

Supplementary Table S1. Operational disease-severity classification used in the present study.

Severity category	Clinical manifestations informing the EULAR 2019 severity framework	Operational definition used in the present study
Mild	Constitutional symptoms; mild arthritis; limited cutaneous involvement (rash $\leq 9\%$ body surface area); platelet count $50\text{--}100 \times 10^9/\text{L}$.	The most severe SLE-related manifestation documented during the disease course was limited to manifestations within the mild category.
Moderate	Moderate-to-severe ("RA-like") arthritis; cutaneous involvement involving approximately 9–18% of body surface area; serositis; platelet count $20\text{--}50 \times 10^9/\text{L}$.	At least one manifestation within the moderate category was documented during the disease course, with no manifestation fulfilling the severe category.
Severe	Major organ-threatening disease (including cerebritis, myelitis, pneumonitis, or mesenteric vasculitis); platelet count $<20 \times 10^9/\text{L}$; TTP-like disease or acute haemophagocytic syndrome; extensive cutaneous involvement ($>18\%$ body surface area).	Any severe SLE-related clinical manifestation documented at any time during the disease course resulted in classification as severe SLE. Lupus nephritis was always classified as severe.

This operational classification was adapted from the clinical severity categories reported in the 2019 EULAR recommendations for the management of SLE (ref. 24) and was not treated as a validated longitudinal severity instrument. Treatment received was not used to define disease severity. Lupus nephritis was classified as severe in this operational scheme.

EULAR: European Alliance of Associations for Rheumatology; RA: rheumatoid arthritis; SLE: systemic lupus erythematosus; TTP: thrombotic thrombocytopenic purpura.

Supplementary Table S2. Comparison of demographic, clinical, and social characteristics across Rurality Score categories.

Characteristic	Overall (N=428)	Score 0 (n=285)	Score 1 (n=108)	Score 2 (n=28)	Score 3 (n=7)	p-value
Demographic characteristics						
Female sex, n/N (%)	376/428 (87.9%)	253/285 (88.8%)	94/108 (87.0%)	23/28 (82.1%)	6/7 (85.7%)	0.786
Caucasian ethnicity, n/N (%)	399/428 (93.2%)	261/285 (91.6%)	104/108 (96.3%)	27/28 (96.4%)	7/7 (100.0%)	0.250
Age at disease onset, years, mean ± SD	37.4 ± 15.6	38.9 ± 15.8	34.4 ± 14.7	35.2 ± 14.1	32.0 ± 21.4	0.066
Participating centre						<0.001
Udine, n/N (%)	225/428 (52.6%)	143/285 (50.2%)	60/108 (55.6%)	16/28 (57.1%)	6/7 (85.7%)	
Pordenone, n/N (%)	68/428 (15.9%)	28/285 (9.8%)	30/108 (27.8%)	9/28 (32.1%)	1/7 (14.3%)	
Trieste, n/N (%)	87/428 (20.3%)	82/285 (28.8%)	5/108 (4.6%)	0/28 (0.0%)	0/7 (0.0%)	
Gorizia, n/N (%)	48/428 (11.2%)	32/285 (11.2%)	13/108 (12.0%)	3/28 (10.7%)	0/7 (0.0%)	
Operational disease-severity category						
Mild, n/N (%)	195/428 (45.6%)	136/285 (47.7%)	48/108 (44.4%)	8/28 (28.6%)	3/7 (42.9%)	0.276*
Moderate, n/N (%)	92/428 (21.5%)	65/285 (22.8%)	22/108 (20.4%)	4/28 (14.3%)	1/7 (14.3%)	0.694*
Severe, n/N (%)	141/428 (32.9%)	84/285 (29.5%)	38/108 (35.2%)	16/28 (57.1%)	3/7 (42.9%)	0.023*
Disease activity and damage						
SLEDAI-2K at last visit, median (IQR)	1.0 (0.0–3.0)	1.0 (0.0–3.0)	1.0 (0.0–3.0)	2.0 (0.0–4.0)	2.0 (1.0–2.0)	0.241
SLICC/ACR Damage Index, median (IQR)	0.0 (0.0–1.0)	0.0 (0.0–1.0)	0.0 (0.0–1.0)	0.0 (0.0–1.0)	1.0 (0.0–1.0)	0.817
SLICC/ACR Damage Index >0, n/N (%)	166/428 (38.8%)	107/285 (37.5%)	43/108 (39.8%)	12/28 (42.9%)	4/7 (57.1%)	0.711
Social characteristics						
High school education or higher, n/N (%)	222/327 (67.9%)	143/215 (66.5%)	63/86 (73.3%)	13/20 (65.0%)	3/6 (50.0%)	0.529
Employed, n/N (%)	189/349 (54.2%)	120/230 (52.2%)	53/89 (59.6%)	13/23 (56.5%)	3/7 (42.9%)	0.617
Certified disability, n/N (%)	23/428 (5.4%)	11/285 (3.9%)	8/108 (7.4%)	2/28 (7.1%)	2/7 (28.6%)	0.031
Components of the Rurality Score						
Distance from referral centre >45 km, n/N (%)	62/428 (14.5%)	0/285 (0.0%)	42/108 (38.9%)	13/28 (46.4%)	7/7 (100.0%)	—
Population density <150 inhabitants/km², n/N (%)	91/428 (21.3%)	0/285 (0.0%)	59/108 (54.6%)	25/28 (89.3%)	7/7 (100.0%)	—
Residence in a mountainous municipality, n/N (%)	32/428 (7.5%)	0/285 (0.0%)	7/108 (6.5%)	18/28 (64.3%)	7/7 (100.0%)	—

Note. Data are presented as n/N (%) unless otherwise indicated. Disease duration was calculated from the recorded diagnosis date to 31 December 2025. Patients with missing education or employment data were excluded from the corresponding denominators. Rurality Score ranges from 0 to 3 and is the sum of distance >45 km from the referral centre, population density <150 inhabitants/km², and residence in a mountainous municipality. P values are exploratory and were not adjusted for multiple comparisons. Continuous variables were compared using the Kruskal–Wallis test and categorical variables using the chi-square or Fisher–Freeman–Halton exact test, as appropriate. No p values are reported for individual Rurality Score components because these variables define the score itself. * For individual global disease-severity categories, p values compare the proportion of patients within each category versus all other severity categories across Rurality Score groups.

Abbreviations: IQR, interquartile range; SD, standard deviation; SLEDAI-2K, Systemic Lupus Erythematosus Disease Activity Index 2000; SLICC/ACR, Systemic Lupus International Collaborating Clinics/American College of Rheumatology.

Supplementary Table S3. Pairwise associations among Rurality Score components.

Component pair	Phi coefficient (ϕ)	<i>p</i> -value
Distance >45 km vs. population density <150 inhabitants/km ²	0.06	0.20
Distance >45 km vs. mountainous municipality	0.14	0.005
Population density <150 inhabitants/km ² vs. mountainous municipality	0.33	<0.001

Note. Phi coefficients quantify pairwise association between the three binary components of the Rurality Score (N=428). *P*-values are from Pearson chi-square tests and are descriptive; they were not adjusted for multiple comparisons.

Supplementary Table S4. Sensitivity analyses for the operational severe SLE category.

Exposure and adjustment set	N	Adjusted OR	95% CI	<i>p</i> -value
Rurality Score (per 1 point increase): age at onset + sex	428	1.35	1.01-1.81	0.042
Rurality Score: age at onset + sex + participating centre	428	1.48	1.08-2.02	0.015
Rurality Score: age at onset + sex + centre + disease duration	428	1.49	1.09-2.03	0.013
Rurality Score: age at onset + sex, education-complete subset	327	1.29	0.92-1.79	0.136
Rurality Score: age at onset + sex + centre + disease duration + education	327	1.51	1.04-2.19	0.030
Distance (per 10 km): age at onset + sex	428	1.06	0.97-1.16	0.216
Distance (per 10 km): age at onset + sex + centre + disease duration	428	1.07	0.97-1.19	0.182

Note. Disease duration was calculated from the recorded diagnosis date to 31 December 2025. Participating centre was entered as a categorical covariate. Education was dichotomised as high school education or higher versus lower education; patients with undeclared education were excluded from the education-complete analyses. The corresponding education-complete model without education is shown to make the effect of complete-case restriction transparent. Continuous distance models estimate the OR per 10-km increase.