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Permalink

https://escholarship.org/uc/item/91881870

Journal

Lupus Science and Medicine, 11(1)

ISSN

2053-8790

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Publication Date

2024-05-15

DOI

10.1136/lupus-2023-001060

Peer reviewed

Positive psychosocial factors may protect against perceived stress in people with systemic lupus erythematosus with and without trauma history

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ABSTRACT

Objective Trauma history is associated with SLE onset and worse patient-reported outcomes; perceived stress is associated with greater SLE disease activity. Stress perceptions vary in response to life events and may be influenced by psychosocial factors. In an SLE cohort, we examined whether stressful events associated with perceived stress, whether psychosocial factors affected perceived stress, and whether these relationships varied by prior trauma exposure.

Methods This is a cross-sectional analysis of data from the California Lupus Epidemiology Study, an adult SLE cohort. Multivariable linear regression analyses controlling for age, gender, educational attainment, income, SLE damage, comorbid conditions, glucocorticoids ≥7.5 mg/day and depression examined associations of recent stressful events (Life Events Inventory) and positive (resilience, self-efficacy, emotional support) and negative (social isolation) psychosocial factors with perceived stress. Analyses were stratified by lifetime trauma history (Brief Trauma Questionnaire (BTQ)) and by adverse childhood experiences (ACEs) in a subset.

Results Among 242 individuals with SLE, a greater number of recent stressful events was associated with greater perceived stress (beta (95% CI)=0.20 (0.07 to 0.33), p=0.003). Positive psychosocial factor score representing resilience, self-efficacy and emotional support was associated with lower perceived stress when accounting for number of stressful events (−0.67 (−0.94 to −0.40), p<0.0001); social isolation was associated with higher stress (0.20 (0.14 to 0.25), p<0.0001). In analyses stratified by BTQ trauma and ACEs, associations of psychosocial factors and perceived stress were similar between groups. However, the number of recent stressful events was significantly associated with perceived stress only for people with BTQ trauma (0.17 (0.05 to 0.29), p=0.0077) and ACEs (0.37 (0.15 to 0.58), p=0.0011).

Conclusion Enhancing positive and lessening negative psychosocial factors may mitigate deleterious perceived stress, which may improve outcomes in SLE, even among individuals with a history of prior trauma who may be more vulnerable to recent stressful events.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ A growing body of research highlights the strong relationship between stress and SLE onset and disease outcomes; however, it is unknown how perceived stress may be influenced by psychosocial factors among those with and without a trauma history in SLE.

WHAT THIS STUDY ADDS

⇒ Perceived stress is higher in individuals with SLE with trauma history suggesting that these individuals may be more vulnerable to the impact of recent stressful events.

⇒ Positive psychosocial factors, such as resilience, self-efficacy and emotional support, are associated with lower stress levels regardless of trauma history.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Leveraging positive psychosocial factors and mitigating negative factors such as social isolation may reduce perceived stress and improve coping among individuals with SLE, particularly for individuals with a history of trauma.

INTRODUCTION

Stressful events that are perceived as traumatic are associated with the risk of new-onset SLE and SLE flares.[1–4] Perceived stress is associated with greater physician-assessed and patient-assessed SLE disease activity.[5] Moreover, many patient-reported disease outcomes—SLE disease activity, damage, cognitive function, pain and fatigue—are worse in individuals with SLE who have experienced life stressors such as adverse childhood experiences (ACEs) and racial discrimination.[5–10] A growing body of research highlights the strong relationships among stress, SLE onset and disease outcomes.

What is less clear is whether some individuals with SLE have a different susceptibility
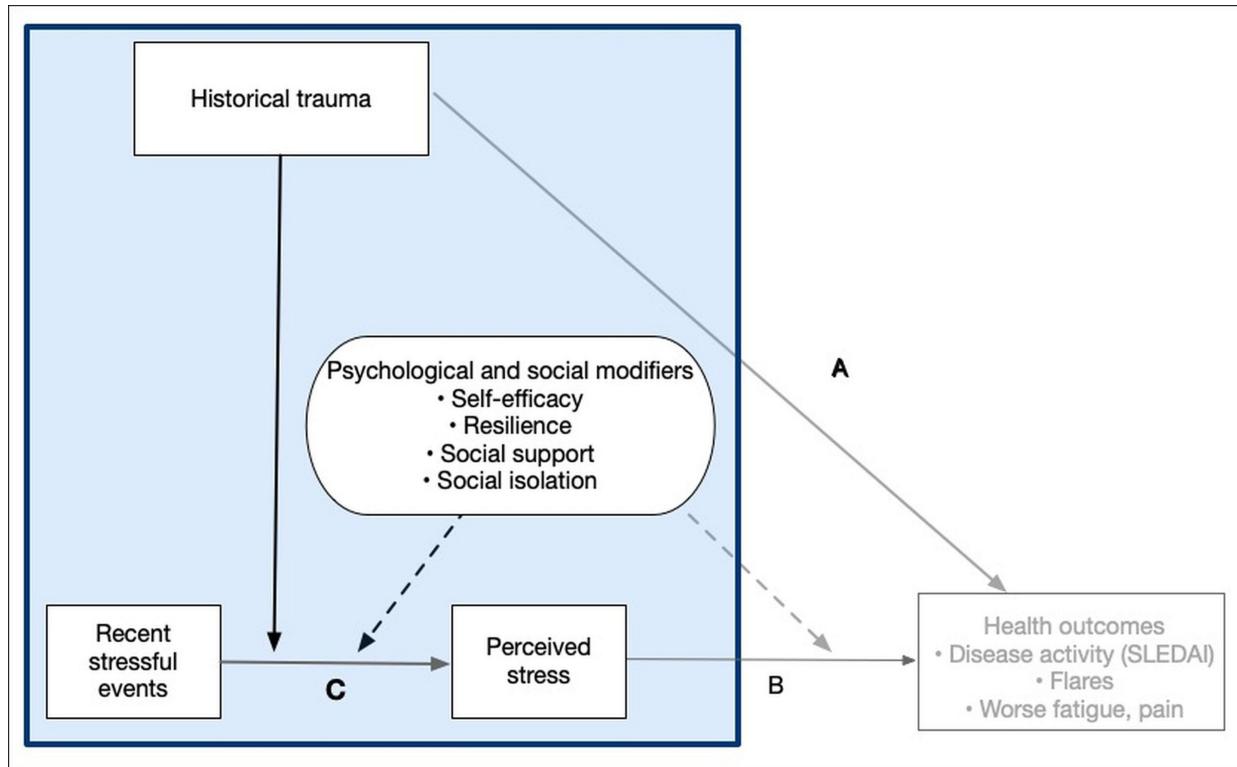
Figure 1 A simplified version of the conceptual model underpinning this analysis. Contributing factors outside the primary pathway (eg, demographics and clinical factors) and feedback pathways are not shown. The current analysis focuses on the portions of the model inside the shaded box, specifically pathway C. Evidence supporting pathways A and B have been published (pathway A[9]); (pathway B[5 6]). Black lines illustrate relationships tested in these analyses. Grey lines illustrate additional pathways in the overall model. Solid lines represent the main proposed causal pathways. Dashed lines represent factors that may change the relationships of the main pathway. SLEDAI, SLE Disease Activity Index.

to the effects of stressful events. Perceived stress—the degree to which one's life is believed to be 'unpredictable, uncontrollable and overloading'—links stressful events and pathology.[11] Individuals may appraise potentially stressful events differently. How an individual appraises potentially stressful events serves an important link between the experience of events and health outcomes. In other words, the impact of stressful events on health may depend on perceptions of those stressors. In turn, perceptions of stress may be modified by stress, trauma and/or psychosocial factors.

The study of perceived stress in SLE is important to reveal whether different types of stressful experiences perpetuate a harmful stress response that contributes to poor outcomes in SLE. Investigators of other disease states have focused on factors such as low resilience or decreased self-efficacy to help identify individuals who may benefit from psychosocial interventions.[12] We hypothesised that relationships among past and current stress, perceived stress and psychosocial factors would be amplified in those with SLE. To develop targeted strategies for individuals with SLE with stress exposures, there is a need to understand who is at higher risk for harmful perceived stress and what factors alter perceived stress.

Guided by our theoretical model (figure 1), we aimed to address the question: do psychosocial factors—three positive (resilience, self-efficacy, emotional support) and one negative (social isolation) correlate with perceived stress in the context of recent stressful life events? We compared whether participants with trauma history reported higher levels of perceived stress following recent life events compared with those without such history.

PARTICIPANTS AND METHODS

This is a cross-sectional analysis of data from the California Lupus Epidemiology Study (CLUES), a prospective longitudinal sample of individuals with confirmed diagnosis of SLE.[13] We used data from baseline study visits as well as data collected during February 2020 to March 2021, dates that correspond with the year 5 follow-up interviews that included information on stress and trauma. Eligibility for this analysis was based on completing the year 5 follow-up interview in which the relevant stress and trauma history data were collected.

As previously described, baseline SLE diagnoses were confirmed by rheumatologists through (1) ≥4 of 11 American College of Rheumatology (ACR) revised criteria for the classification of SLE as defined in 1982 and updated in 1997[14 15]; (2) 3 of 11 ACR criteria with documented treating rheumatologist diagnosis of SLE or (3) a diagnosis of lupus nephritis.[16] Baseline data were collected either in-person or by telephone; year 5 data were

collected by telephone. Participant race and ethnicity were self-reported with fixed categories.

Stress measures
Perceived stress
Perceived stress, the outcome of interest, is a subjective measure of the degree to which life challenges are overwhelming. Perceived stress was assessed with Cohen's abbreviated 4-item Perceived Stress Scale, a validated and widely used measure.[11] Negatively (eg, "How often have you felt that difficulties were piling up so high that you could not overcome them?") and positively worded items (eg, "How often have you felt that things were going your way?") address confidence in managing life stressors. Scores range from 0 (low stress) to 16 (high stress).

Trauma history
We administered the 10-item Brief Trauma Questionnaire (BTQ),[17] developed from the validated Brief Trauma Interview,[18] to assess the experience of trauma. The BTQ was designed to assess Criterion A traumatic experiences (life threat/serious injury), a component of the Diagnostic and Statistical Manual classification for post-traumatic stress disorder.[19] Items query trauma exposures by asking respondents if (a) an event has happened to them, (b) they felt their life was in danger or they would be seriously injured and (c) they were seriously injured because of the event.

We assessed childhood trauma with a 10-item ACE questionnaire based on a validated iteration of the original ACEs study[20 21] that included specific events of abuse (3 items), neglect (2 items) and household challenges (5 items) prior to age 18 years at baseline. Cumulative ACE scores were the sum of the items (range 0–10) with higher scores reflecting greater ACE exposure.[22] ACEs questionnaires were not administered until the baseline visits had been underway for several months, and they were administered only to individuals who participated in an in-person visit and who spoke English or Spanish (a validated Chinese version was not available). Thus, 180 of the 242 participants in the analysis cohort completed the ACEs questionnaire. In previous research, individuals with ACE scores ≥2 had significantly worse outcomes than those with 0 or 1.[9] Therefore, ACE exposures were categorised as 0 or 1 exposures vs 2 or more in our analyses.

We use the term 'BTQ trauma' to refer trauma documented in the BTQ and 'ACEs' to refer to the trauma documented in the ACE questionnaire.

Recent (moderate-to-severe) stressful events
The Life Events Inventory (LEI) is a 51-item survey that assesses potentially stressful events over the past 12 months.[23] Event categories encompass issues of health, living arrangements, family, finances and the law. We adapted the 51-item survey to include 10 other stressful life events for a total of 61 items (shown in online supplemental table 1). The total number of events was used in analyses.

Psychosocial influences on perceived stress
We examined three positive psychosocial influences on perceived stress: resilience, self-efficacy and social support. Resilience reflects the ability to adapt and recover from a stressful situation despite adversity. We used the Brief Resilient Coping Scale (BRCS), a 4-item scale validated in people with SLE (range 0 (low resilience) to 12 (high resilience)).[24] Self-efficacy describes the degree of confidence that an individual has in performing a specific behaviour that will lead to a desired outcome. Emotional support is a type of social support centred on empathy and trust. The Patient-Reported Outcomes Measurement Information System (PROMIS) includes self-efficacy and emotional support scales.[25] Both are 4-item measures. Raw scores are converted to T-scores, with a population mean of 50 and SD of 10.[26] Higher scores represent more of each of these PROMIS constructs (eg, better self-efficacy and greater emotional support).

We examined one negative psychosocial influence, social isolation, defined by infrequent social contact with others. We used the 4-item PROMIS social isolation scale. Scores are reported as T-scores; higher scores represent greater social isolation.

Covariates
Covariates in multivariable regression models included demographic and clinical factors that may be associated with perceived stress. Demographic characteristics were age at baseline, gender, race and ethnicity, educational attainment (high school completion or less, some college or above) and income below the United States (US) federal poverty level for household size. Clinical characteristics from year 5 were SLE disease duration, cumulative SLE organ damage, use of glucocorticoids ≥7.5 mg/day, number of comorbid conditions (heart disease, lung disease, diabetes and cancer) and presence of high levels of depressive symptoms. Disease damage was assessed with the validated Brief Index of Lupus Damage (BILD). Scores ≥2 have been linked to worse SLE outcomes, and a binary variable reflecting scores <2 vs ≥2 was used in analyses. Depressive symptoms were measured with the Patient Health Questionnaire (PHQ-8), which is based on the diagnostic criteria of depression. Scores ≥10 reflect possible depression. A binary variable reflecting score <10 vs ≥10 was used in analyses.

Statistical analyses
As depicted in the figure 1, we tested the hypotheses that (1) recent stressful events are associated with perceived stress, (2) psychosocial factors change the association of recent stressful events to perceived stress and (3) a history of trauma may affect these associations.

First, we compared differences in characteristics between participants who reported BTQ trauma or no BTQ trauma using χ^2 tests for categorical and t-tests for continuous measures. Because of the relatively high correlations among the positive psychosocial factors (online supplemental table 2), we used principal

Table 1 Characteristics of study participants with SLE, by trauma history*

Characteristic	Overall (N=242)	No trauma history (N=71)	Trauma history (N=171)	P value
Sociodemographic factor	% (N) unless specified			
Age, mean±SD	49.4±13.4	46.2±13.7	50.7±13.1	0.02
Women	90.1 (218)	88.7 (63)	90.6 (155)	0.64
Race and ethnicity				0.125
White	33.9 (82)	25.4 (18)	37.4 (64)	
Asian	30.6 (74)	36.6 (26)	28.1 (48)	
Hispanic	24.0 (58)	29.6 (21)	21.6 (37)	
African-American	9.1 (22)	8.5 (6)	9.4 (16)	
Unspecified/Other	2.5 (6)	0	3.5 (6)	
High school education or less	15.3 (37)	19.7 (14)	13.5 (23)	0.22
Household income†				0.64
Poverty income	11.9 (27)	13.4 (9)	11.3 (18)	
SLE-specific characteristic				
SLE disease duration, years, mean±SD	22.2±10.7	20.2±10.9	23.0±10.5	0.07
Paediatric onset disease (diagnosis <18 years)	18.6 (45)	22.5 (16)	17.0 (29)	0.31
Self-report disease damage by BILD, score ≥2	47.5 (115)	38.0 (27)	51.5 (88)	0.06
Glucocorticoid use (≥7.5 mg/day)	13.2 (32)	11.3 (8)	14.0 (24)	0.68

Tabled values are % (n) unless otherwise noted. P values calculated using χ^2 tests for categorical measures and t-tests for continuous measures. Racial and ethnic groups are mutually exclusive, that is, white, Asian and African-American participants were non-Hispanic.
*Trauma defined as perceived danger or threat to life according to Brief Trauma Questionnaire.
†Poverty income defined as ≤125% of the US federal poverty level.
BILD, Brief Index of Lupus Damage.

component analysis to calculate a single 'positive factors' score, based on the eigenvalue loadings of each of the three variables on the first resource.

To examine the relationships of stressful events and positive and negative psychosocial influences on perceived stress, we constructed a series of linear regression models in which the outcome was perceived stress score. In model 1, only the number of potentially stressful life events (LEI) was included. Model 2 added recent events (LEI), the positive psychosocial factor score and PROMIS social isolation score. Model 3 added age, gender, race and ethnicity, educational attainment, income, SLE duration, BILD score, number of comorbid conditions, glucocorticoids ≥7.5 mg/day and depression as covariates. Sensitivity analyses examined models 2 and 3 with the individual psychosocial variables instead of the

Table 2 Perceived Stress Scale and Life Events Inventory and measures of positive (resilience, self-efficacy, emotional support) and negative (social isolation) psychosocial factors, by trauma history* in participants with SLE

	Overall (N=242)	No trauma history (N=71)	Trauma history (N=171)	P value†
Mean±SD				
Perceived Stress Scale	4.7±3.2	3.5±2.9	5.2±3.2	0.0001
Life Events Inventory	4.4±3.0	3.5±2.6	4.9±3.1	0.001
Brief Resilient Coping Scale (range)	8.4±1.9 (0–12)	8.1±2.0 (0–12)	8.5±1.9 (4–12)	0.17
PROMIS self-efficacy‡	49.8±9.3	51.1±9.9	49.2±9.0	0.13
PROMIS emotional support‡	66.6±8.5	68.9±7.8	65.7±8.6	0.008
PROMIS social isolation‡	34.7±6.6	31.9±6.0	35.9±6.5	<0.0001

*Trauma defined as perceived danger or threat to life according to Brief Trauma Questionnaire.
†P values from t-tests comparing scores of individuals with and without trauma history.
‡PROMIS scales, reported as T-scores.
PROMIS, Patient-Reported Outcomes Measurement Information System.

Table 3 Association of perceived stress (Perceived Stress Scale) with stressful events (Life Events Inventory) and positive and negative psychosocial factors, by trauma history (Brief Trauma Questionnaire*), in models with and without adjustment in participants with SLE

	Full sample (n=242)		No trauma history (n=71)		Trauma history (n=171)	
	Beta (95% CI)	P value	Beta (95% CI)	P value	Beta (95% CI)	P value
Model 1						
Life Events Inventory	0.20 (0.07 to 0.33)	0.003	−0.08 (−0.35 to 0.19)	0.55	0.22 (0.07 to 0.37)	0.005
Model R^2	0.04		0.01		0.04	
Model 2						
Life Events Inventory	0.14 (0.03 to 0.24)	0.010	−0.01 (−0.20 to 0.18)	0.91	0.16 (0.04 to 0.29)	0.01
Positive psychosocial factor score†	−0.68 (−0.95 to −0.41)	<0.001	−0.81 (−1.21 to −0.40)	<0.001	−0.63 (−0.98 to −0.28)	<0.001
PROMIS social isolation	0.23 (0.17 to 0.29)	<0.001	0.22 (0.13 to 0.31)	<0.001	0.22 (0.15 to 0.29)	<0.001
Model R^2	0.48		0.54		0.44	
Model 3						
Life Events Inventory	0.14 (0.04 to 0.24)	0.0063	−0.03 (−0.16 to 0.22)	0.78	0.17 (0.05 to 0.29)	0.0077
Positive psychosocial factor score†	−0.67 (−0.94 to −0.40)	<0.0001	−0.68 (−1.16 to 0.20)	0.002	−0.63 (−0.97 to −0.29)	0.0003
PROMIS social isolation	0.20 (0.14 to 0.25)	<0.0001	0.18 (0.09 to 0.28)	0.0004	0.19 (0.11 to 0.26)	<0.0001
Model R^2	0.56		0.67		0.54	

Model 1: includes Life Events Inventory only. Model 2: includes Life Events Inventory, positive psychosocial factor score and PROMIS social isolation T-score. Model 3: includes Life Events Inventory; positive psychosocial factor score; PROMIS social isolation T-score and age, gender, disease duration and education ≤high school, income ≤125% of the US federal poverty level, race and ethnicity, number of comorbidities, BILD score ≥2, glucocorticoid use (≥7.5 mg/day) and PHQ score ≥10.
*Trauma defined as perceived danger or threat to life.
†First eigenvalue from principal component analysis of resilience, emotional support and self-efficacy scores.
BILD, Brief Index of Lupus Damage; PHQ, Patient Health Questionnaire; PROMIS, Patient-Reported Outcomes Measurement Information System.

positive factors score derived from the principal components analysis.

To examine how trauma exposures might affect these relationships, we repeated these models separately for individuals with and without a history of trauma (BTQ).

Finally, we repeated these stratified analyses for the subgroup of the cohort for whom ACEs were available. Because the lifetime trauma questionnaire (BTQ) includes an item querying trauma exposure during childhood, we also repeated the lifetime trauma (BTQ) analyses, excluding that item.

All analyses were conducted in SAS, V.9.4 (SAS Institute, Cary, North Carolina, USA) and Stata Statistical Software, V.15 (StataCorp, College Station, Texas, USA).

Patient participant involvement

Although individuals with SLE were not directly involved in designing the research presented here, the research question was developed specifically on behalf of CLUES participants' experiences of ACEs, perceived stress and flares—each of which associated with worse patient-reported outcomes in SLE.[5 6 9] We sought to examine unaddressed associations among psychosocial factors, perceived stress and trauma to help guide ways to address the effects of traumas even after they have occurred in individuals with SLE. The CLUES team shares outcomes of ongoing and completed research with participants via biannual newsletters.

RESULTS

Of the 251 participants who completed the year 5 interview, 9 were excluded from this analysis for incomplete data, with a final sample size of 242. Most were women participants (90%) with a mean age of 50 years, from diverse racial and ethnic backgrounds, with longstanding SLE (>20 years) and moderate self-reported disease damage (BILD ≥2 in 48%). Seventy-one per cent of individuals with SLE reported BTQ trauma. Additional characteristics are shown in table 1. Those with BTQ trauma were older. Mean perceived stress score was 4.7 (±3.2) which was 0.5 point higher than age-matched US norms.[27] Mean number of stressful life events (LEI) from the prior year was 4.4 (±3.0) (table 2), similar to a sample of healthy middle-aged women,[28] with mean resilience scores (BRCS) that aligned with the original validation cohort.[29] PROMIS scores indicated average levels of self-efficacy, high levels of emotional support and low levels of social isolation.

In multiple regression analyses, model 1 showed the significant positive association of recent stressful life events with perceived stress in the full sample (table 3). In model 2, the positive psychosocial factor score was significantly negatively associated with perceived stress. The social isolation score was positively associated with perceived stress. The addition of these two factors substantially increased the model R^2, but the parameter estimate of recent stressful life events (LEI) did not change in a meaningful way. In model 3, in which covariates were

Table 4 Association of perceived stress (Perceived Stress Scale) with stressful events (Life Events Inventory) and positive and negative psychosocial factors, by ACEs*, in models with and without adjustment

	Full sample (n=180)		No ACEs (n=111)		ACEs (n=69)	
Perceived Stress Scale, mean±SD	4.7±3.1		4.5±3.0		5.2±3.2	
	Beta (95% CI)	P value	Beta (95% CI)	P value	Beta (95% CI)	P value
Model 1						
Life Events Inventory	0.24 (0.08 to 0.39)	0.003	0.19 (–0.14 to 0.42)	0.11	0.25 (0.02 to 0.47)	0.033
Model R^2	0.05		0.02		0.07	
Model 2						
Life Events Inventory	0.18 (0.05 to 0.30)	0.006	0.05 (–0.13 to 0.23)	0.62	0.31 (0.11 to 0.51)	0.003
Positive psychosocial factor score†	–0.61 (–0.92 to –0.29)	0.0002	–0.56 (–0.94 to –0.19)	0.004	–0.85 (–1.47 to –0.23)	0.008
PROMIS social isolation	0.22 (0.15 to 0.28)	<0.0001	0.24 (0.16 to 0.32)	<0.0001	0.17 (0.06 to 0.28)	0.003
Model R^2	0.44		0.43		0.45	
Model 3						
Life Events Inventory	0.20 (0.08 to 0.33)	0.0018	0.07 (–0.12 to 0.27)	0.54	0.37 (0.15 to 0.58)	0.0011
Positive psychosocial factor score†	–0.62 (–0.67 to –0.24)	0.0003	–0.67 (1.07 to –0.27)	0.0013	1.01 (–1.72 to –0.31	0.0056
PROMIS social isolation	0.19 (0.13 to 0.26)	<0.0001	0.22 (0.14 to 0.31)	<0.0001	0.19 (–0.04 to 0.21)	0.17
Model R^2	0.51		0.52		0.61	

Model 1: includes Life Events Inventory only. Model 2: includes Life Events Inventory, positive psychosocial factor score and PROMIS social isolation T-score. Model 3: includes Life Events Inventory; positive psychosocial factor score; PROMIS social isolation T-score and age, gender, disease duration, education ≤high school, income ≤125% of the US federal poverty level, race and ethnicity, number of comorbidities, BILD score ≥2, glucocorticoid use (≥7.5 mg/day) and PHQ score ≥10.
*Childhood trauma by ACE questionnaire scores ≥2.
†First eigenvalue from principal component analysis of resilience, emotional support and self-efficacy scores.
ACEs, adverse childhood experiences; BILD, Brief Index of Lupus Damage; PHQ, Patient Health Questionnaire; PROMIS, Patient-Reported Outcomes Measurement Information System.

added, parameter estimates for recent stressful life events (LEI), positive psychosocial factors and social isolation did not change in a meaningful way, nor did the model R^2. Supplemental analyses using the individual psychosocial factors variables suggested that when considered individually, each of the psychosocial factors was significantly associated with perceived stress (data not shown). However, when all were entered into the same model, results suggested that, among the positive factors, self-efficacy had the greatest association with lower perceived stress (online supplemental table 2).

Stratification by trauma exposure
Stratifying analyses by trauma exposure showed somewhat different results for the two groups. Individuals with BTQ trauma reported greater perceived stress and the experience of more recent stressful life events within the last year than those without a history of trauma (table 2). Individuals with a history of trauma also had lower emotional support and greater social isolation scores. There was no significant difference in resilience and self-efficacy score between individuals with and without trauma history.

In multivariable regression models, for those who had not experienced BTQ trauma, there was no association between the number of recent life events and current perceived stress (table 3). Conversely, the number of recent life events was significantly associated with perceived stress for those with BTQ trauma. Associations

of positive (resilience, self-efficacy and emotional support) and negative (social isolation) factors were similarly associated with perceived stress for each group.

One hundred eighty participants completed the ACE questionnaire. Among these, 69 (38%) reported ≥2 ACEs. Multivariable regression analyses revealed similar results for those with ACEs as for those with broader BTQ trauma: the number of recent life events was significantly associated with perceived stress in those with ACEs but not in those without ACEs. Positive psychosocial factor scores were inversely associated with perceived stress, but the negative factor was not (table 4). Results of the BTQ trauma (BTQ) analysis omitting ACEs were also similar (online supplemental table 3).

DISCUSSION
This is the first study in a cohort of people with SLE to investigate the association of potentially stressful life events with perceived stress, whether psychosocial factors affect perceived stress, and whether these relationships vary by prior trauma exposure. We found that the number of recent stressful life events was associated with greater perceived stress only among individuals with trauma history. Regardless of trauma history and life events, positive psychosocial factors were associated with lower perceived stress while social isolation was associated with greater perceived stress.

Although links between heightened perceived stress and worse disease activity, patient-reported outcomes and mental health in SLE are well documented,[5 7 30 31] the role of life events in influencing perceived stress has received little attention. In the full sample, we found that a greater number of recent stressful life events was independently associated with perceived stress, consistent with findings in other health conditions. For example, a study of post-partum women with >3 recent life stressors had perceived stress that was 3 times greater compared with women with <3 stressors after adjustment for demographic factors.[32] In our stratified analyses, however, this association was seen only for individuals with a trauma history. A study of 176 adults found that a higher number of ACEs correlated with lower well-being and increased stressful events in adulthood; those with more positive psychosocial factors exhibited lower stress and greater well-being.[33] Similarly, in the present study, individuals with trauma history reported both a greater number of life events and greater perceived stress. It was not possible to determine if the association was due to greater exposure to stressful events or greater vulnerability to those events. People with trauma history can develop habituation to stress that is deleterious over time because of a blunted stress-response or lack of ability to recover from stress.[34] Trauma may predispose a person to less favourable social situations which then could increase exposures to more frequent stressful life events or re-traumatisation.[33] Regardless, the association of number of recent stressful life events and trauma history suggests that it may be possible to identify individuals who are more vulnerable to high levels of perceived stress and may benefit from interventions designed to promote positive coping with adversity.

We hypothesised that positive psychosocial factors would mitigate the effect of life events on stress; however, our results did not show meaningful change in the parameter estimates. While there was a significant association of psychosocial factors with stressful events in all groups, it did not change the effects of the stressful events, which suggests that some other coping mechanism or unmeasured factor exists in this role.

We found that positive and negative psychosocial factors were associated with perceived stress. Our finding aligned with links between perceived stress and psychosocial influences shown in individuals with sickle cell disease (SCD). Fewer positive and more negative psychosocial influences—worse self-efficacy, less social support—have contributed to worse perceived stress and worse symptoms for people living with SCD.[35 36] In the present study, self-efficacy had the most robust association with perceived stress among the positive psychosocial factors. In people with SLE, greater self-efficacy has been linked to improved SLE disease activity and overall quality of life.[30 37] In contrast, lower self-efficacy has been associated with health disparities in SLE organ damage, difficulties with medication adherence and lower motivation for self-care.[38–40] In SLE, greater self-efficacy may lead to lower perceived stress through confidence in self-management, such as ability to manage symptoms, or means to cope with SLE disease unpredictability. Importantly, interventions have improved self-management and self-efficacy in SLE.[41–43]

Resilience aligns with positive coping behaviours in SLE.[44] Resilience also fortifies social interactions and positive factors in individuals with rheumatoid arthritis.[45] While deficits in resilience may negatively affect health, some individuals with immature coping patterns at a young age can learn to harness motivation, autonomy and external social support to overcome adversity.[46] Refining and testing evidence-based resilience interventions in SLE are important next steps to reduce negative effects of perceived stress.

A key argument in trauma history and differential appraisals of trauma is that 'traumatic events alone are insufficient to produce enduring stress and debility. Rather, the disorder is the product of the interplay of environmental stressors and psychosocial factors'.[47] This argument is founded on separate behavioural and cognitive theories of situational control. Behavioural control is where an individual overcomes traumatisation by avoidance—like choosing not to engage with a negative person. Cognitive control is when an individual believes that they can successfully manage a threat—like taking a class on self-defence and feeling confident that they can protect themselves if they encounter a potentially dangerous situation. Cognitive control theory has relevance to our findings. While participants with and without trauma history reported no significant difference in resilience, those with trauma history had lower self-efficacy and emotional support than those without trauma. However, when examined individually, resilience was associated with lower perceived stress, even among those with a history of trauma. Strengthening cognitive control by enhancing positive psychosocial factors is a promising step in managing responses to traumatic experiences and merits study in individuals with SLE, since behaviour changes towards self-management could address links between perceived stress and SLE outcomes such as disease activity.

Patients with SLE often report that the unpredictability of SLE contributes to a perceived lack of control of health. This uncertainty may erode confidence and accentuate symptoms of anxiety and depression. Self-management programmes that facilitate a sustained switch from behavioural control (avoidance) to cognitive control (self-efficacy) may provide one approach to lessen perceived stress and could foster post-traumatic growth for people with SLE who have experienced trauma. Understanding how individuals exposed to childhood trauma can foster and sustain positive coping skills through the lifespan may help guide self-management interventions for those with trauma in adulthood.

Our previous work associated trauma history and perceived stress with SLE outcomes. We now establish a connection between stress perceptions and current stress in the context of historical stress and psychosocial

influences. Taken together, adaptations to perceived stress may be possible with fortified psychosocial influences which in turn may affect outcomes such as disease activity, fatigue and flares—even among individuals with trauma exposures.

As research uncovers and strengthens relationships in the stress-health pathway among individuals with SLE, translating this work to clinical settings must keep pace. To ask about trauma history, coping strategies and psychosocial resources during encounters may inform clinicians how to provide more targeted interventions given links between psychosocial adaptation to uncontrollable stress and physical and mental health.[48] Yet there are unmet needs to promote environments where post-traumatic growth can occur.[49] Considerations include support for clinical care teams to recognise trauma and stressors, as well as access to experts in mental and social health services who can help address these factors and strengthen psychosocial resources for individuals with SLE.

Limitations

There are limitations to this study. We were underpowered to stratify within each trauma group by depression; however, we did adjust for depression. As expected, depression was associated with higher stress scores. Trauma can worsen mental health in a dose-response pattern in the general population[50][51] and in those with SLE.[2] Year 5 data collection coincided with the COVID-19 pandemic, a global stressful event that challenged stabilising factors of health, workplace, family and socialisation with disproportionate effects on some persons with SLE.[52] Since such events can retrigger post-traumatic stress and amplify the stress response in those with a history of trauma, it is possible that effects seen among patients with SLE were overestimated. We used cross-sectional data which do not permit conclusions about directionality; those with high perceived stress could also be susceptible to increased life trauma. We do not have measures of the positive psychosocial factors from an earlier point in time. It is possible that the individuals in our study with childhood trauma who interacted with the medical community to participate in a longitudinal cohort study have developed skills that have facilitated positive post-traumatic adaptation. If this is the case, the impact of interventions to improve coping and self-management skills may be even greater among individuals without such adaptation. This sample derived from a population of individuals with median age of 50 years, well-controlled longstanding SLE and strong social support. Studies among individuals who are younger, have more volatile disease activity with recent diagnosis and greater challenges with social determinants of health are warranted, as our findings may be underestimated for these groups.

Our measure of recent stressful events is a count of the number of recent life events and may be an oversimplification of the global experience of recent life stressors. The psychosocial factors appear to affect the evaluations of stress caused by the events, although the number of events continues to play a role in perceived stress for individuals with a history of trauma. In other words, for people without a history of trauma, the cumulative load of potentially stressful events was not a critical determinant of perceived stress. In contrast, people who have a history of trauma may have less ability to manage the cumulative effects of these events. Both groups, however, appear to be able to reap the benefits of positive psychosocial factors and lessening of negative factors. These findings suggest an update to our theoretical model such that the effects of psychosocial factors act directly on perceived stress rather than modifying the relationship between the number of life events and perceived stress.

CONCLUSION

This study adds to the growing body of literature that explores the interplay of stress, trauma and outcomes among people with SLE. We found that individuals who have a history of trauma exposure may be more vulnerable to greater current interpersonal, economic or other stressful experiences that lead to higher perceived stress levels. Awareness of this potentially harmful association can help clinicians direct psychosocial support resources to vulnerable patients as part of a comprehensive trauma-informed care plan. Given demonstrated associations between perceived stress and poor health outcomes in SLE, modifiable positive psychosocial factors such as self-efficacy and emotional support may be important in managing perceptions of stress. Increased access to interventions that strengthen positive and lessen negative psychosocial factors to lower perceived stress is a next step towards improving care for people with SLE.

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Ethics approval The study was approved by the University of California San Francisco institutional review board. Participants provided informed consent before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request. All data relevant to the study are included in the article or uploaded as supplementary information. Data relevant to the study are included in the article or uploaded as supplementary information, any additional data available on reasonable request.

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