

CLUSTER ANALYSIS OF SOCIOECONOMIC AND ENVIRONMENTAL DETERMINANTS MODIFYING ACTIVITY, CHRONICITY AND CLINICAL MANIFESTATIONS OF SYSTEMIC LUPUS ERYTHEMATOSUS IN THE GLADEL 2.0 COHORT



SLEuro
EUROPEAN LUPUS SOCIETY

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BACKGROUND

→ Systemic lupus erythematosus (SLE) is a complex autoimmune disease with heterogeneous clinical manifestations.

→ Evidence from high-income countries suggests that socioeconomic status (SES) and environmental factors influence SLE outcomes, yet data from Latin America remain limited.

OBJECTIVE

→ The objective of this research was to evaluate, across three levels (individual, regional, and national), whether socioeconomic and environmental factors impact the clinical presentation of SLE in the GLADEL 2.0 cohort.

METHODS

→ We analyzed data from 1,083 patients with SLE enrolled in the GLADEL 2.0 cohort across 10 Latin American countries.

» All patients fulfilled the 1982/1997 American College of Rheumatology (ACR) or 2012 Systemic Lupus International Cooperating Clinics (SLICC) classification criteria.

→ Clinical outcomes were disease activity (Systemic Lupus Erythematosus Disease Activity Index 2000 [SLEDAI-2K]), organ involvement (renal, hematologic, cutaneous, musculoskeletal), and organ damage (SLICC/ACR damage index; SDI).

→ Variables were structured into three levels: Level 1 (individual), Level 2 (state/province), and Level 3 (national). Multilevel analyses included sociodemographic variables, environmental exposure to air pollutants (PM_{2.5}, PM₁₀, NO₂), and contextual indicators (income, unemployment, distribution of income or wealth through the Gini index, CO₂ emissions)

→ Statistical analysis included cluster analysis (Ward's method) and principal component analysis (PCA).

RESULTS

→ We identified five distinct clusters of patients with SLE, characterized by unique combinations of clinical severity, patient-reported outcomes (PROs), SES, and environmental exposures.

» Number of patients per cluster were: cluster 1 (n=285); cluster 2 (n=29); cluster 3 (n=74); cluster 4 (n=433); cluster 5 (n=262).

→ Cluster 1 comprised mainly Argentinian (n=223, 78.2%) and Uruguayan (n=49, 17.2%) patients.

→ All patients in cluster 2 were from the Dominican Republic (n=29; 100%).

→ All patients in cluster 3 were from Peru (n=74, 100%).

→ Cluster 4 comprised mainly Brazilian (n=182, 42%), Colombian (n=137, 31.6%), and Paraguayan (n=57, 13.2%) patients.

→ Cluster 5 comprised mainly Mexican (n=176, 67.2%), Argentinian (n=55, 21%), and Chilean (n=31, 11.8%) patients.

→ Heatmaps illustrate select sociodemographic and clinical features (Figures 1, 2), environmental factors (Figure 2), and patient reported outcomes (Figure 3) across the five clusters.

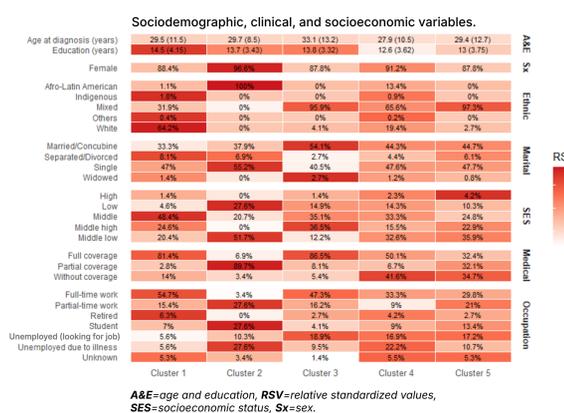
→ PCA showed that clinical manifestations, disease activity, and chronicity were different across the five clusters (Figure 4).

CONCLUSIONS

→ Socioeconomic and environmental factors at individual, regional, and national levels influence the cumulative clinical manifestations and patient-reported outcomes in SLE.

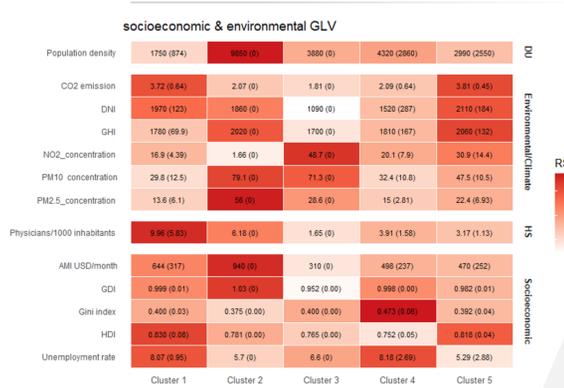
→ Our findings underscore the role of social vulnerability and environmental stressors as potential modifiers of SLE phenotype in Latin America, highlighting the need for context-sensitive interventions and policies to mitigate health inequities.

FIGURE 1. Sociodemographic and clinical characteristics across clusters.



AGE=age and education, RSV=relative standardized values, SES=socioeconomic status, Sx=sex.

FIGURE 2. Socioeconomic and environmental characteristics across clusters. Mean ± standard deviation for selected sociodemographic, environmental, and clinical indicators across the five clusters identified in the study cohort.



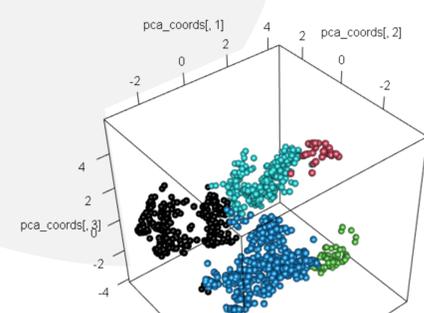
AMI USD=average monthly income in US dollars, DNI=direct normal irradiance (kWh/m²/year), DU=demographic and urban, GDI=Gender Development Index, GHI=global horizontal irradiance (kWh/m²/year), GLV=global level variables, HDI=Human Development Index, HS=health system, RSV=relative standardized values.

FIGURE 3. Patient reported outcomes across clusters. Clusters displayed distinct profiles across organ damage, disease activity, and patient-reported outcomes.



RSV=relative standardized values, SLEDAI=Systemic Lupus Erythematosus Disease Activity Index, SLICC=Systemic Lupus International Collaborating Clinics.

FIGURE 4. Three-dimensional representation of the first three principal components. Five clusters of SLE patients derived from socioeconomic and environmental variables.



PCA=principal components analysis, SLE=systemic lupus erythematosus.

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