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Elevated C-reactive protein and self-reported disease activity in systemic lupus erythematosus

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Abstract

C-reactive protein (CRP), a biomarker of inflammation, has been associated with increased disease activity in rheumatoid arthritis. However, the association in systemic lupus erythematosus (SLE) remains unclear. We examined the association of CRP with self-reported disease activity in the Carolina Lupus Study and described differences by sociodemographic characteristics. The study included baseline and three-year follow-up data on 107 African-American and 69 Caucasian SLE patients enrolled at a median 13 months since diagnosis. Models estimated prevalence differences in the association of baseline CRP with self-reported flares, adjusting for age, sex, race and education. Active disease or flare was reported by 59% at baseline and 58% at follow-up. Higher CRP (>10 μg/ml vs. <3 μg/ml) was associated with a 17% (95% CI: −20, 53%) higher prevalence of flare at baseline and a 26% (95% CI: −9, 62%) higher prevalence of flare at follow-up. These CRP-flare associations were notably stronger in patients with lower education at baseline and in African Americans at follow-up. These findings suggest CRP may be a useful marker in studies of SLE health disparities.

Keywords

systemic lupus erythematosus; C-reactive protein; flares; socioeconomic factors

Introduction

C-reactive protein (CRP), a biomarker of inflammation, has a debated role in the disease course of patients with systemic lupus erythematosus (SLE).[1–4] In other autoimmune

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diseases, such as rheumatoid arthritis, CRP has been associated with increased disease activity,[5–7] but SLE findings are inconsistent. Higher CRP has been seen in African-American SLE patients and those with lower socioeconomic status.[8] In the general population, CRP has also been reported to be higher in African Americans compared to Caucasians.[9, 10] African Americans have a higher incidence of SLE and, on average, increased disease activity and severity compared to Caucasians.[11] It is unknown whether racial/ethnic and socioeconomic differences in CRP are related to disparities in SLE disease activity and outcomes.

In the Carolina Lupus Study (CLU), we previously described a higher index of early disease damage in African American and patients with a lower household income.[12] Here, in a secondary analysis in the same cohort, we examined whether baseline CRP was associated with self-reported active disease or flares at baseline and follow-up. Additional analyses explored sociodemographic differences.

Patients and methods

Study population and design

Carolina Lupus Study (CLU) is a population-based cohort study of SLE patients age 18 years and older diagnosed between January 1, 1995, and July 31, 1999, based on the 1997 ACR classification criteria.[13, 14] Recruitment procedures and demographic characteristics have been described previously.[15] Eligible patients resided in the study area (60 continuous counties in North Carolina and South Carolina) for at least 6 months prior to diagnosis and were identified through referrals from university and community based rheumatologists. Of the 285 patients identified, 93% (n=265) enrolled in the study and completed baseline interviews (median time from SLE diagnosis to enrollment: 13 months). A telephone questionnaire was administered in 2001, after a median follow-up of 39 months, with 75% of the patients participating (n=187). Overall, those lost to follow-up had higher C-reactive protein (CRP) levels at baseline (mean 10.7 μg/ml vs. 8.2 μg/ml in patients not lost to follow-up), and 25% died prior to the follow-up interview. Patients with baseline data on CRP and data on flare at baseline or follow-up were included in this analysis (n=176). Three patients did not have data available on baseline flare, and two patients did not have data on follow-up flare. These patients were included in the analyses for which flare data were available.

Procedures and measures

Baseline data—Questionnaire data were collected through in-person interviews and included demographics (age, sex, self-reported race/ethnicity and education) and smoking status. Blood samples were drawn from 92% of patients. Serum CRP was measured by ELISA (enzyme-linked immunosorbent assay) with a lower limit of detection of 20 ng/ml and sera were tested for anti-native DNA antibody (anti-dsDNA) using fixed *Crithidia luciliae* immunofluorescence, as previously described.[16, 17] Self-reported active disease or flare at baseline was assessed by asking the patient: *Since you were first sick, have you had periods of flare and remission, or has your disease been fairly constant (flare and remission, or fairly constant)? Are you currently having a flare-up or are you in remission (flare-up or*

remission)? Responses were categorized as (0) remission or (1) active disease or flare. Clinical and immunologic features of SLE, including serositis, arthritis, and biopsy-confirmed lupus nephritis at baseline, were abstracted from medical records by a single abstracter.

Follow-up data—Telephone follow-up interviews collected data on the primary outcome variable, disease flare, and health insurance (Medicaid/Medicare or private insurance). Disease flare at follow-up was determined by asking the patient: *In the past 3 months, have you had a lupus flare (a lupus flare is when your lupus gets worse) (Yes/No)?* Responses were categorized as (0) no flare or (1) flare within three months prior to follow-up.

The follow-up questionnaire included the previously validated Systemic Lupus Erythematosus Activity Questionnaire (SLAQ) and the patient global assessment (PGA) of disease activity in the previous three months. SLAQ included questions on 24 SLE symptoms, and a score of 1 was given to any symptom that was present.[18, 19] The PGA of disease activity was captured by the question: *Please rate the activity of your lupus during the past three months: 0 (no activity) to 10 (most activity).*[18] For 127 patients (72% of the study sample) data on SLE damage were collected from medical records by a single, trained abstracter using the Systemic Lupus International Collaborating Clinics (SLICC)/American College of Rheumatology (ACR) Damage Index (SDI).[12] Damage was defined as irreversible change, not related to active inflammation, occurring since the diagnosis of SLE and present for at least six months.[20]

Statistical analyses

Prevalence of flare/active disease at baseline and flare at follow-up were estimated using baseline CRP categorical cut-points to allow interpretation in a clinical context: CRP < 3.0 μg/ml; 3 ≤ CRP < 10 μg/ml; and CRP > 10 μg/ml.[21] Education was used as an indicator of socioeconomic status since it may predict future occupation and wages, while being less influenced by age- or disease-related changes in these characteristics.[22, 23] Education was coded as high school (HS) diploma or less (low education; ≤ HS) and greater than high school diploma (high education; > HS). Race/ethnicity, sex, education and age variables were centered so the intercept of regression models represented the average patient in the study (i.e., an African-American woman aged 42.5 years with some college).

Effect measure modifiers were determined by a likelihood ratio test (α=0.20). Confounding was defined as a 10% change-in-estimate of beta when included in the model. Age, sex, race and education were included in final models to adjust for confounding. Models stratified by education (i.e., ≤ HS or > HS) were also adjusted for education (<12 years, 12 years, some college or vocational training, and college graduate or higher) to control for residual confounding created by dichotomizing the variable.[24] Smoking and health insurance status were not included in the final models as neither were a confounder or modifier.

Linear-risk regression models estimated prevalence, prevalence difference (PD) and 95% confidence interval (CI) for the cross-sectional association of CRP with active disease at baseline and the prospective association of baseline CRP with flare at follow-up, adjusting for age, sex, race/ethnicity and education to control for confounding. In statistical models for

flare at follow-up, baseline flare/active disease was not a confounder in the association of CRP and flare at follow-up and was excluded from the final model. In the subset of patients with available data, SDI score was not a confounder or effect modifier in the association of CRP and flare at follow-up. We examined bivariate relationships between clinical and immunological features of SLE (lupus nephritis, anti-dsDNA, serositis, arthritis, and baseline CRP) with the presence of baseline active disease/flare and with CRP categories using Chi-square test. To determine the preliminary association of baseline CRP and PGA score at follow-up, we used a linear regression model. CRP was analyzed on the natural log scale (lnCRP) to allow for normal distribution in regression models.

All analyses were performed using SAS software, version 9.2 (Cary, NC).

Results

In the Carolina Lupus Study cohort, 90% of patients were female and 61% African-American (Table 1). African-American patients were significantly younger and more likely to have a lower education level compared to Caucasian. A greater percentage of African-American (33%) compared to Caucasian patients (19%) had C-reactive protein (CRP) levels in the highest category (>10 μg/ml). Reported active disease/flare at baseline and follow-up did not vary by race/ethnicity or educational attainment. African Americans were more likely to have lupus nephritis and a higher SLICC/ACR Damage Index (SDI) score at follow-up (mean: 2.1) than Caucasians (mean: 0.9). No differences were seen by education.

CRP and active disease at baseline

Fifty-eight percent of patients reported active disease/flare at baseline (Table 2); of these, a greater proportion had arthritis compared to patients who did not report active disease/flare (80% vs. 65%), but no differences were seen for other clinical and immunologic features of SLE. Prevalence of arthritis and lupus nephritis did not increase with higher CPR levels. Serositis, however, was associated with higher CRP levels, with 59% of patients with CRP >10 μg/ml having serositis confirmed in their medical records at baseline, compared to 41% of patients with CRP <3 μg/ml. The prevalence of anti-dsDNA decreased with higher CRP.

The prevalence of flare/active disease increased with higher CRP levels at baseline when adjusting for age, sex, race and education (Table 3). In patients with CRP < 3 μg/ml, the adjusted prevalence for reported active disease/flare was 31%, compared to 47% in patients with CRP >10 μg/ml (prevalence difference (PD): 17% (95% CI: −20, 53%)). Among patients with a high school education or less, the adjusted prevalence of flare at baseline was 26% for patients with CRP < 3 μg/ml compared to 71% with baseline CRP >10 μg/ml (PD: 45%; 95% CI: −11, 102%), while no differences were noted among those with a higher education level. This represented a statistical interaction (likelihood ratio p-value = 0.08) of education on the association of CRP with self-reported disease activity. Race/ethnicity was not a modifier in the association of baseline CRP and flare/active disease at baseline (likelihood ratio p-value > 0.2).

Baseline CRP and flare at follow-up

The adjusted prevalence of flare at follow-up increased with higher baseline CRP (Table 3), from 46% for patients with a baseline CRP < 3 μg/ml to 72% for patients with baseline CRP >10 μg/ml (PD: 26%; 95% CI: −9, 62%). Only 36% of participants reported both active disease/flare at baseline and flare at follow-up, and the association of baseline CRP and flare at follow-up was not substantially attenuated after adjusting for baseline flare (results not shown). Among African-American patients, there was a positive association of baseline CRP and prevalence of flare at follow-up. Prevalence differences for CRP levels of 3–10 μg/ml and >10 μg/ml compared to < 3 μg/ml were 26% (95% CI: 2, 50%) and 52% (95% CI: 5, 99%), respectively. This pattern was not seen in Caucasians (statistical interaction likelihood ratio test p-value=0.05). Education was not a modifier in the association of CRP with prevalence of flare at follow-up (likelihood ratio p-value > 0.2).

The Patient Global Assessment (PGA) of disease activity score at follow-up was significantly higher in patients reporting a recent flare than those who did not report a flare (Table 4). PGA scores were significantly higher in patients with higher CRP; in linear models (not shown), for every 1-μg/ml increase in natural-log transformed baseline CRP (lnCRP), there was a 0.4 unit increase in PGA score at follow-up. A similar pattern was seen for the SLE Activity Questionnaire (SLAQ) score, with patients who reported a flare at follow-up having a higher mean SLAQ score. No racial/ethnic or educational differences were seen for either disease activity score.

Discussion

These results provide evidence that higher C-reactive protein (CRP) was associated with a greater prevalence of self-reported flares at baseline and flares at follow-up. This is similar to the finding from another SLE cohort showing higher CRP was associated with increased concurrent disease activity.[25] Hence, in addition to being a marker of current disease status, our findings suggest CRP may also predict future disease activity.

Our results are consistent with other studies that show higher CRP levels in African Americans compared to Caucasians, as well as in patients with lower education.[10, 26] Although the literature suggests that African Americans have increased disease activity in comparison to Caucasians,[11] our results show no difference in self-reported baseline active disease/flare and flare at follow-up by race/ethnicity or education. Despite relatively limited statistical power, our analyses revealed substantial effect measure modification by educational attainment and race/ethnicity. These findings suggest that the pathways and underlying causes of disease flares may differ by sociodemographic factors, highlighting the need to understand the etiology of disparities in inflammation and outcomes in SLE patients.

One explanation for the racial/ethnic or socioeconomic differences in the association of CRP and disease activity/flare could be the operation of an underlying factor, such as psychosocial stress, influencing the relationship of CRP with disease activity and flare in African-American patients and patients with lower educational attainment. Both chronic and daily interpersonal stress have been associated with higher CRP[27, 28] and have also been associated with certain symptoms of SLE.[29] Preliminary results of additional data collected

in the our cohort's follow-up interviews show that a higher proportion of African Americans and patients with lower educational attainment felt the need to squelch their anger at least daily. Better understanding is needed of the effects of stress on flare, and the interrelationship of CRP, flares, and stress in SLE patients, and how these factors may contribute to disparities in disease damage and long-term outcomes.

Health care bias may be another underlying factor. Medicare/Medicaid status was not a confounder in the present analysis, but the types of medications prescribed to patients may differ by race/ethnicity. A previous study found a higher proportion of Caucasian compared to African-American patients received the anti-malarial hydroxychloroquine during the first 5 years after diagnosis.[30] Anti-malarial medications have been associated with lower CRP levels,[1] and if Caucasian patients in the present study were prescribed these drugs more often than African-American, this may have influenced the observed racial differences in the relationship of CRP and flare at follow-up. Differences by clinical features seemed unlikely to bias the observed associations.

Our results support a previous study of ter Borg et al.,[31] which found that CRP levels increased during episodes of serositis. We found that the prevalence of serositis reported in the medical records of patients was associated with a higher baseline CRP, which was more pronounced in African-American patients and patients with less than a high school education (results not shown). Notably, we did not see any evidence of higher CRP in patients with arthritis or lupus nephritis, nor did we observe confounding by SDI.

The present study is limited by a lack of available baseline data on medications and body mass index (BMI), both of which may be important factors in the pathway relating CRP and disease activity or flares. Lee, et al[8] suggested that analyses of C-reactive protein and cardiovascular disease in SLE patients should adjust for BMI, ethnicity, education, disease activity and medications, as they were associated with both CRP and cardiovascular disease. Our results may over-estimate the true association, if BMI and medication are confounders in the present analysis. Medication data would also be important in fully understanding the pattern we saw of the prevalence of anti-dsDNA decreasing with higher CRP. The study is also limited by the small sample size and, therefore, relatively low power. Several of the adjusted prevalence difference confidence intervals expanded beyond 0 and 100%, so estimated prevalence differences are imprecise.

Notably, those patients who were lost to follow-up, and not included in these analyses, had higher baseline CRP levels and lower education than those who remained in the study. If they also had higher disease activity, our estimates of the CRP-disease activity association may be lower than if they had been contacted earlier (i.e., in those who died before follow-up) or had otherwise remained in the cohort.

Comparisons of self-reported activity with standardized patient global assessment (PGA) of disease activity and Systemic Lupus Erythematosus Activity Questionnaire (SLAQ) scores gave us confidence in our primary outcome measure and observed associations. However, the study would have benefited from the collection of data from standardized, clinical disease activity measures, such as SLEDAI, SLAM, or BILAG, in addition to self-reported

disease activity/flare. Previous studies have found discrepancies between a physician's assessment of a patient's SLE disease activity and the patient's own assessment.[32–35] Patients tend to score their disease activity higher than a physician and place weight on subjective manifestations of disease, such as poor self-perceived function (both physical and mental) and arthritis, while physicians base their assessment on more objective findings, such as laboratory data or current medications. This is supported in our cohort, with the prevalence of arthritis higher in patients who reported baseline active disease/flare. Additionally, physicians make their assessment of a patient's disease activity based on their overall knowledge of SLE and experience with other patients, while most patients' assessments are in comparison to their own previous physical and mental manifestations.

Nevertheless, patients' perceptions of disease activity may have implications for disease outcomes, as shown by a prospective study of SLE patients that found mental health and physical functions reported by patients in the Medical Outcomes Study SF-20+ predicted death or increased organ system damage after 5 years.[36] In an exploratory analysis of the subset of 127 patients with SDI scores, we found that self-reported flare at baseline was related to a higher SDI score at follow-up (1.7 vs. 1.3 in patients reporting no baseline flare or active disease), and overall, SDI score at follow-up increased 7% for every one μg/ml increase in baseline natural log-transformed CRP (results not shown).

In sum, our findings offer insight into a relationship that is not well understood in the SLE literature. Long-term follow-up of the Carolina Lupus Cohort provides a unique opportunity to elucidate racial/ethnic and socioeconomic disparities in a representative patient population, including a high proportion of African Americans and referrals from community-based physicians. Despite modest sample size, the effects were saw in the analysis were strong enough to show a significant association. Larger studies, with more extensive clinical data, are needed to confirm our findings of racial and educational differences in the relationship of CRP and disease activity in SLE patients. Understanding these relationships may help identify underlying risk factors and sources of disparities in SLE.

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Appendix 1

Abbreviations

ACR	American College Rheumatology
ANOVA	analysis of variance
Anti-dsDNA	anti-native DNA antibody
BILAG	British Isles Lupus Assessment Group index

BMI	body mass index
CI	confidence interval
CLU	Carolina Lupus Study
CRP	C-reactive protein
ELISA	enzyme-linked immunosorbent assay
HS	high school
lnCRP	natural log C-reactive protein
ml	milliliter
NC	North Carolina
ng	nanogram
PD	prevalence difference
PGA	Patient Global Assessment
SC	South Carolina
SD	standard deviation
SDI	Systemic Lupus International Collaborating Clinics/American College of Rheumatology Damage Index
SLAM	Systemic Lupus Activity Measure
SLAQ	Systemic Lupus Erythematosus Activity Questionnaire
SLE	systemic lupus erythematosus
SLEDAI	Systemic Lupus Erythematosus Disease Activity Index
SLICC	Systemic Lupus International Collaborating Clinics

Table 1

Socio-demographic, CRP, and flare characteristics[a]

	African-American n=107 n (%)	Caucasian n=69 n (%)	p-value[b]	≤ HS n=77 n (%)	>HS n=99 n (%)	p-value[b]
Baseline						
Education						
<12 years	26 (24)	7 (10)	0.004	--	--	
12 years	30 (28)	14 (20)		--	--	
Some college	32 (30)	27 (39)		--	--	
College graduate	19 (18)	21 (30)		--	--	
Age at diagnosis						
≤25	20 (19)	8 (12)	0.003	10 (13)	18 (18)	0.06
26–35	32 (30)	14 (20)		14 (18)	32 (32)	
36–45	22 (21)	15 (22)		16 (21)	21 (21)	
46–55	25 (23)	12 (17)		20 (26)	17 (17)	
>55	8 (7)	20 (29)		17 (22)	11 (11)	
CRP, μg/ml						
<3	33 (31)	24 (35)	0.1	23 (30)	34 (34)	0.1
3–10	39 (36)	32 (46)		27 (35)	44 (44)	
>10	35 (33)	13 (19)		27 (35)	21 (21)	
Flare/active disease[c]						
No	44 (42)	28 (41)	0.9	33 (43)	39 (41)	0.8
Yes	61 (58)	40 (59)		44 (57)	57 (59)	
Disease characteristics[c]						
Anti-dsDNA+	64 (65)	35 (56)	0.3	45 (64)	54 (60)	0.7
Arthritis	75 (72)	53 (77)	0.5	57 (74)	71 (74)	1.0
Serositis	45 (44)	31 (46)	0.8	31 (41)	45 (47)	0.4
Lupus nephritis	33 (31)	9 (13)	0.007	17 (22)	25 (25)	0.6
Follow-up						
Flare[c]						
No	43 (40)	29 (43)	0.7	30 (39)	42 (43)	0.7

	African-American n=107 n (%)	**Caucasian n=69 n (%)**	**p-value[b]**	**≤ HS n=77 n (%)**	**>HS n=99 n (%)**	**p-value[b]**
Yes	64 (60)	38 (57)		46 (61)	56 (57)	
	Mean (SD)	Mean (SD)	p-value[d]	Mean (SD)	Mean (SD)	p-value[d]
PGA	4.8 (2.9)	4.2 (2.5)	0.1	4.6 (2.9)	4.6 (2.7)	1.0
SLAQ	10.7 (5.7)	10.7 (4.7)	1.0	10.1 (5.5)	11.2 (5.2)	0.6
SDI[c]	2.1 (2.0)	0.9 (1.2)	<0.001	1.7 (1.8)	1.4 (1.7)	0.3

[a] anti-dsDNA: anti-double stranded DNA; CRP: C-reactive protein; HS: high school; NC: North Carolina; PGA: Patient Global Assessment; SC: South Carolina; SD: standard deviation; SDI: Systemic Lupus International Collaborating Clinics Damage Index; SLAQ: Systemic Lupus Erythematosus Activity Questionnaire;

[b] Chi-square test;

[c] data missing for flare/active disease at baseline (n=3), arthritis (n=3), serositis (n=4), and anti-dsDNA (n=15), flare at follow-up (n=2), and SDI at follow-up (n=49);

[d] t-test

Table 2

Frequency of disease manifestations by presence of flare at baseline and baseline C-reactive protein (n=176)[a]

	Baseline Active Disease/Flare			Baseline C-reactive Protein (µg/ml)			
	Yes n=101 n (%)	**No n=72 n (%)**	**χ^2 p-value**	**< 3 n=57 n (%)**	**3 - <10 n=71 n (%)**	**> 10 n=48 n (%)**	**χ^2 p-value**
Lupus nephritis[b]	23 (22)	19 (26)	0.6	15 (26%)	16 (23%)	11 (23%)	0.9
Anti-dsDNA+	54 (59)	43 (64)	0.5	37 (69%)	42 (66%)	20 (47%)	0.06
Serositis	47 (48)	29 (41)	0.4	23 (41%)	26 (38%)	27 (59%)	0.07
Arthritis	79 (80)	46 (65)	0.03	39 (70%)	53 (76%)	36 (77%)	0.6

[a] data on baseline active disease/flare missing for n=3 patients;

[b] data missing for anti-dsDNA (n=15), serositis (n=5), and arthritis (n=3);

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Table 3

Association of baseline C-reactive protein with active disease/flare at baseline and follow-up (n=176)[a]

			Active Disease/Flare at Baseline			Flare at Follow-Up		
Baseline CRP (μg/ml)	**CRP Mean ±SD**	**N[b]**	**Flares n (%)[c]**	**Adj Prev[d]**	**PD (95% CI)[d]**	**Flares n (%)[c]**	**Adj Prev[d]**	**PD (95% CI)[d]**
Overall cohort								
< 3	1.3±0.8	57	31 (54)	31%	0. (ref.)	26 (46)	46%	0. (ref.)
3–10	6.6±2.0	69	44 (64)	39%	8% (−10, 26%)	42 (59)	59%	13% (−5, 31%)
>10	18.9±8.5	47	26 (55)	47%	17% (−20, 53%)	34 (72)	72%	26% (−9, 62%)
African-American								
<3	1.4±08	33	17 (52)	43%	0. (ref.)	13 (39)	62%	0. (ref.)[f]
3–10	7.0±1.9	39	25 (66)	54%	11% (−14, 35%)	26 (67)	88%	**26% (2, 50%)**
>10	19.5±8.7	35	19 (56)	65%	22% (−27, 70%)	25 (71)	114%	**52% (5, 99%)**
Caucasian								
<3	1.2±0.8	24	14 (58)	21%	0. (ref.)	13 (57)	45%	0. (ref.)
3–10	6.1±2.0	32	19 (61)	26%	5% (−22, 33%)	16 (50)	40%	−5% (−32, 21%)
>10	17.1±7.9	13	7 (54)	32%	11% (−44, 66%)	9 (75)	35%	−11% (−64, 43%)
High school education or less								
< 3	1.4±0.8	23	11 (48)	26%	0. (ref.)[e]	10 (43)	63%	0. (ref.)
3–10	7.2±1.9	27	19 (70)	49%	23% (−6, 51%)	16 (59)	77%	14% (−14, 43%)
>10	18.7±8.6	27	14 (52)	71%	45% (−11, 102%)	20 (77)	91%	28% (−28, 85%)
Greater than high school education								
< 3	1.2±0.7	34	20 (59)	29%	0. (ref.)	16 (48)	38%	0. (ref.)
3–10	6.2±2.0	44	25 (60)	30%	1% (−23, 24%)	26 (59)	51%	13% (−10, 36%)
>10	19.1±8.5	21	12 (60)	31%	1% (−46, 48%)	14 (67)	64%	26% (−20, 72%)

[a] Adj prev, adjusted prevalence; CI, confidence interval; CRP, C-reactive protein; PD, prevalence difference; ref, reference; SD, standard deviation;

[b] data missing for active disease/flare at baseline (n=3) and flare at follow-up (n=2);

[c] Row percentages;

[d] Prevalence adjusted for age, sex, race, and education;

[e] effect measure modification by education (likelihood ratio p-value=0.08);

$f_{\text{effect measure modification by race (likelihood ratio p-value=0.05)}}$

Table 4

Mean distribution of Patient Global Assessment (PGA) and SLE Activity Questionnaire (SLAQ) Scores (n=174)[a]

	PGA (0–10 scale)		SLAQ (0–24 scale)	
	Mean (SD)	**p-value**	**Mean (SD)**	**p-value**
Self-reported follow-up flare				
Yes	5.8 (2.5)	<0.001[b]	13.0 (4.6)	<0.001[b]
No	2.9 (2.2)		7.3 (4.7)	
Race				
African-American	4.8 (2.9)	0.1[b]	10.7 (5.7)	1.0[b]
Caucasian	4.2 (2.5)		10.7 (4.7)	
Education				
High school education or less	4.6 (2.9)	1.0[b]	10.1 (5.5)	0.6[b]
Greater than high school	4.6 (2.7)		11.2 (5.2)	
Baseline CRP				
<3	3.9 (2.8)	0.02[c]	9.8 (5.3)	0.2[c]
3–10	4.5 (2.6)		10.6 (5.0)	
>10	5.5 (2.8)		11.8 (5.8)	

[a] CRP, C-reactive protein; PGA, Patient Global Assessment; SLAQ, SLE Activity Questionnaire; SD, standard deviation;

[b] t-test

[c] ANOVA