. Some practitioners, for instance, might associate corticosteroids with more severe disease. When defining our categories for RA treatment intensity, we attempted to stay close to the ratings of the Delphi panel and opinions of our own rheumatologists. We therefore believe the DMARD classification we proposed is a reasonable representation of RA treatment intensity. Finally, although our findings suggest that the weighting used for the RARBIS is valid, others could derive a different weighting scheme using the same results from the Delphi panel.

All subscale scores except the surgery and extraarticular manifestation subscales were particularly correlated with intensity of RA treatment. One explanation for the lack of association with surgery is that we could not reliably differentiate surgery for RA from that for non-RA indications. As for extraarticular manifestations, we only have data for vasculitis and rheumatoid lung nodules. Inclusion of other extraarticular manifestations such as Felty's syndrome and Sjögren's disease, although rare, may improve the performance of the extraarticular manifestations subscale. We decided to include these 2 scores in the total score despite their lack of correlation with RA treatment intensity as they were regarded as important markers for disease severity by the Delphi panel[13].

We observed that in a cohort of VA patients with RA, the RARBIS was significantly associated with intensity of RA treatment, and is thus likely to be a good surrogate for RA disease severity. Our rationale for using VA data was based on the richness and accessibility of the VA medical record system. We do not believe that the RARBIS is limited to this population. We are testing the index's validity compared with the DAS in another cohort of patients with RA. Ultimately, the RARBIS will be useful in developing an administrative data-based severity score. Such a severity index will be an important methodological advancement for adjusting for disease severity in epidemiological studies of medication use in patients with RA.

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APPENDIX 1. All variables with data collected.

Demographics
Date of birth
Gender
Employment status

Dates
Date of review
Date died during study year

Clinical Indicators
Number of rheumatologist visits in the study year
Number of hospitalizations in the study year
Number of flares in the study year
ACR functional status classification in the study year
- Class I (no limitation)
- Class II (self-care, working, no hobbies)
- Class III (self-care, not working, no hobbies)
- Class IV (limited self-care, bed-bound)

Worst ambulatory status in the study year
- Independent
- With device
- Wheelchair

Worst medical doctor outpatient global in the study year
- Poor
- Good(well)
- Very good(very well)
- Excellent

Most no. of hours of morning stiffness in the study year
Vasculits any time
Subcutaneous nodules any time
Swollen joints in the study year
Worst patient outpatient global report in the study year
Number of outpatient intraarticular steroids in the study year
Number of outpatient intramuscular steroids in the study year

Radiology Reports (before and including the study year)
Pulmonary / "rheumatoid lung"
Joint erosions (presence/absence)
Joint space narrowing
Atlantoaxial (cervical spine) C1, C2 subluxation

Laboratory (before and including the study year)
Rheumatoid factor titer
Platelet count
C-reactive protein
Erythrocyte sedimentation rate

Medication (study year only)
Number of months of prescription use during the study year of the following drugs:

Oral glucocorticoids
- a) Prednisone, medrol, prednisolone

Nonbiologic DMARD
- a) Methothrexate (Rheumatrex)
- b) Sulfasalazine (Azulfidine)
- c) Gold (Auranofin, Myocrisine)
- d) Azathioprine (Imuran)
- e) Hydroxychloroquine (Plaquenil)
- f) Leflunomide (Arava)
- g) Cyclosporine (Neoral, Sandimmune)

Biologic DMARD
- a) Etanercept (Enbrel)
- b) Adalimumab (Humira)
- c) Infliximab (Remicade)
- d) Kineret (Anakinra)

Surgery (counts of any of the following surgeries before and including the study year)

CPT CODE	DESCRIPTION
Cervical	
22548	Arthrodesis, anterior transoral or extraoral technique, clivus-C1-C2 (atlas-axis), with or without excision of odontoid process
22554	Arthrodesis, anterior interbody technique, including minimal diskectomy to prepare interspace (other than for decompression); Cervical below C2
22590	Arthrodesis, posterior technique, craniocervical
22595	Arthrodesis, posterior technique, atlas-axis (C1-C2)
22600	Arthrodesis, posterior or posterolateral technique, single level; Cervical below C2 segment
Shoulder	
23470	Arthroplasty, glenohumeral join; hemiarthroplasty
23472	Total shoulder (glenoid and proximal humeral replacement (eg, total shoulder))
23800	Arthrodesis, glenohumeral joint
23802	With autogenous graft (includes obtaining graft)
Elbow	
24360	Arthroplasty, elbow; with membrane (eg, fascial)
24361	With distal humeral prosthetic replacement
24362	With implant and fascia lata ligament reconstruction
24363	With distal humerus and proximal ulnar prosthetic replacement (e.g., total elbow)
24365	Arthroplasty, radial head;
24366	with implant
24800	Arthrodesis, elbow joint; local
24802	with autogenous graft (includes obtaining graft)

Wrist

25332	Arthroplasty, wrist, with or without interposition, with or without external or internal fixation
25441	Arthroplasty with prosthetic replacement; distal radius
25442	Distal ulna
25443	Scaphoid carpal (navicular)
25444	Lunate
25445	Trapezium
25446	Distal radius and partial or entire carpus (total wrist)
25447	Arthroplasty, interposition, intercarpal or carpometacarpal joints
25800	Arthrodesis, wrist; complete, without bone graft (includes radiocarpal and/or intercarpal and/or carpometacarpal joints)
25805	With sliding graft
25810	With iliac or other autograft (includes obtaining graft)
25820	Arthrodesis, wrist; limited, without bone graft (e.g., intercarpal or radiocarpal)
25825	With autograft (includes obtaining graft)
25830	Arthrodesis, distal radioulnar joint with segmental resection of ulna with or without bone graft (e.g., Sauve-Kapandji procedure)

Hand

26130	Synovectomy, carpometacarpal joint
26135	Synovectomy, metacarpophalangeal joint including intrinsic release and extensor hood reconstruction, each digit
26140	Synovectomy, proximal interphalangeal joint, including extensor reconstruction, each interphalangeal joint
26145	Synovectomy, tendon sheath, radical (tenosynovectomy), flexor tendon, palm and/or finger, each tendon
26530	Arthroplasty, metacarpophalangeal joint; each joint
26531	With prosthetic implant, each joint
26535	Arthroplasty, interphalangeal joint; each joint
26536	With prosthetic implant, each joint
26820	Fusion in opposition, thumb, with autogenous graft (includes obtaining graft)
26841	Arthrodesis, carpometacarpal joint, thumb, with or without internal fixation;
26842	With autograft (includes obtaining graft)
26843	Arthrodesis, carpometacarpal joint, digit, other than thumb, each;
26844	With autograft (includes obtaining graft)
26850	Arthrodesis, metacarpophalangeal joint, with or without internal fixation;
26852	With autograft (includes obtaining graft)
26860	Arthrodesis, interphalangeal joint, with or without internal fixation
26861	Each additional interphalangeal joint
26862	With autograft (includes obtaining graft)
26863	With autograft (includes obtaining graft), each additional joint

Hip

27130	Total hip replacement
27284	Arthrodesis, symphysis pubis (including obtaining graft)
27286	With subtrochanteric osteotomy

Knee

27334	Arthrotomy, with synovectomy, knee; anterior or posterior
27437	Arthroplasty, patella; without prosthesis
27438	With prosthesis
27440	Arthroplasty, knee, tibial plateau;
27441	With debridement and partial synovectomy
27442	Arthroplasty, femoral condyles or tibial plateau(s), knee;
27443	With debridement and partial synovectomy
27445	Arthroplasty, knee, hinge prosthesis (e.g., Walldius type)
27446	Arthroplasty, knee condyle and plateau; medial or lateral compartment
27447	Medial and lateral compartments with or without patella resurfacing (total knee arthroplasty)
27580	Arthrodesis, knee, any technique

Ankle

27700	Arthroplasty, ankle;
27702	With implant (total ankle)
27703	Revision, total ankle
27870	Arthrodesis, ankle, any method
27871	Arthrodesis, tibiofibular joint, proximal or distal

Foot

28270	Capsulotomy; metatarsophalangeal joint, with or without tenorraphy, each joint (separate procedure)
28272	Interphalangeal joint, each joint (separate procedure)
28292	Keller-type Procedure
28293	Resection of joint with implant
28294	Joplin procedure
28296	With metatarsal osteotomy
28297	Ladius-type procedure
28298	By phalanx osteotomy
28299	By double osteotomy
28705	Arthrodesis; pantalar
28715	triple
28725	subtalar
28730	Arthrodesis, midtarsal or tarsometatarsal, multiple or transverse;
28735	With osteotomy (e.g., flatfoot correction)
28737	Arthrodesis, with tendon lengthening and advancement, midtarsal, tarsal navicular-cuneiform (e.g., Miller-type procedure)
28740	Arthrodesis, medtarsal or tarsometatarsal, single joint
28750	Arthrodesis, great toe; metatarsophalangeal joint
28755	Interphalangeal joint
28760	Arthrodesis, with extensor hallucis longus transfer to first metatarsal neck, great toe, interphalangeal joint (e.g., Jones-type procedure)