
The Simplified Disease Activity Index (SDAI) and the Clinical Disease Activity Index (CDAI): A review of their usefulness and validity in rheumatoid arthritis

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ABSTRACT

Composite indices or pooled indices are useful tools for the evaluation of disease activity in patients with rheumatoid arthritis (RA). They allow the integration of various aspects of the disease into a single numerical value, and may therefore facilitate consistent patient care and improve patient compliance, which both can lead to improved outcomes.

The Simplified Disease Activity Index (SDAI) and the Clinical Disease Activity Index (CDAI) are two new tools for the evaluation of disease activity in RA. They have been developed to provide physicians and patients with simple and more comprehensible instruments. Moreover, the CDAI is the only composite index that does not incorporate an acute phase response and can therefore be used to conduct a disease activity evaluation essentially anytime and anywhere.

These two new tools have not been developed to replace currently available instruments such as the DAS28, but rather to provide options for different environments. The comparative construct, content, and discriminant validity of all three indices – the DAS28, the SDAI, and the CDAI – allow physicians to base their choice of instrument on their infrastructure and their needs, and all of them can also be used in clinical trials.

Introduction

The measurement of disease activity in rheumatoid arthritis (RA) has a long history. A variety of instruments have been described and used for this purpose, including various types of joint counts, acute phase reactants, global assessment scales, pain, fatigue, and even more general measures such as anemia, hemoglobin, or body weight. To achieve a more standardized approach, the American College of Rheumatology (ACR),

the European League Against Rheumatism (EULAR), and the World Health Organization/International League Against Rheumatism (WHO/ILAR) have recommended “core” sets of variables to be used in RA disease activity assessment (1-3). These measures included swollen and tender joint counts, patient assessment of pain, patient and evaluator global assessment of disease activity, a measure of the acute phase response, and evaluation of function aspects.

However, due to the high variability of the presentation and course of RA as well as the reflection of different disease characteristics in each of the above variable, no single measure can reliably capture disease activity in all patients; likewise, evaluation of all measures individually is associated with methodological and statistical problems, especially when employed as endpoints in clinical trials (4). All of these different considerations conferred a rationale for “pooling” individual measures of disease activity into composite scores. Such scores: (a) create better consistency in disease activity evaluation across physicians; (b) allow patients to better understand the meaning of “disease activity” by providing a single number; and (c) increase power and reduce sample size requirements in clinical trials (5-7) (Fig. 1). Importantly, consistent and frequent disease activity evaluation and consequent treatment adjustment have been shown to improve outcome, even in the short-term perspective of clinical trials (8). In this respect, a better understanding of the term “disease activity” by the patients is likewise beneficial since – as, for example, in diabetes or hypertension – this can be key for the success of and compliance to therapy (9, 10) (Fig. 1).

The characteristic of a composite index or pooled index is the integration of various single measures into one sum-

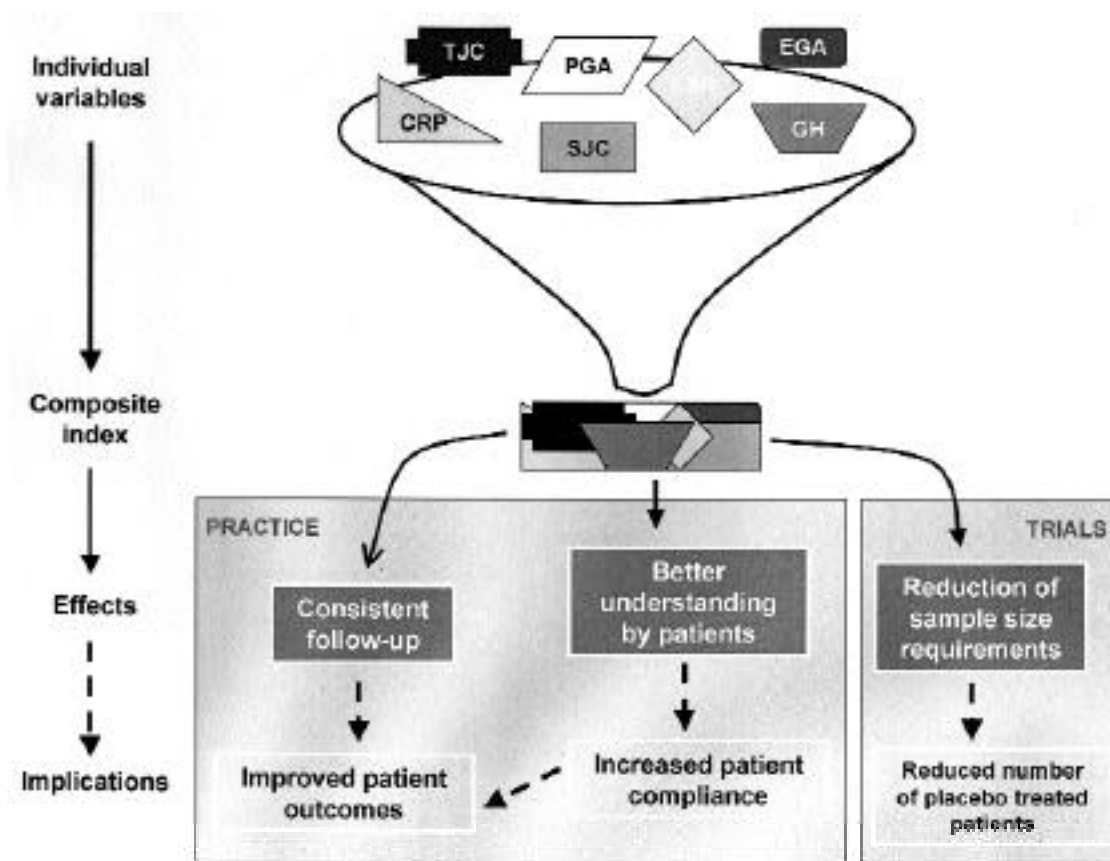


Fig. 1. Rationale for composite indices. The combination of various disease activity surrogates (**top**) in a composite index (**middle**) allows for more consistent follow-up in clinical practice (especially if several physicians are involved) (**left path**) and reduction of sample size requirements in trials (**right path**) (“effects”). This leads to improved patient outcomes in practice or to fewer patients needed on placebo in trials (“implications”). The middle path indicates better understanding of disease activity by the patient, which is likely to increase compliance and improve outcomes. This path might only be applicable to the SDAI and CDAI due to their relatively simple and straightforward composition. In addition, the CDAI might add to the left path by allowing not only consistent, but also more frequent evaluations, since acute phase reactants are not required.

mary number. It should be contrasted to “criteria”, which evaluate disease activity surrogates on the basis of particular cut-off points; these can relate to the categorization of particular states, such as “remission criteria”, or to a classification of response, such as the ACR response criteria (11). Composite indices should also be contrasted with pure self-report questionnaires of disease activity, such as the RADAI (12) or the RADAR (13), which do not comprise objective assessment and rely on the patient’s memory of past activity. Likewise, function and quality of life, although mainly driven by the disease process (14,15), are confounded by irreversible joint damage which may significantly differ among patients. Therefore respective questionnaires do not necessarily measure the degree of disease activity reliably (14,16-18), although they are valuable to obtain a

global view of functional capacity. Examples of such questionnaires are the HAQ (19) and its modifications (20-23), the AIMS (24), and the SF-36 (25).

Elements included in current composite indices

The currently available composite disease activity indices that provide a single number on a continuous scale are the Disease Activity Score (DAS) (26), the DAS using 28 joint counts (DAS-28) (27), the Simplified Disease Activity Index (SDAI) (28), and the Clinical Disease Activity Index (CDAI) (29) (Table I). In Table I the individual elements included in these scores are presented and their theoretical ranges are calculated based on their respective formulae.

All indices use a 28 swollen joint count and a 28 tender joint count, except for the original DAS, which employs the

Ritchie Articular Index (a graded assessment of 26 joint regions) (30) to evaluate tenderness and a 44 joint count to assess swelling. Acute phase reactants are integrated into the DAS (ESR), DAS28 (ESR), and SDAI (CRP), but not the CDAI. Although formulae for the DAS and DAS28 are available which include CRP instead of ESR, these scores have not yet been fully published and validated.

All of these indices include a patient self-report measure. While it is defined as “patient global assessment of disease activity” (PGA) in the SDAI and CDAI, it is defined as “global health” (GH) in the DAS and DAS28. Conceptually “global health” includes several aspects of health outcomes – that is, also those not or not directly related to disease activity. Frequently, the PGAs used as a substitute for GH in the DAS and DAS28 calculation (31), although

Table I. Elements of composite indices and their potential contributions* to the total index.

Elements	SDAI	CDAI	DAS	DAS28
Number of swollen joints	Simple count (0-28)	Simple count (0-28)	More extensive joint counts (0-2.86)	Simple count, square root transformed (0-1.48)
Number of tender joints	Simple count (0-28)	Simple count (0-28)	Ritchie Index: graded joint counts; square root transformed (0-4.77)	Simple count; square root transformed (0-2.96)
Acute phase reactants	CRP in mg/dL (0.1-10.0)	–	ESR, log transformed (0.23-1.51)**	ESR, log transformed (0.49-3.22)**
Patient global health	–	–	VAS in mm (0-0.72)**	VAS in mm (0-1.40)**
Patient global disease activity	VAS in cm (0-10.0)	VAS in cm (0-10.0)	–	–
Evaluator global disease activity	VAS in cm (0-10.0)	VAS in cm (0-10.0)	–	–
Total index	No immediate scoring due to CRP; simple calculation possible (0.1-86.0)	Immediate scoring possible; simple calculation possible (0-76.0)	No immediate scoring due to ESR; calculator required (0.23 – 9.87)	No immediate scoring due to ESR; calculator required (0.49-9.07)

*Based on the transformation and weighting of individual elements according to the formula of the respective index; assumed ranges are 2 to 100mm/h for ESR, and 0.1 to 10mg/dL for CRP.

**The DAS and DAS28 formulae have also been modified to include CRP instead of ESR, and to substitute the patient global health by a constant. These versions are less commonly used and not well validated.

these indices have not been derived in that way. The SDAI and CDAI include the “evaluator global assessment of disease activity” in addition to the PGA. While the PGA is a subjective measure, the evaluator global integrates subjective and objective measures that are obtained and available to the evaluator. In clinical practice, very rarely is one of them assessed individually without the other, and patients usually view their disease as more active than do their physicians, as can be seen in most clinical trials and observational databases (32).

Rationale for the development of the SDAI

The development of the SDAI was originally based on the notion that the available non-dichotomous disease activity indices of those days, the DAS and the DAS28, although ingenious as continuous scales and highly valuable in clinical studies of RA, might be too complicated for disease activity assessment in clinical practice, since their complex formula required additional tools such as a nomogram, a calculator

or a computer (28). The idea to simply employ a numerical summation of the values of a derived set of disease activity variables reflecting inflammatory joint disease was first proven to be valid and sensitive to change in patients with reactive arthritis in the context of the development and validation of the Disease Activity index for Reactive Arthritis (DAREA) (33). Subsequently, this concept was implemented and validated for RA using several clinical trial datasets (28, 34-36).

Thus, the SDAI constitutes a simple numerical addition of individual measures on their original scale and overcomes the problems of the transformations and weighting that are used in other composite indices with the consequent need for a calculator. Also, the SDAI includes both the patient and the evaluator global assessments of disease activity, which adjusts for the frequently observed discrepancy between these two measures (see above). The inclusion of CRP instead of ESR was made for several reasons: CRP is one of the most reliable measures of the acute-phase response and is responsive to

changes in tissue damage (37); it is a direct measure of the acute phase response and is less confounded by other factors compared to ESR, hence more precisely reflecting RA activity (34, 38); and it might be more useful in clinical trials due to the fact that a central laboratory can be used. Similar arguments have also been marshalled to support the modification of the DAS and DAS28 formulae that comprise CRP instead of ESR (31). CRP expressed in mg/dL, as employed in the SDAI, provides a sensible range of values for use in an unweighted additive score.

Another effect of integrating disease activity into a single number is the potentially better understanding it affords patients of the clinical concept of activity as the basis for treatment decisions (Fig. 1). The simple formula of the SDAI may help patients to understand what a measurement means in terms of disease activity. Also, patients (and physicians) might more clearly understand what a particular increment on the SDAI scale means clinically; this is not intuitively possible on the DAS and DAS28 scales. However, as mentioned

Table II. Validation of the SDAI in the leflunomide cohorts (28).

Cohort	Time	Correlation with DAS28		Correlation with HAQ	
		Cross-sectional	Changes	Cross-sectional	Changes
MN301, baseline	Baseline	0.91	-	0.46	-
MN301, 6 months	6 months	0.93	0.90	0.63	0.56 (0.56)
MN302, baseline	Baseline	0.91	-	0.36	-
MN302, 12 months	12 months	0.91*	0.90*	0.53	0.57 (0.47)
US301, baseline	Baseline	0.80	-	0.44**	-
US301, 12 months	12 months	0.91*	0.92*	0.66**	0.48** (0.56)

*Performed with 6 month data; **modified HAQ.

above (Fig.1), the patients' understanding of disease activity measures can improve outcomes; although this has not yet been investigated in RA, analogies from other diseases may be inferred (9, 10). The simple evaluation of the SDAI enables patients to know their index, just as patients with diabetes know their blood glucose levels and HbA1c and understand the meanings of these parameters.

Removing the CRP from the SDAI: The rationale for the CDAI

The DAS, DAS28, and SDAI contain an acute phase response (APR) measure in their formula. Although the inclusion of CRP or ESR increases the face validity and content validity of an index, an abbreviation of the SDAI sparing the CRP was deemed practical for several reasons (29).

First, laboratory test results are frequently missing at patient visits and thus a consistent evaluation using a composite score is hampered or delayed. Some physicians tend to use previous APR measurements in order to calculate composite indices, but this approach is not ideal since it contaminates the evaluation of current RA activity with previous activity. However, in clinical practice the lack of APR frequently leads to the ignoring of APR and to the making of judgmental decisions, leading to loss of consistency in the follow-up (Fig. 1). This loss of consistency is a concern in clinics where patients are not generally seen by the same physician at each visit; it also reduces the potential to make immediate therapeutic decisions and thus the potential benefit of intensifying therapy (8).

Second, APR values correlate with each of the other core set variables, especially those employed in the composite indices, suggesting that they may not add importantly to a composite score (39). Finally, the ACR criteria as well, which were developed to evaluate response to treatment, do not necessarily require improvement in APR: APR comprises only one of five measures, of which only three need to change by more than 20%. Nevertheless, the ACR response criteria and the EULAR response criteria (based on the DAS28) were shown to have comparable validity (40).

The statistical validity of excluding CRP from the SDAI was extensively tested in the original CDAI study (29). Although CRP did not show significant co-linearity with other measures in the SDAI, it was found that only 5% of the SDAI remained unexplained without CRP; in the DAS28, ESR contributed only ~15%. Since a significant proportion of patients have normal or near normal CRP and ESR (41), this might be a yet another reason for the relatively small contribution of APR to composite indices.

Validations of the SDAI and CDAI Association with the DAS28 and the ACR response criteria

The SDAI and CDAI were validated in the original studies which they were developed in, using additional cohorts of patients. The SDAI was derived and tested in one leflunomide dataset (MN301, n = 358), and was then validated in two additional datasets (MN302, n = 999; and US301, n = 482) (Table II). It was later further validated in a cross-sectional cohort (42) and in an incep-

tion cohort (29), and also by several other authors (43-45). The CDAI has been validated in both a cross-sectional (routine) cohort and in an inception cohort. Some aspects of the CDAI had already been examined in the SDAI study (28) (correlation of CDAI changes with HAQ changes). In the original study (28), the SDAI was correlated with the DAS28, where it generally showed a Pearson coefficient of > 0.9 at baseline and after 6-12 months (Table II); changes in SDAI and DAS28 were likewise correlated at ~0.90 (Table II). Although a good correlation can be expected between indices that share some components, the SDAI includes the CRP instead of ESR (which correlate at a Pearson coefficient of ~0.6) and in addition includes the physician global assessment. However, the most intriguing aspect of the excellent correlation between SDAI and DAS28 is the fact that the components of the DAS28 are transformed and weighted before they are summed to constitute the total index.

For the validation of the CDAI, we performed Pearson correlation analysis between SDAI, CDAI, and DAS28 in an inception cohort (n = 91 patients) and in a cross-sectional routine cohort (n = 279 patients) as mentioned above. In the inception cohort we looked at the respective correlations at baseline and after 12 months of follow-up (Fig. 2a); in the routine cohort we analyzed the first and the third visit of patients, which were separated by an average of 6.8 months (Fig. 2b). It can be seen that in the various analyses the SDAI and CDAI values correlated almost perfectly, and that the correlation between the

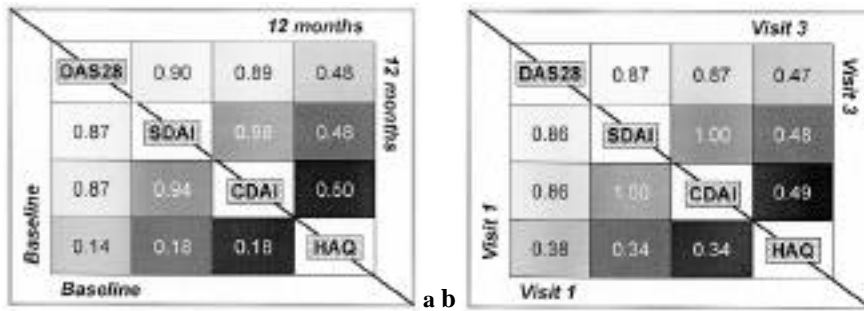


Fig. 2. Cross-sectional correlation of DAS28, SDAI, CDAI, and HAQ in an inception cohort of 91 RA patients (a) and a routine cohort of 279 RA patients (b). The correlation coefficients are tabulated for baseline and 12 months for the inception cohort (a) and for the first and third visit for the routine cohort (average lag: 6.8 months) (b). All correlations were significant at the $p < 0.001$ level, except for the baseline correlations with the HAQ in the inception cohort.

SDAI or the CDAI and the DAS28 was generally likewise very good at 0.87 – 0.90. The changes between the various scores were likewise highly correlated (Fig. 3). All of the cross-sectional correlations and correlations of changes between these indices were highly statistically significant ($p < 0.001$).

The ACR response criteria classify response to treatment into various categories depending on the amount of relative improvement in several core set variables, and have served as the mainstay of treatment evaluation in clinical trials over the past decade. The SDAI study showed more average improvement in the higher ACR response categories (Fig. 4, left panel). The same was seen for SDAI changes and for CDAI changes in the inception cohort and the routine cohort (Fig. 4, left and

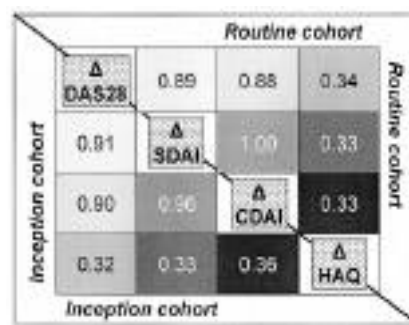


Fig. 3. Correlation of changes in the DAS28, SDAI, CDAI, and HAQ in an inception cohort of 91 RA patients (below the diagonal line) and a routine cohort of 279 RA patients (above the diagonal line). Pearson correlation coefficients are tabulated and were significant at the $p < 0.001$ level.

middle panels). In the routine cohort, the changes were much smaller due to the lower baseline activity of patients,

but they were still graded despite the fact that most patients fulfilling the ACR50 criteria were also ACR70 responders. Importantly there was no difference between the grading seen for the SDAI or the CDAI compared to the more complex DAS28 (Fig. 4, right panel).

In the original SDAI study, validity was further evaluated using a survey of patient profiles among 21 rheumatologists. This analysis showed that the SDAI had an excellent agreement with the physician’s ratings of the patients’ disease activity (28).

Association with function

The correlation with the Health Assessment Questionnaire Disability Index (HAQ) scores was very similar for the SDAI and the DAS28 in the original study (Table II) and in our two additional cohorts (Fig. 2a,b), although the degrees of correlation varied considerably across the various cohorts. Generally, correlations of the composite scores were lower at baseline and higher at follow-up, which indicates that the HAQ might not reflect high levels of disease activity sufficiently. In the trial populations (Table II), the correlations with HAQ scores were higher than in the observational cohorts (Fig. 2a,b). All of these effects were similar regardless of which index was used. Changes in composite scores were correlated with changes in the HAQ scores with r

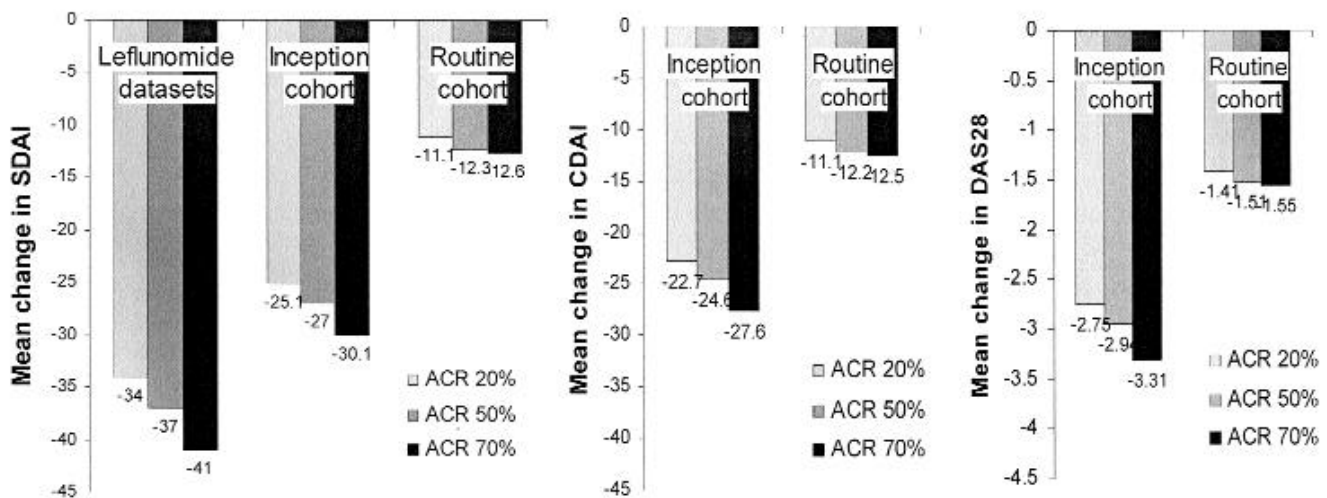


Fig. 4. Changes in the composite indices in relation to the degree of the ACR response. Bars depict the mean changes in SDAI (a), CDAI (b), and DAS28 (c) in patients achieving 20%, 50%, and 70% responses according to the ACR criteria. In the leflunomide datasets, 1,839 patients were evaluated after 6 months; in the inception cohort 91 patients were evaluated after 12 months; in the routine cohort, 279 patients were evaluated after a mean of 6.8 years.

= ~0.3 in the observational cohorts (Fig. 3) and $r = 0.5\text{--}0.6$ in the trial cohorts (Table II). The correlation of CDAI changes with HAQ changes has also already been investigated in the original SDAI study (28), revealing very similar coefficients compared to the SDAI-HAQ correlation ($r = 0.47\text{--}0.56$).

Association with radiographic changes

The association with radiographic damage was assessed using different approaches. In the original SDAI study (28), it was shown that radiographic scores increased in a graded fashion in patients with no SDAI improvement (SDAI change <10 points; mean change in the Sharp score: 3.2) compared to those with minor response (10-21 points; change in Sharp score: 1.9), and those with major response (>22 SDAI points; change in Sharp score: 1.1). These results were less graded if the DAS28 response was used (mean change in the Sharp score: 1.1, 3.5, 3.2, respectively for no response, minor, and major response). In the CDAI study, 56 patients with a complete 3-year radiographic follow-up were evaluated. The time-integrated CDAI, SDAI, and DAS28 scores were similarly correlated with the change observed in the Larsen scores ($r = 0.54, 0.59, \text{ and } 0.58$, respectively).

Remission and active disease

Definition of cut-off points

Aside from measuring disease activity on a continuous scale in individual patients, it is important to define the states of disease activity that a patient experiences. On the one hand this allows one to define the criteria for treatment initiation/switch (e.g., high disease activity or moderate disease activity) or for curtailing treatment (e.g., remission or low disease activity), and on the other hand it opens up additional possibilities for the characterization of new drugs in trials based on the proportion of patients who achieve a particular state as an additional outcome.

These notions have led to the determination of cut-off points to differentiate activity states. These states are tradi-

tionally remission, low disease activity, moderate disease activity, and high disease activity. For the original DAS, these cut-off points were defined in 1996 in a study by Prevoo *et al.* (46) using a modification of the ARRemission criteria (47) as the gold standard. In contrast, none of the DAS cut-off points for other states nor any of the DAS28 cut-off points have been derived in a formal study (48) (Table III, "original definition"). Furthermore, the original study by Prevoo *et al.* was based on data from therapeutic approaches dating to almost a decade ago. Therefore, recently the issue of disease activity states was newly addressed in an extensive study based on opinion data (49). In that study, 35 expert rheumatologists rated 32 patient profiles with different presentations. The adjudications by these experts served as the gold standard for three conceptually different analytic approaches to determining DAS28 and SDAI cut-off points accurately. All three approaches led to very similar results, and final estimates were proposed (49) as shown in the "newly proposed definition" in Table III.

In addition, we now show data on the respective CDAI cut-offs which we derived using a strategy and analysis plan identical to the one in the study on the SDAI and DAS28 cut-off points (49). To date no such cut-off points have been presented for the CDAI. In comparison to the SDAI cut-off points, the newly determined CDAI cut-off points reasonably reflect the absence of CRP in that score. For example, the remission cut-off point for the SDAI is 3.3, and the one for the CDAI is 2.8, i.e. a 0.5 difference, which corresponds to the usual upper level of the normal range and the expected level of CRP (in mg/dL) in patients near remission. These intuitive results are an additional validation of the methods used to derive the cut-off.

Validation of the cut-off points

Declaring a patient to be in a particular disease activity state has two sources of variation: first, the disease activity index it is based on, and second, the particular cut-off used for this index.

Therefore, it is important to investigate by how much a patient's classification differs if different scores are used.

One way is to look at agreement using Kappa statistics, which return a number between 0 and 1 that corresponds to the level of agreement beyond chance. In Figure 5, the Kappa values for each of the three pairs of indices is shown, and indicate substantial agreement between the DAS28 and the SDAI or the CDAI (50). This corresponds to approximately two-thirds of patients who are classified concordantly. In only ~1% of the patients were disease activity states classified as being two categories higher in one score than in the other. No patient was classified as being in remission by one index/cut-off and at the same time as having high disease activity by another (Fig. 5). Agreement between SDAI and CDAI was almost perfect with ~90% of patients concordantly classified. This again indicated that CRP is not a decisive measure, at least for the purpose of patient classification.

The average level of residual disease activity in patients in DAS28 remission was different from the levels in patients in SDAI or CDAI remission (49). This is most likely due to the DAS28 formula, which allows patients to be classified as "in remission" despite the presence of a considerable number of residual swollen joints (up to 13/28 joints in our cohort) or high patient global scores (up to 67/100 mm). It also allows patients to have potentially high pain scales, which do not form part of any of these indices; patients in SDAI or CDAI remission in this cohort did not have pain levels exceeding 54/100 mm, while those in DAS28 remission had pain scores of up to 76/100 mm (49). Similar data have been observed by others (51). However, these pain scores might incorporate chronic damage in addition to disease activity, and therefore can be disconnected from other measures of activity.

Comparative usefulness of indices as tests for disease activity states

The usefulness of a composite index as a "test" for disease activity and disease activity states can be analyzed using Receiver Operating Characteristics

Table III. Cutoff values for different disease activity states.

Index	Disease activity state	Original definition	Newly proposed definition
SDAI	Remission	5	3.3
	Low disease activity	20	11
	Moderate disease activity	40	26
	High disease activity	> 40	> 26
CDAI	Remission	-	2.8
	Low disease activity	-	10
	Moderate disease activity	-	22
	High disease activity	-	> 22
DAS28	Remission	2.6	2.4
	Low disease activity	3.2	3.6
	Moderate disease activity	5.1	5.5
	High disease activity	> 5.1	> 5.5

(ROC) curve analysis. The area under the ROC curve (AUC) corresponds to the overall analysis for accuracy of a test, with an AUC of 1.0 indicating a perfect test and an AUC of 0.5 indicating a useless test.

Soubrier *et al.* (44) tested the accuracy of SDAI and DAS28 (in its various modifications) using the rheumatologist’s clinical decision to start a new DMARD as the gold standard (which essentially relates to moderate or high disease activity). The AUC was highest for the SDAI (0.914), and lower for all forms of the DAS28: the AUC of the DAS28 versions using 3 variables were lower than the AUC of the 4 variable versions, and the AUC of the DAS28

versions including CRP were higher than those of the DAS28 versions including ESR. The AUC of the DAS28 versions were 0.863 (4 var, ESR), 0.888 (4 var, CRP), 0.839 (3 var, ESR), and 0.878 (3 var, CRP).

In a similar analysis using the explicit judgment of the physicians with regard to moderate or high disease as the gold standard (ratings obtained from the survey mentioned above), we found similar results. The SDAI had the highest AUC (95% confidence interval) of 0.958 (0.947 to 0.969). The AUC of the DAS28 and CDAI followed closely behind, and were almost identical: 0.952 (0.940 to 0.963) and 0.949 (0.936 to 0.961), respectively.

Another recent study from Belgium showed a higher AUC for the DAS28 (0.840) than for the SDAI (0.824) or CDAI (0.821). The gold standard in this investigation was the decision of the rheumatologist to increase the infliximab dose in patients on a particular clinical protocol, which served as a surrogate for insufficient control of the disease, i.e. moderate or high disease activity. However, from the report of the original study (52) it appears that the physicians were in fact using the DAS-28 to guide their decisions, which were later used as the gold standard. If this was truly the case, it would explain the different ranking of the composite indices compared to the other studies, but essentially all three studies indicate that there is no important difference in the diagnostic accuracy between the simplified indices and the DAS28. Therefore, in this respect as well it seems that the measures included in all three composite scores are major determinants of their comparable validity, and that this is not jeopardized by omitting the transformations and weighting of these measures.

Conclusion

Therapy for rheumatoid arthritis has seen great progress over the past 10 years, including the approval of new drugs and the implementation of new strategies. Given these possibilities,

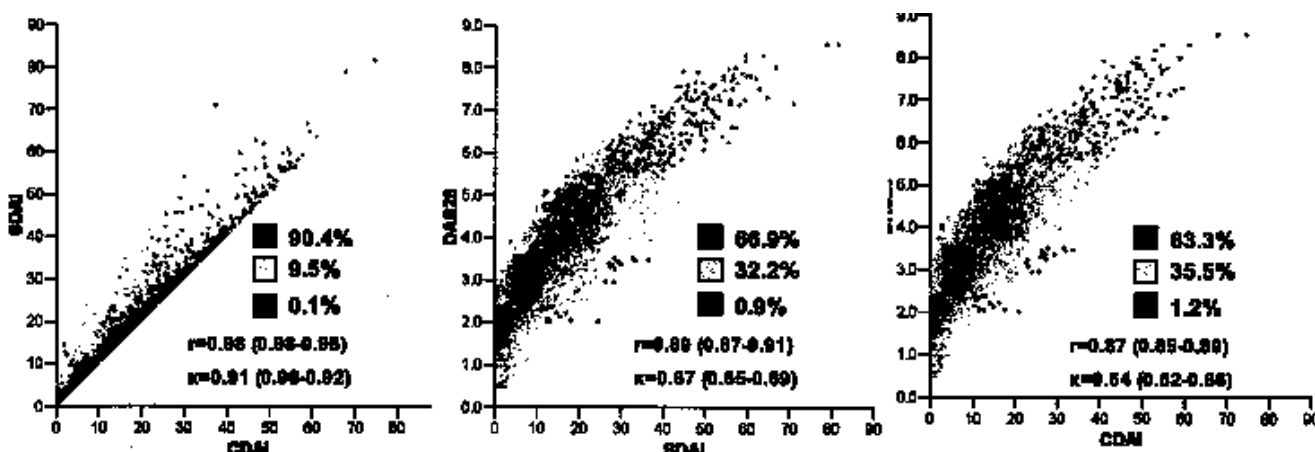


Fig. 5. Correlation of different indices and agreement on the definition of disease activity states. Scatter plots show pairs of values for SDAI, CDAI, and DAS28 in 2,754 patient observations. The corresponding Pearson correlation coefficients (and 95% confidence intervals) are shown as inserts. The agreement on disease activity states is coded as: dark grey = same category; light grey = different by one category; and black = different by two categories. The corresponding proportions are given as the percent of all observations, and the weighted kappa (and 95% confidence interval) is presented as a statistical mean of agreement.

long-term remission, normalization of physical function and sustained quality of life are now achievable for many patients. However, the progress in therapeutic modalities and strategies has been faster than the refinement of the outcome measures in RA. In accordance with these achievements and in stark contrast to past times ("past" meaning even less than a decade ago), these measures need to be reliable especially in the low disease activity range. Furthermore, there is an increased need for independence from large clinical settings as a prerequisite of successful follow-up and good outcome in the majority, and ideally in each and every patient. The DAS28 has served the rheumatologic community very well for more than a decade. It has evened up the path for the assessment of disease activity rather than simply evaluating relative responses to therapy. However, not surprisingly, some limitations have emerged, as they tend to do with any measure, for example the lower specificity of the DAS28 when it comes to low disease activity and in particular remission, not to mention its complex formula. This limitation, however, only became important recently, when low disease activity and remission became major and achievable goals of RA therapy, and therefore the ability to accurately measure disease activity at the lower end of the scale came into focus for all potential instruments.

The greatest advantage associated with the CDAI is its potential to be employed in the evaluation of patients with RA consistently, with close frequency, and independently of any calculating device (8), since it can essentially be evaluated everywhere and anytime. In addition, the better understanding of the scores by the patients could contribute to improving outcomes, which makes the simple SDAI and CDAI potentially useful not only for evaluation, but also for improving outcomes. Such scores will allow physicians to encourage their patients to keep track of their "Index". This brief and clear message to the patients may also ensure better consistency in evaluations, since patients could ask for their "actual" index value re-

gardless of who their personal physician is, just as patients with diabetes usually want to know their HbA1c results.

The introduction of new tools such as the SDAI and the CDAI was not aimed at competing with the DAS28, which remains the most extensively validated activity index for RA, but rather to provide new views and create new options; to satisfy the calls for more comprehensible indices, both for physicians and patients, and for tools that will allow immediate treatment decisions without being solely based on self-reporting. The simple formulae of the SDAI and CDAI have been shown not to detract from the validity of the disease activity assessment in many direct comparisons with the DAS28, and also with respect to response criteria, functional instruments, and radiographic progression. It is important to know that all these composite indices have comparable validity, so that physicians can pick the tool that works best in their clinical setting, given their practical needs and constraints.

Although the SDAI and the CDAI were primarily developed for use in clinical practice, they have turned out to be equally valid and reliable in clinical trials. Thus, one of these simple indices could be employed unrestrictedly in clinical studies and in routine practice.

Rheumatoid arthritis has always been the disease prototype for rheumatologists with respect to the development of novel therapeutics and novel measures. It might be worthwhile to test the concept of the SDAI and CDAI also for other entities as well, especially those where reliable measures of disease activity are scarce, such as psoriatic arthritis or ankylosing spondylitis. The development and use of the SDAI and CDAI for RA has demonstrated that instruments can offer greater practicability and comprehensibility without necessarily sacrificing construct, content, and discriminant validity, and might even have higher face validity.

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The Simplified Disease Activity Index (SDAI) and the Clinical Disease Activity Index (CDAI): A review of their usefulness and validity in rheumatoid arthritis. Introduction The measurement of disease activity in rheumatoid arthritis (RA) has a long history. Elements included in current composite indices The currently available composite disease activity indices that provide a single number on a continuous scale are the Disease Activity Score (DAS) (26), the DAS using 28 joint counts (DAS-28) (27), the Simplified Disease Activity Index (SDAI) (28), and the Clinical Disease Activity Index (CDAI) (29) (Table. I). In Table I the individual elements included in these scores are presented and their theoretical ranges are calculated based on their respective formulae. Assessment of disease activity in rheumatoid arthritis (RA) should be viewed as a dynamic, on-going process; many experts recommend assessing the Clinical Disease Activity Index (CDAI) at every patient visit. Early treatment is important for optimal RA outcomes, and the CDAI can help give a gestalt view of a patient's disease severity and activity. The CDAI provides an excellent overview of a patient's disease severity (it correlates closely with the SDAI which requires laboratory data) and the DAS-28 (which is a much longer, 28-joint assessment). The CDAI can also help guide therapy base Aletaha D, Smolen J (2005) The Simplified Disease Activity Index (SDAI) and the Clinical Disease Activity Index (CDAI): a review of their usefulness and validity in rheumatoid arthritis. *Clin Exp Rheumatol* 23(Suppl 39):S100-S108PubMedGoogle Scholar. 7. Osborne RH, Wilson T, Lorig KR et al (2007) Does self-management lead to sustainable health benefits in people with arthritis? A 2-year transition study of 452 Australians. *J Rheumatol* 34:1112-1117PubMedGoogle Scholar. 8.