Validation of systemic lupus erythematosus disease activity score (SLE-DAS) in a Russian cohort of patients

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Abstract

Background: Systemic lupus erythematosus (SLE) is a heterogeneous autoimmune disease characterized by fluctuating activity affecting multiple organ systems. Timely and accurate assessment of disease activity is critical for guiding clinical decisions and implementing treat-to-target strategies. The Systemic Lupus Erythematosus Disease Activity Score (SLE-DAS) is a recently developed, continuous, and weighted index for disease activity, though it has not yet been validated in Russian patients.

Objective: To validate SLE-DAS in a Russian cohort of patients with SLE.

Methods: We prospectively enrolled 200 SLE patients followed for ≥12 months at the V.A. Nasonova Research Institute of Rheumatology. The median age was 35.0 [26.0–43.0] years; 84.5% were female. Median disease duration was 63.0 [22.0–158.0] months. Clinical and laboratory data were analyzed to assess SLE-DAS performance. Internal consistency of SLE-DAS was assessed using Cronbach's alpha. Convergent validity was evaluated via correlation with the Systemic Lupus Erythematosus Disease Activity Index 2000 (SLEDAI-2K) and Physician Global Assessment (PGA). To compare the ability of SLE-DAS and SLEDAI-2K to identify active SLE, we performed a receiver operating characteristic (ROC) analysis with determination of the area under the curve (AUC), sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and Cohen's kappa. Responsiveness was analyzed using the Wilcoxon test, SRM, and Cohen's d.

Results: At baseline, the median SLEDAI-2K was 8.0, PGA 0.99, and SLE-DAS 8.38. SLE-DAS showed excellent convergent validity (ρ = 0.878 with both SLEDAI-2K and PGA). Internal consistency was moderate for binary components (α = 0.663), while quantitative variables showed low agreement. According to DORIS remission framework, 90.5% of patients had active SLE. ROC analysis showed high diagnostic accuracy: AUC = 0.899 for SLE-DAS and 0.870 for SLEDAI-2K. After reclassifying 23 patients on glucocorticoids >5 mg/day without clinical activity as inactive, SLE-DAS showed superior performance: AUC = 0.973, sensitivity 96.2%, specificity 97.6%, PPV 99.3%, NPV 82.4%, κ = 0.86. Responsiveness at 6 and 12 months was also confirmed (SRM = –0.78 and –0.66, both $p < 0.0001$).

Conclusion: SLE-DAS is a valid, responsive, and accurate tool for assessing SLE activity in Russian patients and may improve clinical monitoring in routine practice.

Keywords: Systemic lupus erythematosus; Systemic lupus erythematosus disease activity score; SLE-DAS; Validation study; Disease activity.

Key messages

- SLE-DAS is a novel index that enables accurate, continuous, and responsive assessment of disease activity in SLE
- First validation of SLE-DAS in Russia shows strong performance versus SLEDAI-2K and excellent agreement with clinical disease activity
- Our findings support the use of SLE-DAS in routine clinical practice and research settings in Russia.

Introduction

Systemic lupus erythematosus (SLE) is a chronic autoimmune rheumatic disease characterized by a breakdown of immune tolerance, activation of autoreactive T and B cells, and subsequent overproduction of autoantibodies against nuclear antigens, ultimately leading to immunoinflammatory damage in multiple organs[1,2]. The clinical manifestations of SLE are variable, ranging from mild symptoms to severe, life-threatening organ damage[3].

Although timely diagnosis of SLE is essential, early diagnosis alone is insufficient in real-world clinical practice. Equally important is the ongoing assessment of disease activity. The choice of an optimal quantitative tool for assessing SLE activity remains a subject of continued debate and investigation. Accurate and timely evaluation of disease activity is essential, as it allows for comprehensive characterization of the patient's clinical profile, supports the rationale for further diagnostic work-up, and facilitates consistent longitudinal management across different clinicians. Moreover, reliable activity assessment is fundamental for implementing treat-to-target strategies, detecting flares, and recognizing both typical and atypical disease manifestations. It also plays a critical role in selecting appropriate candidates for biologic therapies or clinical trials and in providing an objective measure of therapeutic response, particularly in the context of biologic agents.

SLE activity encompasses the cumulative burden of clinical signs and serological abnormalities across multiple organ systems[4]. The disease typically follows a relapsing-remitting course, with periods of remission interrupted by disease flares[5]. However, defining a flare remains challenging due to the heterogeneous and dynamic nature of SLE, with significant variability in disease manifestations between and within individuals[6].

Disease activity and the frequency of disease flares are major contributors to morbidity and mortality in SLE[7,8]. Despite extensive research, no single validated and reliable biomarker is currently available for monitoring SLE activity. Traditional immunological markers – such as low C3 and C4 levels and elevated anti-double-stranded DNA (anti-dsDNA) antibodies – have long been associated with active disease and an increased risk of flares. However, many patients continue to exhibit these serological abnormalities even after their clinical symptoms have been resolved. This discrepancy, known as serologically active but clinically quiescent SLE, raises important questions about the usefulness of these markers for guiding treatment decisions, predicting imminent flares, and assessing true disease control[9].

Activity indices therefore play a crucial role in SLE management. They help clinicians characterize current disease manifestations, monitor changes over time, and support therapeutic decision-making. They also provide researchers with standardized measures for studying patient cohorts

and evaluating outcomes in clinical trials[10]. An ideal activity index should comprehensively capture all relevant domains of the disease (reflecting strong content validity), be sensitive to change in order to detect treatment responses or flares and offer reliability and objectivity across different clinical settings[11].

In 2019, D. Jesus *et al.* developed and validated a new tool to assess SLE activity, the Systemic Lupus Erythematosus Disease Activity Score (SLE-DAS), which was derived applying multivariate linear regression analysis with Physician Global Assessment (PGA) as dependent variable[12]. The SLE-DAS index includes 17 items of SLE activity in different organ systems, 13 of which are dichotomously scored as present or absent and 4 as numerical variables (number of swollen joints out of 28, proteinuria, thrombocytopenia and leukopenia), with the index itself calculated using a specific weight for each item derived as a linear regression formula. An official free online calculator (available at sle-das.eu) was created to calculate the final score, but it is available in English. Notably, a validated Brazilian Portuguese translation of the SLE-DAS has recently been published[13].

The first validation study showed a good correlation between SLE-DAS and PGA and SLEDAI-2K, and the value of SLE-DAS as a predictor of irreversible damage accrual further supported its construct validity[12]. The delta limit of 1.72 points for SLE-DAS change outperformed the 4-point SLEDAI-2K criterion for detecting clinically significant changes in disease activity[12]. The SLE-DAS definitions for categories of disease activity (remission: SLE-DAS ≤2.08; mild activity: 2.08<SLE-DAS≤7.64; moderate: 7.64 < SLE-DAS ≤ 9.90, severe: SLE-DAS > 9.90) were derived in a tertiary real-life cohort and validated in a large multicenter, multiethnic cohort, including patients from two lupus clinics and populations from five clinical trials[14,15].

The aim of the study is to validate SLE-DAS on a Russian cohort of patients.

Materials and methods

The study included 200 patients with SLE who were followed up in V.A. Research Institute of Rheumatology. All patients included in the study signed informed consent. All patients had standard clinical, laboratory and instrumental examinations before inclusion in the study and during follow-up.

The diagnosis of SLE was based on the classification criteria of the Systemic Lupus International Collaborating Clinics (SLICC) 2012[16]. Disease activity in the previous 30 days was scored, using Physician Global Assessment (PGA) (0–3) and SLEDAI-2K[17,18]. Organ damage was assessed using the SLICC / American College of Rheumatology damage index (ACR)[19].

The study was approved by the Ethics Committee at the V.A. Nasonova Research Institute of Rheumatology (Protocol №25 dated 15.12.2022).

Permission to adapt the SLE-DAS index into Russian was obtained from Professor Luís Sousa Inês [20] the following steps were performed: direct and back translation of the SLE-DAS index; expert examination of the text; formation of the preliminary version; approval of the test version; and formation of the final version. We used the calculator on the sle-das.eu website to calculate the SLE-DAS index.

Quantitative variables were described using the median (Me), 25th and 75th percentiles. Qualitative variables were presented as frequencies. The Shapiro-Wilk test was used to assess the normality of data distribution. Spearman's rank correlation coefficient (rs) was applied for correlation analysis. Internal consistency of SLE-DAS was evaluated by treating its clinical and laboratory components as items of a unified scale, based on the assumption that both types of domains represent interrelated manifestations of the same underlying construct – global SLE disease activity.

Internal consistency of SLE-DAS was evaluated using Cronbach's alpha. Given the different measurement properties of the index components, reliability was assessed separately for binary and quantitative domains. Binary items, reflecting the presence or absence of clinical manifestations, were coded dichotomously (0/1). Quantitative items included swollen joint count (28-joint assessment), proteinuria, leukocyte count, and platelet count. For quantitative components, two approaches were applied: analysis using raw continuous values across all patients and analysis with masking of quantitative variables when the corresponding binary domain was inactive, consistent with the SLE-DAS scoring structure whereby inactive domains do not contribute to the total score. Cronbach's alpha coefficients were calculated independently for each component group using standard reliability statistics.

To determine responsiveness to change, SLE-DAS scores were compared in patients before and after therapeutic intervention and across predefined follow-up timepoints (6 and 12 months), with patient follow-up conducted without specific focus on treatment effectiveness and without analysis of therapeutic response. Depending on data distribution, within-subject changes were assessed using either the paired t-test for normally distributed data or the Wilcoxon signed-rank test for non-normal distributions. Receiver Operating Characteristic (ROC) analysis was used to determine the Area Under the Curve (AUC), sensitivity (Se), and specificity (Sp) of the evaluated parameters. Positive predictive value (PPV) was calculated using the formula: PPV = True Positives / (True Positives + False Positives) × 100%. Negative predictive value (NPV) was calculated as follows: NPV = True Negatives / (False Negatives + True Negatives) × 100%. Differences were considered statistically significant at $p \leq 0.05$.

Statistical analysis was performed on a personal computer using IBM SPSS Statistics 26.0 for Windows (IBM Corporation, USA).

Results

A detailed description of the demographic, clinical, and laboratory characteristics of the SLE patients is provided in Tables I and II.

The categories of SLE activity according to SLE-DAS values are presented in Table III. According to the SLE-DAS, the larger group of patients (n = 91, 45.5%) were categorized as having severe disease activity (see Table III). By contrast, high or very high activity, as defined by SLEDAI-2K, was observed in only 59 patients (29.5%) out of 200 (Table I), with 34 patients (17%) categorized as having high activity and 25 patients (12%) – as having very high activity. SLE-DAS identified high disease activity significantly more frequently than SLEDAI-2K ($p < 0.0001$, OR = 1.99, 95% CI: 1.32–3.01).

The binary components of the SLE-DAS demonstrated moderate internal consistency (Cronbach's $\alpha = 0.663$). In contrast, the quantitative components showed negligible internal consistency, with $\alpha = 0.005$ in the unmasked analysis and $\alpha = 0.0002$ after masking inactive domains. These findings indicate statistical independence among the quantitative measures.

As expected, SLE-DAS correlated with SLEDAI-2K ($rs = 0.878$, $p < 0.0001$) and PGA ($rs = 0.878$, $p < 0.0001$), no correlation was found with SLICC/ACR DI ($rs = -0.039$, $p = 0.58$). In addition, SLEDAI-2K also correlated with PGA ($rs = 0.966$, $p < 0.0001$) and did not correlate with SLICC/ACR DI ($rs = -0.059$, $p = 0.41$).

Inactive SLE was defined according to the DORIS framework, based on the absence of clinical manifestations of SLE, a PGA score < 0.5, and a GCs dose ≤ 5 mg/day. Using these criteria, 181 out of 200 patients (90.5%) were classified as having active disease at the time of assessment.

To compare the performance of the SLE-DAS and SLEDAI-2K indices in identifying active SLE, we performed receiver operating characteristic (ROC) analysis (Figure 1). ROC curve analysis demonstrated excellent discriminatory performance for all indices, with AUC values of 0.870 (0.820–0.921), $p < 0.0001$ for SLEDAI-2K, and 0.899 (0.856–0.942), $p < 0.0001$ for SLE-DAS.

A notable challenge in our cohort was that 23 out of 200 patients (11.5%) continued to receive GCs at doses greater than 5 mg/day despite having no clinical signs of active SLE. For subsequent analyses, these patients were classified as clinically inactive. Based on this adjustment, we assessed the diagnostic performance of the SLE-DAS and SLEDAI-2K indices. SLE-DAS demonstrated a slightly higher AUC values of 0.973 (0.952–0.994), $p < 0.0001$ compared to the

SLEDAI-2K AUC values of 0.956 (0.930–0.981), $p < 0.0001$, indicating better overall accuracy in identifying active SLE (Figure 2).

To further examine agreement with the reference standard, we dichotomized each index using established or literature-supported thresholds (SLE-DAS > 2.08, SLEDAI-2K ≥ 4). Table IV summarizes the agreement between each disease activity index and the clinical presence of SLE activity as measured by Cohen's kappa coefficient, sensitivity, specificity, along with their PPV and NPV.

These results highlight the superior accuracy and agreement of the SLE-DAS in identifying active SLE within the studied cohort.

To evaluate the responsiveness of SLE-DAS, scores were compared at baseline and follow-up visits at 6 and 12 months. Among patients with available paired data at 6 months (n = 106, SLE-DAS median (range) was 2.08 [1.12–7.64]), the mean change in SLE-DAS was –9.47, with a Standardized Response Mean (SRM) of –0.78 and a Cohen's d of –0.69. The change was statistically significant (Wilcoxon signed-rank test, $p < 0.0001$), indicating a moderate to large effect size.

At 12 months (n = 97, SLE-DAS median (range) was 2.08 [1.12–6.47]), the mean change in SLE-DAS was –7.73, with an SRM of –0.66 and a Cohen's d of –0.63 ($p < 0.0001$). These findings confirm that SLE-DAS is sensitive to changes in disease activity over time and is suitable for monitoring treatment response in longitudinal clinical settings.

Discussion

A timely and reliable assessment of disease activity is essential for the management of systemic lupus erythematosus (SLE). Despite the availability of several validated tools for assessing disease activity and damage in SLE (e.g., SLEDAI, SLE-DAS, BILAG-2004), the EULAR core dataset recommendations prioritize consistent organ-based assessment and allow clinicians to select whichever validated instruments they consider most appropriate[21]. This approach ensures flexibility, comprehensive data collection, and alignment with the 2023 EULAR recommendations[21].

Quantifying disease activity is essential for guiding treatment strategies, determining long-term prognosis, characterizing disease trajectory, identifying flares, establishing eligibility for biologic therapy and evaluating therapeutic response. Most existing activity indices are based on objective clinical and laboratory features associated with active SLE. However, as they are typically applied at a single time point, they provide a snapshot rather than a dynamic representation of disease activity over time[22,23].

The recently developed SLE-DAS includes a broader range of disease manifestations including less frequent but clinically significant features such as gastrointestinal, hemolytic anemia, and cardiopulmonary involvement. This comprehensive structure allows for improved sensitivity to change in disease activity compared to traditional tools like SLEDAI-2K or PGA, while maintaining high specificity and user-friendliness[12].

These advantages were confirmed in a prospective cohort study of 326 patients with moderate-to-severe SLE. SLE-DAS, but not SLEDAI-2K, was significantly associated with the risk of hospitalization due to SLE-related complications and comorbidities[24]. Similarly, Wang *et al*. found that patients with moderate-to-severe SLE activity as defined by SLE-DAS were more likely to be hospitalized for both SLE and non-SLE-related causes, whereas SLEDAI-2K activity showed a more limited predictive value[25]. These discrepancies may be explained by the inclusion of cardiopulmonary manifestations in the SLE-DAS, which are not captured by the SLEDAI-2K.

Additional evidence supporting the sensitivity of SLE-DAS, particularly in patients with low disease activity, was reported in a cohort of Latin American patients of Mexican Mestizos ethnicity. In this population, SLE-DAS outperformed SLEDAI-2K in distinguishing low disease activity states. However, the authors noted no significant advantage of SLE-DAS over SLEDAI-2K in patients with moderate to high disease activity[26]. Subsequently, SLE-DAS was validated as a tool for identifying lupus low disease activity, with a proposed cut-off value of ≤ 2.48[27].

The study by Hassan *et al.* demonstrated the superior sensitivity of SLE-DAS in assessing musculoskeletal involvement compared to SLEDAI-2K[28]. In a study by Jesus *et al.*, patients classified as having severe disease activity by both SLE-DAS and BILAG-2004, or by SLE-DAS alone, showed similarly high disease burden based on clinical features and Health-Related Quality of Life (HR-QoL) measures. In contrast, those identified as severe by BILAG-2004 alone appeared to have less pronounced disease severity as perceived by both clinicians and patients[29].

Given the importance of monitoring SLE activity during pregnancy, SLE-DAS has also been evaluated in this context. Its application during the first trimester was shown to predict disease flares in the second and third trimesters, supporting its role as a reliable tool for assessing disease activity in pregnant patients with SLE[30].

Our findings confirm that SLE-DAS is a valid and informative tool for assessing disease activity in Russian patients with SLE. The index demonstrated strong convergent validity. High correlations were observed between SLE-DAS and both SLEDAI-2K (rs = 0.878) and the PGA (rs = 0.878). According to the DORIS criteria, 90.5% of patients were classified as having active SLE.

Both SLEDAI-2K and SLE-DAS showed strong discriminatory capacity in ROC analysis. However, SLE-DAS demonstrated a higher AUC (0.899) compared with SLEDAI-2K (0.870), representing a

meaningful improvement in overall diagnostic accuracy. The persistence of GCs use in clinically inactive patients likely reflects continued therapeutic caution among both clinicians and patients, driven by concerns about disease flares and incomplete implementation of steroid-sparing strategies. This pattern highlights ongoing challenges in GCs withdrawal in routine practice and may contribute to discrepancies between clinical activity measures and real-world treatment exposure.

After excluding patients who were clinically inactive but continued taking GCs >5 mg/day, the performance of both indices improved. Even with these stricter criteria, SLE-DAS retained superior diagnostic performance. SLE-DAS demonstrated greater sensitivity (96.2%) compared with SLEDAI-2K (93.0%), greater specificity (97.6%) compared with SLEDAI-2K (69.0%), a higher PPV (99.3%) compared with SLEDAI-2K (91.9%), a higher NPV (82.4%) compared with SLEDAI-2K (72.5%), and stronger agreement with the clinical standard (Cohen's kappa 0.86) compared with SLEDAI-2K (0.63).

SLE-DAS also demonstrated excellent responsiveness to change over time. The mean decreases of –9.47 points over a 6-month period were accompanied by an SRM of –0.78, indicating a moderate to large effect size. Consistently over time, a similar trend was observed at 12 months (SRM = –0.66), supporting the longitudinal applicability of SLE-DAS.

The proposed activity categories for SLE-DAS (remission, mild, moderate, and severe) aligned well with clinician-defined disease activity. Patients classified in remission or with low disease activity were generally clinically inactive, whereas nearly all patients with moderate or severe SLE-DAS scores were clinically active. These findings support the applicability and validity of the proposed thresholds in real-world settings.

This study has several limitations that should be acknowledged. Firstly, while the sample was clinically diverse, it was drawn from a single center, which may affect how generalizable the findings are to other populations within Russia. Secondly, not all patients attended follow-up visits at 6 and 12 months, which could affect the responsiveness analysis and introduce attrition bias

Taken together, these results affirm that SLE-DAS is a valid, sensitive, and clinically relevant index for assessing and monitoring disease activity in patients with SLE. Its performance across multiple domains of validation supports its implementation in routine clinical care and research.

Conclusion

The SLE-DAS was found to be highly valid and clinically useful for assessing disease activity in a Russian cohort of patients with SLE. It showed an excellent correlation with established indices, high diagnostic accuracy and a robust sensitivity to change over time. The proposed activity thresholds also aligned well with disease states defined by clinicians, which supports the applicability of the scale in real-world practice. Due to its comprehensive structure, responsiveness and ease of use, the SLE-DAS scale could be used as a reliable tool for the routine monitoring of patients with SLE, for treatment planning and for research.

Tables and Figures

Table I. Characteristics of the patients included in the study

Baseline characteristics of the patients included		SLE patients n=200
Age, median (years)		35.0 [26.0 – 43.0]
Disease duration, median (months)		63.0 [22.0 – 158.0]
Gender: Female / male, n (%)		169 (84.5) / 31 (15.5)
PGA, median (range)		0.99 [0.58–1.35]
SLEDAI-2K, n (%)	No activity (0)	18 (9)
	Low activity (1-5)	46 (23)
	Mild activity (6-10)	77 (39)
	High activity (11-20)	34 (17)
	Very high activity (>20)	25 (12)
SLEDAI-2K, median (range)		8.0 [4.0 – 12.0]
SLICC/ACR DI, n (%)	No damage (0)	78 (39)
	DI = 1	57 (29)
	DI = 2-4	53 (26)
	DI >4	12 (6)
SLICC/ACR DI, median (range)		1.0 [0.0 – 2.0]
Medication	Glucocorticoids, n (%) / ≤5 mg/day	198 (99) / 33 (16.7)
	Hydroxychloroquine	191 (95.5)
	Immunosuppressants, n (%)	100 (50)
	Biologics, n (%)	78 (39)

SLE - Systemic Lupus Erythematosus; PGA – Physician Global Assessment; SLEDAI-2K – Systemic Lupus Erythematosus Disease Activity Index 2000; SLICC/ACR DI – SLICC/ACR Damage Index – Systemic Lupus International Collaborating Clinics/American College of Rheumatology damage index.

Table II. Clinical and laboratory characteristics of the SLE patients

SLICC 2012 criteria	Throughout the disease course, n (%)	Study baseline, n (%)
Clinical criteria		
Acute cutaneous lupus	129 (65)	48 (24)
Chronic cutaneous lupus	111 (56)	72 (36)
Oral ulcers	93 (47)	29 (15)
Nonscarring alopecia	101 (51)	62 (31)
Arthritis	167 (84)	59 (30)
Serositis	87 (44)	41 (21)
Renal involvement	99 (49)	61 (30)
Neurologic involvement	28 (14)	9 (5)
Hemolytic anemia	77 (39)	47 (24)
Leukopenia	113 (57)	25 (13)
Thrombocytopenia	58 (29)	13 (7)
Immunological criteria		
ANA	200 (100)	200 (100)
Anti-dsDNA	187 (94)	126 (63)
Anti-Sm	31 (16)	31 (16)
Anti-Ro/SS-A	66 (33)	66 (33)
Anti-La/SS-B	19 (9.5)	19 (9.5)
Anti-RNP70	28 (14)	28 (14)
Antiphospholipid antibodies	73 (36.5)	32 (16)
Low complement	182 (91)	130 (65)

SLICC – Systemic Lupus International Collaborating Clinics; ANA – antinuclear antibodies; Anti-dsDNA – anti-double stranded DNA antibodies; Anti-Sm – anti-Smith antibodies; Anti-Ro/SS-A – antibodies to cytoplasmic nuclear antigen SS-A; Anti-La/SS-B – antibodies to cytoplasmic nuclear antigen SS-B; Anti-RNP70 – anti-(U1) small nuclear RNA antibodies.

Table III. Baseline SLE activity according to the SLE-DAS

SLE-DAS disease activity	**SLE patients, n=200**, n (%)
Remission	48 (24)
Mild activity	44 (22)
Moderate activity	17 (8.5)
Severe activity	91 (45.5)
SLE-DAS, median (range)	8.37 [3.03–17.39]

SLE – Systemic Lupus Erythematosus; SLE-DAS – Systemic Lupus Erythematosus Disease Activity Score.

Table IV. Agreement and predictive values of disease activity indices compared to clinical assessment

Active SLE	Disease activity index	Sensitivity (true positive rate)	Specificity (true negative rate)	PPV	NPV	Cohen's kappa coefficient
According DORIS	SLE-DAS	84.0%	95.0%	95.2%	32.3%	0.47
	SLEDAI-2K	83.9%	57.9%	95%	27.5%	0.31
According DORIS, excluding GCs doses	SLE-DAS	96.2%	97.6%	99.3%	82.4%	0.86
	SLEDAI-2K	93.0%	69.0%	91.9%	72.5%	0.63

SLE – Systemic Lupus Erythematosus; DORIS – Definition Of Remission In Systemic Lupus Erythematosus; PGA – Physician Global Assessment; SLEDAI-2K – Systemic Lupus Erythematosus Disease Activity Index 2000; SLE-DAS – Systemic Lupus Erythematosus Disease Activity Score; PPV – positive predictive value; NPV – negative predictive value.

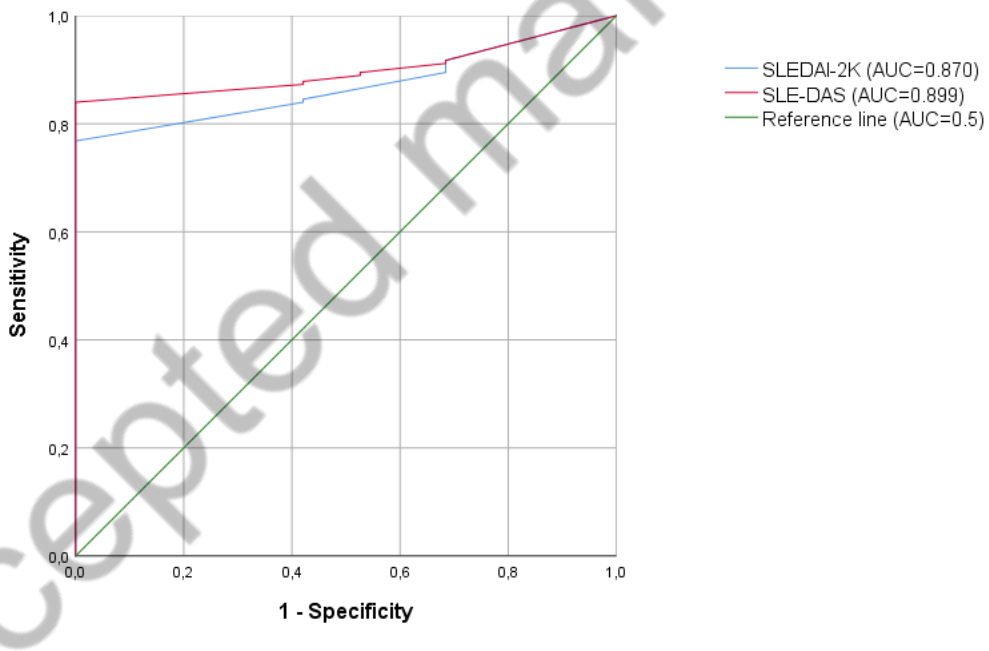

Figure 1. ROC curves for SLE-DAS and SLEDAI-2K using DORIS criteria as the reference standard

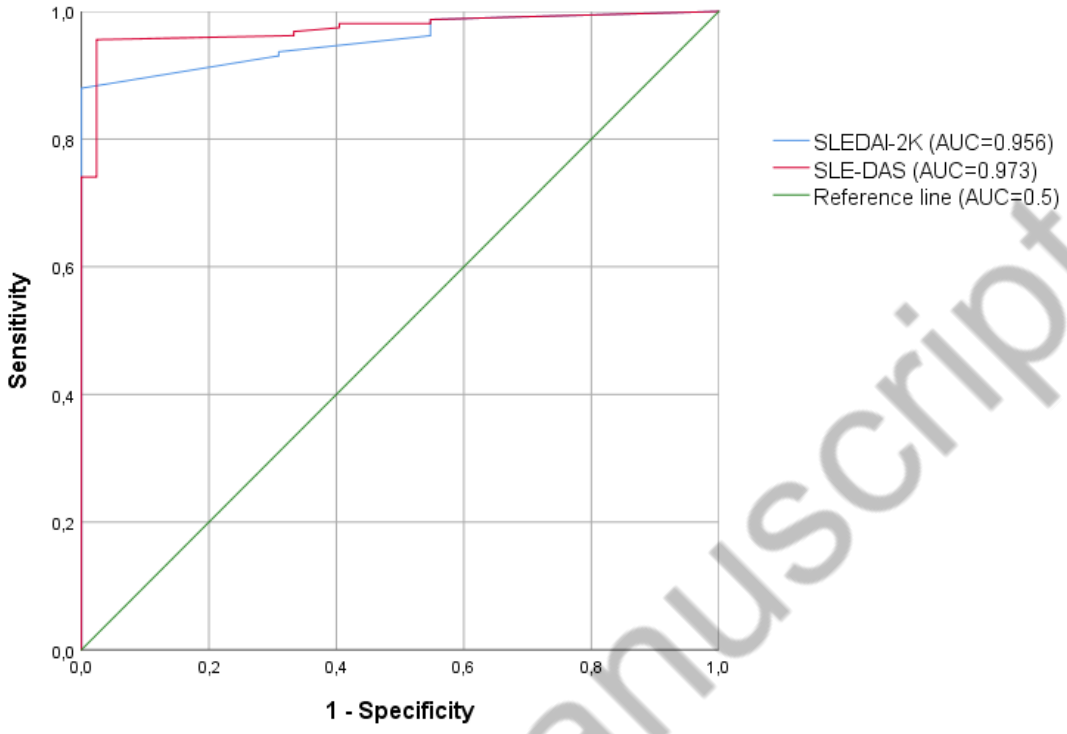

Figure 2. ROC curves for SLE-DAS and SLEDAI-2K using DORIS criteria as the reference standard excluding glucocorticoid dose

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