HHS Public Access

Author manuscript

Arthritis Care Res (Hoboken). Author manuscript; available in PMC 2016 December 01.

Published in final edited form as:

Arthritis Care Res (Hoboken). 2015 December ; 67(12): 1664–1670. doi:10.1002/acr.22643.

A Comparison of Care Provided in Practices with Nurse Practitioners and Physicians Assistants versus Sub-Specialist Physicians Only: A Cohort Study of Rheumatoid Arthritis

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Abstract

Background—The Affordable Care Act proposes wider use of nurse practitioners (NPs) and physician assistants (PAs), but little is known about outcomes of care provided by them in medical specialties. We compared the outcomes of care for patients with rheumatoid arthritis (RA) seen in practices with NPs or PAs and rheumatologists versus practices with rheumatologists only.

Methods—We enrolled seven rheumatology practices in the US – four with NPs or PAs and three without. Disease activity of RA, categorized as remission, low, moderate, or high, using standardized measures were abstracted from medical records from the most recent two years. We performed a repeated measures analysis using generalized linear regression to compare disease activity for visits to practices with NPs or PAs versus rheumatologist only, adjusting for disease duration, serologic status, RA treatments and disease activity measures.

Results—Records from 301 patients, including 1982 visits were reviewed. Patients had a mean age of 61 years and 77% were female. In the primary adjusted analysis, patients seen in practices with NPs or PAs were less likely to have higher disease activity (OR 0.32, 95% CI 0.17–0.60, p = 0.004) than those seen in practices with rheumatologists only. However, there were no differences in the change in disease activity.

Conclusions—Patients seen in practices with NPs or PAs had lower RA disease activity over 2-years compared with those seen in rheumatologist only practices; no differences were observed in the change in disease activity between visits either within or between type of provider practice.

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Potential Conflicts: Dr. Solomon receives salary support from research grants to his institution from Lilly, Amgen, Pfizer, and CORRONA. He has participated in unpaid roles on trials funded by Pfizer, Lilly, and Bristol Myers Squibb. He receives royalties from UpToDate. No other potential conflicts were noted.

INTRODUCTION

The Affordable Care Act (ACA) specifically supports the more widespread use of nurse practitioners (NPs) and physician assistants (PAs) in the US health care system to address anticipated physician workforce shortages across a myriad of medical specialties.[1] This recommendation assumes that outcomes for patients seeing primarily NPs or PAs will be at least as good as those seeing primarily physicians. Some data suggest that the assessments and treatment recommended by NPs or PAs differ from physicians, [2–4] and some studies suggest that care provided by NPs or PAs is more often adherent with guidelines than care provided by physicians.[5–7] However, there is almost no data directly comparing clinical outcomes across provider types.[8] In particular, there is very little data in non-procedure oriented medical sub-specialties, such as rheumatology, upon which to base policy recommendations, though these specialties face acute projected workforce shortages, especially in rural areas.[9]

Rheumatologists have worked with NPs and PAs for over a decade in various practice settings. In many instances, the NPs and PAs practice in a semi-independent manner, seeking input from rheumatologists relatively infrequently.[10, 11] They prescribe the full range of treatments for rheumatoid arthritis (RA) and provide initial and follow-up assessments.[10, 11] There are several hundred NPs and PAs in rheumatology practice across the US in addition to approximately 3,000 rheumatologists. However, an impending rheumatologist shortage suggests that many more providers of rheumatologic care may be needed.[12]

The objective of the current study was to examine the process and outcomes of care provided by NPs or PAs working in tandem with rheumatologists, compared to patients cared for exclusively by rheumatologists, focusing on patients with RA. The care of RA provides a good setting to compare practices with NPs or PAs versus those with rheumatologists only because of the existence of standardized disease activity measures in RA.[13]

METHODS

Study Design and Data Collection

We carried out an observational cohort study in seven rheumatology practices in the US. Four practices had NPs or PAs and three did not. Eligible practices, chosen as a convenience sample, must have had an NP or PA for at least six months and at least 30 patients with RA seen for at least 24-months. Patients included had a minimum of two different visits with an RA disease activity measures assessed during this period. The allowable disease activity measures included a Disease Activity Score-28, a Clinical Disease Activity Index, or a Routine Assessment of Patient Index.[14–16] These measures were chosen because they are all recommended by the American College of Rheumatology and have moderate-high correlation with each other.[13] We identified four geographically dispersed rheumatology practices with NPs or PAs willing to participate. After identifying four practices with NPs or PAs, we recruited three practices without NPs or PAs, representing similar regions of the US

as the practices with NPs or PAs. The same eligibility criteria were applied to the non-NP or PA practices.

A trained research assistant conducted an on-site structured medical record review at each of the seven practices. The research assistant was trained by one of the investigators (DHS) on 20 medical records of patients with RA; the inter-rater reliability across all items on the record abstraction form between the research assistant and trainer was high (kappa = 0.9). Data were abstracted from at least 30 consecutive patients seen for at least 24-months at each site. The study period consisted of the most recent 24-months of care for these patients, with all 24-month periods from 2010 – 2013. If patients were seen more than once over a two-month period, only the first visit in this period was recorded unless subsequent visits contained disease activity measures. These visits were a convenience sampling and did not include the first visit to the practice. Four of the seven practices used electronic medical records and three paper-based records.

We used a data collection form (available from investigators) that included age, gender, disease duration, serologic status, laboratory (complete blood count, liver and kidney function tests) and radiology tests (musculoskeletal) ordered, RA treatments, adverse events, and disease activity measures. The research protocol was approved by the Partners Human Research Committee in Boston, MA. The STROBE check list was followed for reporting the results (see Appendix 1).[17]

Outcomes

The outcome of interest was the disease activity measure, categorized into remission, low, moderate and high (see below). This four category ordinal ranking is widely used in clinical studies of RA, and provides a standardized comparison of disease activity across a spectrum of patients in a variety of settings. Not all visits had disease activity measures recorded; 654 of 1982 (33%) visits did not have recorded measures. We did not attempt to impute disease activity values for such visits. Furthermore, one practice recorded three of the four components of the Clinical Disease Activity Index; this practice's disease activity measures were converted to a Clinical Disease Activity Index based on imputation (see Appendix 2).

Processes of care, such as drug prescribing, laboratory testing and imaging requests, were also recorded. In addition, the medical record review included information on patient age, gender, disease duration, serologic status, DMARD use, and which provider was seen (NP or PA, rheumatologist, or both).

Statistical Analysis

The baseline characteristics of patients in the two groups of practices – those seen in practices with NPs or PAs and those without -- were compared, using two sample t-tests or Wilcoxon rank sum tests for continuous variables and Chi-square test for categorical data. The processes of care during the two year study period were also compared; these included the number of visits, RA treatments, use of laboratory and radiology tests, and changes in treatment.

The primary analysis of the disease activity measures compared visits with NPs or PAs versus those with rheumatologist only. Some visits in NP or PA practices were with rheumatologists; thus, an indicator variable noted whether a visit was with an NP, PA or a rheumatologist. The disease activity measure was considered a four-level ordinal variable: 0 = remission, 1 = low disease activity, 2 = moderate disease activity, and 3 = high disease activity, using accepted thresholds across each of the different disease activity measures (see Appendix 3). The repeated measure analysis (patients contributed multiple visits) was performed using a generalized linear mixed model (GLMM) for ordinal outcomes (proportional odds model). Adjustments were made for age, gender, disease duration, serologic status, DMARD use, and type of provider. Associations were expressed as odds ratios (OR) with 95% confidence intervals (CI).

We conducted additional analyses related to the disease activity measures. The first of these evaluated the area under the curve (AUC) for disease activity across the 24-months of follow-up. Thus, each patient contributed up to 24 months of disease activity measures categorized as 0 – 3. The AUC was compared across patients in the NP or PA practices versus those seen in practices without NPs or PAs using a linear regression model, adjusting for the same set of covariates as noted above. Finally, the change in disease activity measures between visits was examined in a repeated measure proportional odds model, similar to the primary analysis. All analyses were conducted using SAS (version 9.2; Cary, NC).

RESULTS

Sample Description

Characteristics of the practices and patients are presented in Table 1. The practices were located in Seattle (NP or PA only), Phoenix (both NP or PA and rheumatology only), Metropolitan New York (both NP or PA and rheumatology only) and Metropolitan Boston (both NP or PA and rheumatology only). The mean visits per patient over the study period was higher in the practices with NPs or PAs (7.4 ± 2.6) versus practices without (5.7 ± 1.9; $p < 0.0001$). In the practices with NPs or PAs, 61.9% of visits did not include the rheumatologist, 10.7% included NP or PA and rheumatologist, and 27.4% included only the rheumatologist. The mean age of patients was slightly older in practices without NPs or PAs (65 years) than those with (57 years), but this difference was not statistically significant ($p = 0.31$). The percentage of patients who were female (80% versus 74%) and the serologic status (68.5% versus 69.8%) were similar across practice types. There were more patients with 10+ years of RA seen in the practices without NPs or PAs (60%) than those with (49%), but this difference was not statistically significant ($p = 0.27$). Disease activity at baseline was lower among the patients seen at practices with NPs or PAs ($p = 0.08$), with slightly over 60% in remission or low disease activity compared with approximately 50% in similar disease states in rheumatologist only practices.

Processes of Care

The processes of care differed across practice types (see Table 2). The use of laboratory tests (81% versus 62%) and radiology tests (20% versus 14%) was slightly higher for patients

seen in NP or PA practices (both p-values <0.001). The percentage of visits with DMARD starts and stops was slightly higher in visits to practices with NPs or PAs. More of the DMARD starts by practices with NPs or PAs were made with patients in low (31%) or moderate disease activity (43%) compared with the rheumatologist only practices where DMARD starts were more likely to be made in moderate (34%) or high disease activity (44%).

The types of RA treatments were similar across practice types. There were 103 DMARD initiations (9% of visits) in the NP or PA practices and 62 (8% of visits, p = 0.01) in the rheumatologist only practices. Methotrexate was the most common synthetic DMARD initiated, accounting for approximately one-third of initiations in both types of practices. However, biologic DMARDs were more commonly initiated in NP or PA practices (52%) versus rheumatologist only (36%; p = 0.001). In Table 3, we show the types of DMARDs used at any time in the patient sample. The percentage of patients who used a synthetic DMARD (85% versus 73%, p = 0.01) and/or a biologic DMARD (80% versus 47%, p < 0.0001) was higher for patients seen at NP or PA practices compared with rheumatologist only.

Outcomes

In the primary adjusted analysis, patients seen in NP or PA practices were less likely to have higher disease activity (OR 0.32, 95% CI 0.17–0.60, p = 0.004) than those seen in practices with only rheumatologists (see Table 4). In other words, there was a 68% lower odds of patients being in a disease activity one-level higher; proportional odds assumptions were met. Similar trends were observed in the AUC analysis; with the linear outcome of disease activity over the 24-month study period, we found a significantly lower AUC for patients seen in practices with NPs or PAs (β = −6.35, p = 0.0055). However, there were no differences in the change in disease activity comparing patients seen in practices with NPs or PAs versus rheumatologist only (OR 0.98, 95% CI 0.94–1.03).

DISCUSSION

We studied processes and outcomes of care for patients with RA, comparing patients seen in rheumatology practices with NPs or PAs versus practices with rheumatologists only. We found that patients were similar across the practice types, but that the number of visits was higher for patients seen by practices with NPs or PAs. As well, the percentage of visits with laboratory and/or radiology tests was higher in practices with NPs or PAs. Similar types of DMARDs were used across the two types of practices, with more patients seen in NP or PA practices using synthetic and/or biologic DMARDs. We had hypothesized that disease activity measures would be similar for visits with NPs or PAs. If anything, there was a suggestion that disease activity at each visit across the two-year study period was slightly better for patients seen in practices with NPs or PAs. However, there was no difference when change in disease activity was compared across practice types.

Prior work suggests that care in practices with NPs or PAs is similar to care in practices without; sparse data suggests that care in practices with NPs or PAs may be more concordant with guidelines.[5, 6] RA is a disease with an undulating course that requires

frequent medication changes and re-assessments. Rheumatologists with over-subscribed practices may not be able to see patients back with adequate frequency to keep their disease activity under tight control, while practices with NPs or PAs may have improved access for patients. This is supported by our data that show more frequent visits with NPs or PAs. However, it is also possible that our findings of slightly better disease activity at each visit relates to patient selection factors (i.e., easier to manage disease activity among patients seen by NPs or PAs) that could not be adequately controlled with the adjusted models.

While these findings reflect one sub-specialty and a single disease entity, they do support the hypothesis that increasing the use of NPs or PAs does not compromise process or outcomes of care. Other analyses have found that NPs or PAs adhere more rigorously to treatment algorithms than physicians.[5, 6, 18] However, there is a relative paucity of data comparing outcomes between practices with NPs or PAs and physicians in many specialties, so firm conclusions cannot be drawn from our study. If NPs or PAs are to play an increasing role in the US health care system, it would be useful to conduct similar studies in other specialties, and with other common conditions, to compare outcomes between patients seen in practices with and without NPs or PAs.

In the analyses we conducted, NPs or PAs practiced alongside rheumatologists; many of the practices suggested that the NPs or PAs and rheumatologists formed a provider team. It is unclear what roles the NPs or PAs alone, versus the team they work on, play in delivering health care. It is also unclear whether rheumatologists that foster a provider team with NPs or PAs are systematically different than rheumatologists who practice without NPs or PAs. However, much evidence suggests that team-based organizational designs can enhance care processes and outcomes in health care.[19, 20]

In fields such as rheumatology with workforce deficits, increased training and recruitment of NPs or PAs could help medically underserved communities.[21] Most states require on-site supervision of NPs or PAs by physicians. While we did not study independent practice by NPs or PAs, it would be worth considering demonstration projects relaxing these requirements so that NPs or PAs could practice more independently, especially in medically underserved areas.

Our study was non-randomized, limiting the causal inference. It is plausible that patients seen by NPs or PAs have been pre-selected because their disease activity is less severe and more responsive. However, three of the NP/PA practices assign all new patients to have a non-rheumatologist provider; the other practice strongly encourages it, but it is not required. There was some suggestion of baseline differences based on the results in Table 1. It would have been ideal if all patients were newly diagnosed with RA, but this was not feasible. As well, it is also possible that practices with NPs or PAs have a different management approach, with physician and NPs or PAs working as more functional teams that provide more responsive care. This study, with its relatively small sample size and limited data collection, does not permit firm conclusions about these questions. But, we did find that the years since graduation was slightly longer for rheumatologists without NPs or PAs (data not shown). We also did have some visits with missing disease activity measures. However, all visits in both groups had disease activity measures noted at the time of new DMARD starts.

The disease activity measurements were made by different providers across various practices without standardized teaching. While this is typical for this type of comparative effectiveness study, it may introduce misclassification.

While limited in certain respects, this study also has important strengths. One research assistant collected all data across both types of practices. Information regarding several important confounders was collected and used in adjusted regression analyses. All analyses were consistent in finding that patients seen in practices with NPs or PAs did not have worse disease activity.

In conclusion, disease activity control was not inferior and may have actually been slightly better in the NP or PA practices as compared with practices using rheumatologists only. These findings support the provisions in the ACA towards an expanding role for NPs or PAs. However, the higher utilization of laboratory and radiology testing raises concerns that NP and PAs may not practice as efficiently as rheumatologists. Randomized experiments or further demonstration efforts can help clarify the optimal value of NPs or PAs.

Acknowledgments

Support: This work was supported by the NIH-NIAMS (P60 AR-047782).

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CLINICAL SIGNIFICANCE

1. There is an impending shortage of rheumatologists in the US.
2. Nurse practitioners and physician assistants provide a range of services in the care of RA similar to a rheumatologist.
3. Patients with RA seen in practices with nurse practitioners and physician assistants have similar disease activity outcomes as those with only rheumatologists.

Table 1

Baseline Characteristics of Practices and Patients

	NP or PA	Rheumatologist only	p-values
N patients	158	143	
N visits	1168	814	
N rheumatologists	7	7	
N of NPs or PAs	6	NA	
Visits per patients, mean (SD)*	7.4 (2.6)	5.7 (1.9)	<.0001
Seen by mid-level provider only	723 (61.9%)	--	
Seen by rheumatologist only	320 (27.4%)	814 (100.0%)	
Seen by both providers	125 (10.7%)	--	
Female sex	126 (80%)	106 (74%)	0.27
Disease duration			
<2 years	17 (11.0%)	12 (8.8%)	0.27
2–5 years	20 (13.0%)	13 (9.6%)	
5–10 years	42 (27.3%)	29 (21.3%)	
10+ years	75 (48.7%)	82 (60.3%)	
Missing	4 (2.5%)	7 (4.9%)	
Seropositive, n (%)	76 (68.5%)	67 (69.8%)	0.07
Disease activity at first visit			0.08
Remission	29 (32.9%)	33 (28.7%)	
Low	27 (30.7%)	26 (22.6%)	
Moderate	24 (27.3%)	35 (30.4%)	
High	8 (9.1%)	24 (18.3%)	

NP, nurse practitioner; PA, physician assistant; SD, standard deviation. Seropositive refers to rheumatoid factor or anti-CCP antibody. This variable had 34% missing for patients seen at practices with mid-level providers and 32% missing for the other practices.

* In the NP/PA group: average visits by provider were as follows: 4.6 NP or PA only, 2.0 rheumatologist only, and 0.8 to both.

Table 2

Laboratory Tests, Radiology Tests, and Disease-Modifying Anti-Rheumatic Drug Changes among Practices With and Without Nurse Practitioners or Physician Assistants, by Visit

	NP or PA	Rheumatologist only	P-value
Visits, n	1168	814	
Laboratory tests	950 (81.3%)	501 (61.5%)	<0.001
Radiology tests	232 (19.9%)	110 (13.5%)	<0.004
DMARD starts	103 (8.8%)	62 (7.6%)	0.01
DMARD stops	90 (7.7%)	54 (6.6%)	0.02
Corticosteroid starts	37 (3.2%)	39 (4.8%)	0.23
Corticosteroid stops	30 (2.6%)	41 (5.0%)	0.02
Disease activity measures noted at visits with DMARD starts			0.02
Remission	12 (11.6%)	4 (6.5%)	0.27
Low disease activity	32 (31.1%)	10 (16.1%)	0.03
Moderate disease activity	44 (42.7%)	21 (33.9%)	0.26
High disease activity	15 (14.6%)	27 (43.5%)	<0.001

NP, nurse practitioner; PA, physician assistant; DMARD, disease-modifying anti-rheumatic drug. Laboratory and radiology tests refer to at least one order.

Table 3

Disease Modifying Anti-Rheumatic Drugs Used by Patient (Not per Visit)

	NP or PA	Rheumatologist only	p-values
Patients	158	143	
Synthetic DMARDs, any	135 (85.4%)	105 (73.4%)	0.01
Methotrexate	105 (66.5%)	73 (51.1%)	
Hydroxychloroquine	40 (25.3%)	35 (24.5%)	
Sulfasalazine	6 (3.8%)	5 (3.5%)	
Leflunomide	29 (18.4%)	20 (13.9%)	
Gold salts	1 (0.6%)	0 (0.0%)	
Auranofin	1 (0.6%)	1 (0.7%)	
Azathioprine	1 (0.6%)	5 (3.5%)	
Biologic DMARDs, any	126 (79.8%)	67 (46.9%)	<.0001
Infliximab	45 (28.5%)	20 (14.0%)	
Etanercept	28 (17.7%)	27 (18.9%)	
Adalimumab	30 (19.0%)	13 (9.1%)	
Abatacept	26 (16.5%)	5 (3.5%)	
Tocilizumab	15 (9.5%)	6 (4.2%)	
Rituximab	7 (4.4%)	8 (5.6%)	
Golimumab	11 (7.0%)	2 (1.4%)	
Certolizumab pegol	6 (3.8%)	0 (0.0%)	
Tofacitinib	0 (0.0%)	4 (2.8%)	
Anakinra	1 (0.6%)	0 (0.0%)	

NP, nurse practitioner; PA, physician assistant; DMARD, disease-modifying anti-rheumatic drug.

Table 4

Adjusted Odds Ratios for Differences in Categorical Disease Activity Measures Compared across Patients Seen in Practices with Nurse Practitioners or Physician Asssistants Versus Those with Rheumatologist Only

Variable	Primary analysis, per visit (OR, 95% CI) *	Secondary analysis, change between visits (OR, 95% CI)*	Secondary analysis, area under the curve (β coefficient) †
NP or PA (vs not)	0.32 (0.17–0.60)	0.98 (0.94–1.03)	−6.35 (p = 0.0055)
Disease activity category at baseline	...	...	9.85 (p < 0.001)
Age, per year	0.99 (0.98–1.02)	1.00 (0.99–1.00)	−0.005 (p = 0.95)
Female gender	2.24 (1.09–4.61)	0.98 (0.93–1.02)	0.34 (p = 0.89)
Duration of RA, per year	1.18 (0.87–1.61)	1.01 (0.99–1.03)	0.92 (p = 0.59)
Seropositive	1.26 (0.69–2.30)	1.02 (0.98–1.06)	1.08 (p = 0.59)
DMARD use, any	0.64 (0.43–0.95)	0.99 (0.94–1.03)	−2.85 (p = 0.20)

Notes: Categorical disease activity measures were remission (0), low disease activity (1), moderate disease activity (2), and high disease activity (3). The disease activity category at baseline was not entered into all analyses since it was part of the outcome. Abbreviations: NP, nurse practitioner; PA, physician assistant; RA, rheumatoid arthritis; DMARD, disease-modifying anti-rheumatic drug.

*Odds ratio (OR) denotes the odds of a one level increase in disease activity, with odds ratios less than one denoting a reduced odds. They were calculated using a proportional odds model that accounted for the hierarchical clustering.

†The β coefficients denote the area under the disease activity curve for the 24 months, with scores of 0–3 interpolated for each month. They were calculated in generalized linear models. Thus, the maximum value would equal 72. The patients seen in practices with mid level providers experienced a lower area under the curve (β = −6.35).

Appendix 1

STROBE Checklist

	Description	Page location
Title and abstract	Indicate study design and give balanced summary of findings	Pages 1–2
Rationale	Explain the rationale for the study	Pages 3–4
Objectives	State study objective(s)	Page 4
Study design	Present key elements of study design	Page 6
Setting	Describe setting, locations, dates	Page 6
Participants	Describe selection criteria and any matching criteria	Page 6
Variables	Define outcomes, exposures, covariates	Page 7
Data sources	Give how each variable was measured	Page 7
Bias	Describe how sources of bias were managed	Pages 7–8
Quantitative variables	How were quantitative variables handled and were categories used	Page 8
Statistical methods	Describe methods of analysis, missing data, sensitivity analyses	Page 8
Participants	Describe numbers of subjects and any reasons for non-participation	Page 9
Descriptive data	Describe study participants and exposures	Page 9
Outcome data	Report number of events or other outcomes	Page 10
Main results	Give unadjusted and adjusted estimates	Page 10
Other analyses	Report sensitivity analyses	Page 10
Key results discussion	Summarize key findings	Page 11
Limitations	Discuss limitations	Pages 12–13
Interpretation	Give a cautious overall interpretation	Pages 11–13
Generalizability	Discuss external validity	Page 13
Funding	Describe sources of funding and potential conflicts	Page 1

Adapted from reference [17]

Appendix 2

Development and Testing of a Modified Clinical Disease Activity Index

One practice had information on three of four aspects of the CDAI – tender joint count (TJC), swollen joint count (SWJ) and physician global (PG). We developed two modifications of the CDAI using de-identified data supplied by John Cush, MD. These data contained all components of the CDAI. The two modifications are described below. We tested each modification against the original CDAI using a multi-level Kappa test. Both modifications performed well, but modification 2 was slightly better and was used to categorize patients from the one practice with only three elements of the CDAI.

	Description of calculation	Weighted kappa (95% confidence interval)	P-value
Modified CDAI 1	TJC+SWJ+ (PGx2)	0.80 (0.75 – 0.85	0.03
Modified CDAI 2	(TJC + SWJ + PG) x76/66	0.91 (0.87 – 0.95)	0.02

Appendix 3

Disease Activity Thresholds for Commonly Used Rheumatoid Arthritis Disease Activity Scores

	DAS28 (0–10)	SDAI (0–86)	CDAI (0–76)	RAPID3 (0–30)
High	>5.1	>26	>22	>12
Moderate	3.2 – 5.1	11.1 – 26	10.1 – 22	6.1 – 12
Low	2.6 – 3.1	3.3 – 11	2.9 – 10	3.1 – 6
Remission	≤ 2.5	≤ 3.3	≤ 2.8	≤ 3

Adapted from Reference [13]. DAS28, Disease Activity Score – 28 joint count; SDAI, Simplified Disease Activity Index; CDAI, Clinical Disease Activity Index; RAPID3, Rheumatoid Arthritis Patient Index of Disease – 3 questions. The range of possible scores is presented in the parentheses.