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Racial Disparities in Medication Adherence between African American and Caucasian Patients With Systemic Lupus Erythematosus and Their Associated Factors

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Objective. Medication nonadherence is more common in African Americans compared with Caucasians. We examined the racial adherence gaps among patients with systemic lupus erythematosus (SLE) and explored factors associated with nonadherence.

Methods. Cross-sectional data were obtained from consecutive patients prescribed SLE medications seen at an academic lupus clinic between August 2018 and February 2019. Adherence was measured using both self-report and pharmacy refill data. High composite adherence was defined as having both high self-reported adherence and high refill rates. Covariates were patient-provider interaction, patient-reported health status, and clinical factors. We compared adherence rates by race and used race-stratified analyses to identify factors associated with low composite adherence.

Results. Among 121 patients (37% Caucasian, 63% African American), the median age was 44 years (range 22-72), 95% were female, 51% had a college education or more, 46% had private insurance, and 38% had high composite adherence. Those with low composite adherence had higher damage scores, patient-reported disease activity scores, and more acute care visits. High composite adherence rate was lower among African Americans compared with Caucasians (30% vs 51%, $P = 0.02$), and the gap was largest for those taking mycophenolate (26% vs 75%, $P = 0.01$). Among African Americans, low composite adherence was associated with perceiving fewer "Compassionate respectful" interactions with providers and worse anxiety and negative affect. In contrast, among Caucasians, low composite adherence was only associated with higher SLE medication regimen burden and fibromyalgia pain score.

Conclusion. Significant racial disparities exist in SLE medication adherence, which likely contributes to racial disparities in SLE outcomes. Interventions may be more effective if tailored by race, such as improving patient-provider interaction and mental health among African Americans.

INTRODUCTION

Substantial racial health care disparities exist in systemic lupus erythematosus (SLE), with the incidence, prevalence, and long-term outcomes of SLE being worse amongst under-represented racial and ethnic minority patients compared with Caucasian patients (1). Racial disparities also exist in medication adherence: growing evidence has demonstrated lower medication adherence rates among minority SLE patients (2–5). Among SLE patients of all races, medication nonadherence has been reported to be as high as 80% and is a major preventable cause of increased morbidity and mortality (3,6–8). Higher nonadherence rates among minorities have been hypothesized to partially explain known racial outcome disparities in SLE. Yet, determinants of nonadherence in SLE have not been extensively studied, and little is known about racial differences in adherence barriers to SLE medications. Patient-physician relationship and quality of communication have been theorized to contribute to the increased nonadherence among minority patients (9). Given the frequent racial mismatch between SLE patients and providers

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SIGNIFICANCE & INNOVATION

- We found that adherence rates were low across all types of SLE medications, and nonadherence was associated with worse SLE outcomes.
- We found significant racial disparities in medication adherence among SLE patients, with the largest racial difference among those prescribed mycophenolate, even after adjusting for age. As mycophenolate is a critical first-line medication for lupus nephritis, racial disparities in adherence likely contributes to known disparities in SLE outcomes.
- Importantly, we found distinct racial differences in factors associated with nonadherence. Although nonadherence among African Americans is associated with worse scores in certain domains of patient-provider interactions and mental health, nonadherence among Caucasians is only associated with higher SLE medication regimen burden and fibromyalgia pain score. This suggests interventions tailored by race may be more effective in improving adherence in SLE.

(10,11), the impact of patient-provider communication on medication adherence is an area that is highly relevant but understudied. We aimed to examine racial differences between African American and Caucasian patients in adherence to SLE medications and explore factors associated with nonadherence by race, with the ultimate goal of identifying avenues for intervention.

METHODS

Study setting and population. Consecutive eligible patients were recruited from a tertiary academic lupus clinic staffed by six attending rheumatologists (four are Caucasian and two are Asian) who share the clinical care for all lupus patients. Included patients were over age 18, fluent in English, self-identified as either African American or Caucasian, met ACR 1997 or Systemic Lupus International Collaborating Clinics (SLICC) 2012 SLE criteria, and were prescribed at least one medication for SLE by lupus clinic providers (12,13). Patients were not enrolled if they were pregnant or nursing, which may temporarily alter medication-taking behavior, or had significant cognitive or language barriers that prevented questionnaire completion. We did not include patients new to the lupus clinic as their SLE diagnoses may not have been established, and we wanted to focus on patients who have an ongoing relationship with their providers. All participants provided written informed consent. The study was approved by the institutional review board (IRB) at Duke University (IRB study: Pro00100861).

Data collection. Cross-sectional data were obtained through questionnaires and electronic medical record review. Self-reported sociodemographic information including race and ethnicity was collected. In addition, the following instruments and measures were obtained.

Adherence measures. We used the Medication Adherence Self-Report Inventory (MASRI) part A, an instrument validated in SLE, to measure self-reported adherence to SLE medications (14). This is a six-item questionnaire about the amount of medication taken in the past month and provides a numerical estimate of adherence from 0%-100%. High self-reported adherence was defined as MASRI ≥ 90%, according to published cutoff (14). Additionally, we obtained pharmacy refill information for all SLE medications prescribed in the prior 3 months through phone calls to each patient's pharmacy. High refill was defined as having a medication possession ratio (MPR) of 80% or greater (15). High composite adherence was defined as having both high self-reported adherence (MASRI ≥ 90%) and high refills (MPR ≥ 80%). We categorized patient's adherence into high and low composite adherence for each SLE medication as well as accounted for all SLE medications the patient is prescribed.

Patient-provider interaction. We used the Interpersonal Processes of Care Survey (IPC-29) (16), which has 29 items on a five-point Likert scale, to assess seven domains of patient-provider interaction, including "Hurried communication" (doctors spoke fast, were hard to understand, ignored patient's concerns, were bothered by patient's questions, and were distracted), "Elicit concerns responded" (doctors found out patient's concerns, heard patient's concerns, and took them seriously), "Explained results medications" (doctors explained results and medications), "Patient-centered decision making" (doctors asked patient and worked out treatment together), "Compassionate respectful" (doctors provided emotional support, were compassionate and respectful), "Discrimination" (doctors made assumptions, discriminated), and "Disrespectful office staff" (office staff were negative and rude, gave patient a hard time, and talked down to patient). Scores for each domain ranged from 1 to 5, and higher scores indicate higher frequency of that domain.

Patient self-efficacy. We used the Patient-Reported Outcomes Measurement Information System (PROMIS) short forms to measure both general self-efficacy (four items) and self-efficacy for managing medications and treatments (eight items). Raw scores were uploaded to the scoring service, where T-scores were obtained (17). A T-score of 50 correlates to the reference population mean, with a standard deviation of 10. A five-point difference (half a standard deviation) is considered a clinically significant difference (18,19).

Patient-reported health status. The PROMIS-29 short form, a validated instrument in SLE (20,21), was used to measure patient-reported physical function, anxiety, depression, fatigue, sleep disturbance, social function, and pain. Patients also completed the 2011 American College of Rheumatology Fibromyalgia Criteria questionnaire (22), which assessed fibromyalgia symptom severity.

SLE disease activity and damage. We used the Systemic Lupus Activity Questionnaire (SLAQ) (23), a validated patient-reported SLE disease activity measure. In addition, the SLE Disease Activity Index (SLEDAI) (24), a provider-derived SLE disease activity measure, was completed at the study visit by

the attending rheumatologist, and the SLICC Damage Index was obtained via medical record review (25).

Health records review. The following were collected from medical record review: insurance status, disease duration, hospitalizations/emergency room visits in the past 12 months, Charlson comorbidities (26), and prescribed medications. A Medication Regimen Complexity Index was calculated according to standard methods based on route and frequency of administration, with a higher score indicating a more complex regimen (27).

Statistics. To determine the sample size, we estimated adherence would average 40% in African American and 65% in Caucasian patients with SLE based on a literature review of known rates of medication adherence in SLE patients (28,29). A sample size of 124 with 62 African American and Caucasian patients with SLE each would provide 80% power and 5% alpha error to detect a statistically significant difference in adherence rates between the two groups.

Categorical variables were described with percentages, and continuous variables were summarized with either mean (standard deviation) or median [interquartile range (IQR)], depending upon distribution. We compared all adherence measures by race and performed logistic regression analysis to derive age-adjusted odds ratios (ORs) for having high adherence measures for African Americans, using Caucasian patients as reference.

We chose composite adherence as the most clinically meaningful outcome measure as it indicates that the patient had both refilled and reported taking a medication. High and low composite adherence groups were compared using chi-squared tests or Fisher's exact tests for categorical variables, and *t* tests or Wilcoxon rank-sum tests for continuous variables, as appropriate. We then performed race-stratified analyses to identify factors differentially associated with composite adherence level between African American and Caucasian patients.

Statistical analyses were performed using STATA (version 14.2; StataCorp).

RESULTS

Study population. One hundred and thirty-four patients with SLE were consented between August 2018 and February 2019. For this analysis, we excluded nine patients who did not complete any portion of the questionnaires and four patients who self-identified as "other" race. There were no significant differences in demographics between patients who did and did not complete the questionnaire. Of the 121 patients included, 76 (63%) were African Americans and 45 (36%) were Caucasians. The median age was 44 (IQR, 34-53), 95% were female, 51% had college or above education level, 41% were on disability, 17% had Medicaid insurance, and 44% were married (Table 1). Compared with Caucasians, African American patients were younger, less likely to be married or have college or above education, and more likely to be on disability (Table 2). On average, patients had been diagnosed with SLE for 15 years, and disease duration was not significantly different by race or adherence levels. The most frequently prescribed SLE medications were hydroxychloroquine (86%) and prednisone (45%). Disease-modifying antirheumatic drugs (DMARDs) were prescribed to 59%, with the most common being mycophenolate (35%), followed by azathioprine (12%), methotrexate (12%), and leflunomide (3%). Belimumab was prescribed to 5%. On average, patients were prescribed two SLE medications (Table 3).

Medication adherence. Overall, 81 (67%) patients had high self-reported adherence (MASRI ≥ 90%), 58 (48%) had high refills (MPR ≥80%), and only 46 (38%) had high composite adherence (MASRI ≥ 90% and MPR ≥ 80%) for all SLE medications prescribed. High composite adherence rates for hydroxychloroquine was 48%, 44% for prednisone, 34% for DMARDs as a whole, and 36% for mycophenolate.

Compared to patients with high composite adherence for all SLE medications prescribed, those with low composite adherence were younger (41 vs 48, $P = 0.01$) and more likely to be African American (71% vs 50%, $P = 0.02$). There were no significant

Table 1. Comparing patient demographic between high and low composite adherence

		Composite Adherence		
	Total (n = 121)	High (n = 46)	Low (n = 75)	*P* value
Age, years, median[IQR]	44[34-53]	**48[38-56]**	**41[32-50]**	**0.01**
Female	95%	91%	97%	0.1
African American	63%	**50%**	**71%**	**0.02**
College or above education	51%	52%	51%	0.9
Married	44%	50%	40%	0.3
Insurance type				0.9
Private	46%	50%	44%	
Medicaid	17%	15%	19%	
Medicare	31%	30%	32%	
Other	6%	5%	5%	

Abbreviation: IQR, interquartile range.
Bolded values indicate *p*-value <0.05.

Table 2. Comparing demographics between Caucasian and African American patients

Patient Characteristics	Total (n = 121)	Caucasian (n = 45)	African American (n = 76)	*P* value
Age, years, median[IQR]	44[34-53]	**46[38-60]**	**41[32-50]**	**0.006**
Female	95%	91%	97%	0.1
College or above education	51%	**71%**	**39%**	**0.001**
Disability	41%	**27%**	**49%**	**0.02**
Married	44%	**62%**	**33%**	**<0.001**
Insurance type				0.2
Private	46%	56%	41%	
Medicaid	17%	7%	24%	
Medicare	31%	31%	32%	
Other	6%	6%	3%	
SLE disease duration, years, median[IQR]	15[8-21]	14[7-18]	15[9-22]	0.3

Abbreviation: IQR, interquartile range; SLE, systemic lupus erythematosus.
Bolded values indicate *p*-value <0.05.

differences in education level, disability, or insurance status between adherence groups in bivariate analysis.

Those with low composite adherence had higher SLICC damage scores (median 2 vs. 1, p=0.02) and SLAQ scores (median 9 vs 6, p=0.01) and were more likely to have had at least 1 ER visit or hospitalization in the past year (65% vs. 46%, p=0.03) (Table 3).

Those with low composite adherence also reported more "Hurried communication" with the provider, a trend for less "Compassionate respectful" interaction, lower self-efficacy in managing medications and treatments, and higher anxiety and pain intensity. They were prescribed more SLE medications with a more complex SLE medication regimen.

Racial differences in adherence. Comparing adherence measures by race, African American patients were less likely than Caucasians to have high self-reported adherence (58% vs 82%, *P* = 0.006), high refills (41% vs 60%, *P* = 0.04), and high composite adherence (30% vs 51%, *P* = 0.02) for all SLE medications combined (Table 4). There were no racial differences in rates of high composite adherence for hydroxychloroquine or DMARDs as a whole. However, African Americans were less likely to have high composite adherence for prednisone (34% vs 75%, *P* = 0.02) and mycophenolate (26% vs 75%, *P* = 0.01). In age-adjusted models, African Americans compared with Caucasians had lower odds of high self-reported adherence [OR: 0.35; 95% confidence inter-

Table 3. Comparing patient-reported and clinical factors between high and low composite adherence

	Total (n = 121)	Composite Adherence		*P* value
		High (n = 46)	Low (n = 75)	
Hurried communication,[a] median[IQR]	1.3[1-1.8]	**1[1-1.5]**	**1.3[1-1.8]**	**0.03**
Hard words, median[IQR]	1[1-2]	**1[1-2]**	**2[1-2]**	**0.03**
Compassionate respectful,[a] median[IQR]	5[4.2-5]	5[5-5]	5[4-5]	0.06
Compassionate, median[IQR]	5[4-5]	**5[5-5]**	**5[4-5]**	**0.05**
Self-efficacy in taking meds,[b] median[IQR]	48[42-56]	51[46-61]	47[41-55]	0.08
Anxiety,[b] median[IQR]	52[40-58]	51[40-56]	53[40-60]	0.05
Pain intensity,[c] mean (SD)	4 (2.6)	3.6 (2.8)	4.3 (2.5)	0.09
>2 SLE medications	70%	**51%**	**81%**	**0.001**
SLE regimen complexity, median[IQR]	7[3-9]	**5[3-8]**	**8[5-10]**	**0.02**
SLICC damage score, median[IQR]	2[0-3]	**1[0-2]**	**2[1-4]**	**0.02**
SLAQ, median[IQR]	9[5-14]	**6[4-12]**	**9[7-15]**	**0.01**
SLEDAI, median[IQR]	2[0-5]	0.5[0-4]	2[0-6]	0.08
≥1 ER visit/hospitalization	58%	**46%**	**65%**	**0.03**
SLE disease duration, y, median[IQR]	15[8-21]	14[9-18]	15[8-21]	1.0

Abbreviation: ER, emergency room; IPC-29, Interpersonal Processes of Care Survey with 29 questions; IQR, interquartile range; meds, medications; PROMIS, Patient-Reported Outcomes Measurement Information System; SD, standard deviation; SLAQ, Systemic Lupus Activity Questionnaire, SLE, systemic lupus erythematosus, SLEDAI, SLE Disease Activity Index, SLICC, Systemic Lupus International Collaborating Clinics.
[a] IPC-29 survey, score ranges from 1 to 5; 1 is the best score for hurried communication, 5 is the best score for compassionate respectful, other domains (elicited concerns, explained results, patient-centered decision making, discrimination, and disrespectful office staff) were nonsignificant.
[b] PROMIS measures, reference population mean score is 50, clinically significant difference is 5, higher score indicates more of the domain.
[c] Part of PROMIS-29, score ranges from 0 to 10, with 10 indicating most severe pain.
Bolded values indicate *p*-value <0.05.

Table 4. Comparing adherence measures between African Americans and Caucasians and age-adjusted odds ratios for high adherence, with Caucasians being the reference group

		Caucasian	AA	OR	95% CI	*P* value	Adj OR[a]	95% CI	*P* value
All SLE meds (n = 121)	Self-report	**82%**	**58%**	**0.30**	**0.1-0.7**	**0.01**	**0.35**	**0.14-0.87**	**0.02**
	Refill	**60%**	**41%**	**0.46**	**0.2-1.0**	**0.04**	0.57	0.26-1.2	0.16
	Composite	**51%**	**30%**	**0.42**	**0.2-0.9**	**0.02**	0.5	0.22-1.1	0.09
Prednisone (n = 54)	Refill	83%	57%	0.27	0.05-1.4	0.1	0.4	0.07-2.3	0.3
	Composite	**75%**	**36%**	**0.19**	**0.04-0.8**	**0.02**	0.22	0.05-1.1	0.06
HCQ (n = 104)	Refill	67%	55%	0.62	0.3-1.4	0.26	0.78	0.33-1.8	0.6
	Composite	56%	43%	0.60	0.3-1.3	0.2	0.74	0.32-1.7	0.5
DMARD (n = 71)	Refill	**64%**	**38%**	**0.35**	**0.1-1.0**	**0.05**	0.39	0.13-1.1	0.08
	Composite	45%	29%	0.50	0.2-1.3	0.2	0.6	0.2-1.8	0.35
MMF (n = 42)	Refill	**88%**	**38%**	**0.09**	**0.01-0.8**	**0.03**	**0.1**	**0.01-0.9**	**0.04**
	Composite	**75%**	**26%**	**0.12**	**0.02-0.7**	**0.02**	**0.16**	**0.02-1.0**	**0.05**

Abbreviation: AA, African American; Adj, adjusted; CI, confidence interval; DMARD, disease-modifying antirheumatic drugs; HCQ, hydroxychloroquine; meds medications; MMF, mycophenolate; OR, odds ratio; SLE, systemic lupus erythematosus
[a] Using Caucasians as the reference group adjusting for age.
Bolded values indicate p-value <0.05.

val (CI): 0.14-0.87, $P = 0.02$], high refills of mycophenolate (OR: 0.1; 95% CI: 0.01-0.9, $P = 0.04$), and high composited adherence to mycophenolate (OR: 0.16; 95% CI: 0.02-0.99, $P = 0.05$).

Factors associated with adherence by race. We found significant racial differences in factors associated with composite adherence level (Table 5). Though scores for patient-provider interaction were near or at optimal obtainable scores across all domains, African Americans with low composite adherence compared to high composite adherence perceived less "Compassionate respectful" interaction and had a trend for more "Hurried communication" with their providers. These were mainly reflected through questions about doctors being compassionate and concerned about the patient's feelings and doctors using hard words, ignoring what the patient told them, and appearing distracted. African Americans with low composite adherence also had worse mental health as reflected by higher anxiety and negative affect.

In contrast, among Caucasian patients, scores for the Interpersonal Processes of Care Survey domains were not different by composite adherence levels, except there was a trend for more perceived "Discrimination" among those with low composite adherence, mainly reflected in the question about doctors making assumptions of the patient's income. In contrast, Caucasians with

Table 5. Comparing high and low composite adherence, stratified by race

	African American			Caucasian		
	High (n = 23)	Low (n = 53)	*P* value	High (n = 23)	Low (n = 22)	*P* value
Hurried communication,[a] median[IQR]	1.1[1-1.5]	1.5[1-1.8]	0.07	1[1-1.5]	1[1-1.5]	0.7
Hard words, median[IQR]	**1[1-2]**	**2[1-2]**	**0.04**	1[1-2]	1[1-2]	0.7
Doctor ignore, median[IQR]	**1[1-1]**	**1[1-2]**	**0.05**	1[1-1]	1[1-1]	0.7
Doctor distracted, median[IQR]	1[1-1]	1[1-1]	0.07	1[1-1]	1[1-1]	0.7
Compassionate respectful,[a] median[IQR]	**5[5-5]**	**5[4-5]**	**0.02**	5[4.4-5]	5[4.2-5]	0.6
Compassionate, median[IQR]	**5[5-5]**	**5[4-5]**	**0.05**	5[4-5]	5[4-5]	0.5
Concerned, median[IQR]	**5[5-5]**	**5[4-5]**	**0.04**	5[4-5]	5[4-5]	0.6
Discrimination,[a] median[IQR]	1[1-1]	1[1-1]	0.8	1[1-1.5]	1[1-1]	0.06
Assume income, median[IQR]	1[1-1]	1[1-1]	1	1[1-1]	1[1-1]	0.09
Negative effect, median[IQR]	**13[11-16]**	**16[13-21]**	**0.02**	16[12-21]	16[12-21]	0.8
Anxiety,[b] median [IQR]	**43[40-58]**	**54[40-60]**	**0.04**	51[40-56]	50[40-59]	0.6
Social health,[b] median[IQR]	54(9)	50 (10)	0.06	46(11)	47 (10)	0.4
>2 SLE medications	65%	84%	0.09	**39%**	**77%**	**0.01**
SLE regimen complexity, median[IQR]	7[3-11]	8[5-10]	0.6	**3[3-7]**	**7[3-9]**	**0.03**
SLEDAI, median[IQR]	2[0-4]	4[2-6]	0.06	2[0-4]	0[0-4]	0.8
SLAQ, median[IQR]	6[4-11]	9[5-13]	0.06	**8[4-12]**	**12[8-18]**	**0.04**
Fibromyalgia pain, mean (SD)	4.4 (3.3)	4.6 (3.0)	0.4	**4.4 (3.1)**	**6.2 (2.7)**	**0.04**

Abbreviation: IPC-29, Interpersonal Processes of Care Survey with 29 questions; IPC-29, Interpersonal Processes of Care Survey with 29 questions; IQR, interquartile range; PROMIS, Patient-Reported Outcomes Measurement Information System; SD, standard deviation; SLAQ, Systemic Lupus Activity Questionnaire; SLE, systemic lupus erythematosus; SLEDAI, SLE Disease Activity Index.
[a] IPC-29 survey, score ranges from 1 to 5, 1 is best for "Hurried communication" and "Discrimination," 5 is best for "Compassionate respectful."
[b] PROMIS measures, reference population mean score is 50, clinically significant difference is 5; a higher score indicates more of the domain.
Bolded values indicate p-value <0.05.

low compared to high composite adherence took more SLE medications, had more complex SLE regimens, and had higher fibromyalgia pain scores (Table 5).

DISCUSSION

In this tertiary care lupus clinic cohort, adherence rates were low by both subjective and objective measures and were comparable to previously reported adherence rates in SLE (28,30). Not surprisingly, low composite adherence was associated with worse SLE outcomes, including higher SLAQ scores, SLICC damage scores, and more emergency room visits or hospitalizations, further underscoring the critical need to address adherence in order to improve disease outcomes and reduce health care costs.

Although many studies have identified racial disparities in outcomes of SLE, few have specifically examined racial disparities in medication adherence among SLE patients. Our data add valuable insight to the existing literature. We found significant racial disparities in all measures of adherence. The racial gap in adherence was largest for mycophenolate, even after adjusting for age. As mycophenolate is one of the most important first-line treatments for lupus nephritis, this adherence gap likely disproportionately contributes to known racial disparities in SLE outcomes, such as increased mortality and end-stage renal disease among African Americans.

In two large longitudinal studies of Medicaid beneficiaries with SLE by Feldman et al (4,5), the Medicaid-insured population had uniformly low degrees of adherence to hydroxychloroquine, azathioprine, and mycophenolate, and minority race was associated with lower adherence to hydroxychloroquine and azathioprine, but there was no racial difference in mycophenolate adherence. The authors also found different patient characteristics predicting nonadherence across medications. Although the Feldman et al studies assessed MPR longitudinally over 12 months and included exclusively Medicaid recipients, our study assessed pharmacy refills in the prior 3 months, and only 44% of participants were using Medicaid insurance. These distinctions may explain differences in our results. However, despite these differences, importantly, our studies all point to racial disparities in medication nonadherence in SLE, and that adherence patterns and associated factors are not uniform across all SLE medications.

Our study is an important addition to the literature on factors associated with nonadherence in SLE. We found that quality of patient-provider communication, patient mental health, and pill burden were associated with adherence level and therefore are potential areas for intervention. Although these factors have been described in the past in association with nonadherence, little is known about whether these relationships are modified by race. Interestingly, we found that entirely distinct factors were associated with nonadherence between African American and Caucasian patients. Although patient-provider communication and mental health were significantly associated with adherence level among African Americans, pill burden and fibromyalgia scores were significant among Caucasians.

Few studies have examined differences in adherence barriers by race. Heiman et al studied a group of African American patients with SLE and found that depression was associated with low adherence (31). Mosley-Williams et al examined 19 potential barriers and found that negative effect (depression, medication concerns, and physical symptoms), short-term memory problems, and need for child or elderly care were associated with nonadherence among African Americans, whereas treatment inefficacy and lack of trust were associated with nonadherence among Caucasians (32). Although we did not specifically measure many of the elements studied by Mosley-Williams et al, it is notable that mental health has surfaced as an important consideration for barrier to adherence, especially among African Americans. Racial differences in adherence barriers suggest a need for tailored strategies to promote adherence among patients from different cultural backgrounds. In addition to ensuring cultural appropriateness, interventions among African Americans with an emphasis on quality patient-provider communication and improved patient mental health may be more effective. Whether the factors we identified are associated with adherence longitudinally also warrants further investigation.

Major strengths of this study include the use of both subjective and objective measures of adherence, thereby limiting social desirability biases from self-reported nonadherence measures alone. We also measured many domains of patient-provider interactions, which has not been extensively described in SLE populations before. Lastly, many of our instruments have been validated in SLE populations.

There are also several limitations to this study. First, our sample size may have limited statistical power to detect differences in race-stratified analyses and examinations of adherence to individual medications. However, we were still able to find significant disparities in adherence and differences in adherence barriers by race in our exploratory analyses. This speaks to the importance of considering race in future adherence studies and interventions. Second, certain important medications, such belimumab, were only prescribed to very few patients in this cohort; therefore, we were not able to meaningfully examine adherence levels to all SLE medications. Third, patients were recruited from one tertiary care lupus clinic, and we focused on African American and Caucasian patients because of the low numbers of patients of other racial and ethnic groups. Therefore, our sample may not be representative of patients with SLE from other clinical settings. Additionally, we only examined adherence in the 3-month period prior to the clinic visit. As adherence behavior is dynamic, longitudinal studies are able to distinguish between persistent nonadherents and those with partial nonadherence (4,5). Future studies should investigate racial differences in the dynamic patterns of adherence behavior. Lastly, we were unable to make claims about causation because of the cross-sectional design of the study. Our results should be confirmed with future longitudinal studies.

In conclusion, we identified large racial disparities in SLE medication adherence, especially among patients prescribed mycophenolate. Importantly, nonadherence was associated with more acute care utilization, higher patient-reported SLE activity, and higher SLE damage scores, likely contributing to known racial disparities in outcomes. We also identified important potential areas for intervention to improve adherence, providing evidence in favor of interventions that are tailored to patients' racial backgrounds.

AUTHOR CONTRIBUTIONS

All authors made substantial contribution to this manuscript. Drs Sun, Eudy, and Clowse drafted the article, and all authors revised it critically. Sun, Criscione-Schreiber, Rogers, Sadun, Doss, and Clowse contributed to Acquisition of data. All authors gave final approval of the version to be published.

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Acquisition of data.

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