HHS Public Access

Author manuscript

J Clin Rheumatol. Author manuscript; available in PMC 2019 April 28.

Published in final edited form as:

J Clin Rheumatol. 2018 October ; 24(7): 368–374. doi:10.1097/RHU.0000000000000794.

Depressive Symptoms Are Associated With Low Treatment Adherence in African American Individuals With Systemic Lupus Erythematosus

Erica Heiman, MD, MS[*], **S. Sam Lim, MD, MPH**[†], **Gaobin Bao, MPH**[†], and **Cristina Drenkard, MD, PhD**[†]

[*]Divisions of General Medicine and Geriatrics, Emory University, Atlanta, GA.

[†]Division of Rheumatology, Department of Medicine, Emory University, Atlanta, GA.

Abstract

Objective—African American (AA) people with systemic lupus erythematosus (SLE) are at high morbidity and mortality risk, and they often require multiple medications. Low medication adherence is a highly prevalent, multidimensional problem associated with poor outcomes in people with SLE. Depression, a predictor of low adherence in people with chronic conditions, has been described in over 35% of AAs with SLE. We hypothesized that depressive symptoms would be increasingly associated with low adherence in this population.

Methods—Research subjects predominantly belong to the Georgians Organized Against Lupus cohort, a population-based cohort of predominantly AA individuals with SLE in the Atlanta metropolitan area. Medication adherence and severity of depressive symptoms were measured using validated self-reported tools: the 8-item Morisky Medication Adherence Scale and the 9-item Patient Health Questionnaire, respectively. We used univariate and multivariate logistic regression to examine the odds ratios of low medication adherence across individuals with increasing severity of depressive symptoms.

Results—Among 632 AA SLE participants, 336 (54%) reported low medication adherence and 217 (34.6%) reported “moderate” or “severe” depressive symptoms. In univariate logistic regression, significant risk factors for low adherence were depressive symptoms, low self-efficacy, poor satisfaction with care, female sex, younger age, hurried patient-physician communication, poorer shared decision-making, less compassionate physician communication style, poor/fair health, and higher disease activity score. In multivariate regression, younger age, female sex, and more severe depressive symptoms were associated with low medication adherence.

Conclusions—This is the first study to examine factors associated with low medication adherence among a population-based cohort of AA individuals with SLE. Depression was a strong correlate of low medication adherence. Mental health interventions aiming to address and treat depression may increase medication adherence.

Correspondence: Cristina Drenkard, MD, PhD, 49 Jesse Hill Jr Dr, Atlanta, GA 30303. cdrenka@emory.edu.

The authors declare no conflict of interest.

Keywords

lupus; medication adherence; depression; mental health; systemic lupus erythematosus

African American (AA) individuals are affected by systemic lupus erythematosus (SLE) at a higher rate than other ethnic groups.[1–3] Among patients with SLE, AAs have been shown to have higher morbidity, mortality, and increased risk of complications such as end-stage renal disease,[4–7] and will in many cases require the use of complex medication regimens.

As described by the World Health Organization (WHO), adherence to medications is a multidimensional problem that encompasses the health care system, the characteristics of the disease and its therapies, as well as patient-related and socioeconomic factors.[8] A growing body of evidence suggests racial disparities in adherence to medication regimens among individuals with chronic conditions, with higher prevalence of noncompliance in AAs compared with whites.[9–11]

Medication adherence plays a critical role in determining clinical outcomes and health care utilization in SLE,[12–14] and can be increasingly challenging in AA populations as the disease manifestations become more protean and severe.[15] Prior studies suggest that 45% to 70% of SLE patients have poor treatment adherence,[12,16,17] with AA individuals demonstrating significantly lower adherence rates than white subjects in 1 study examining Medicaid beneficiaries.[18] Because cultural and socioeconomic factors can impact adherence, these rates may vary across ethnic and demographic subgroups. However, none of these prior studies has specifically focused on the burden of nonadherence and its correlates in AA individuals with SLE. A prior assessment of a small sample of white and AA individuals with SLE suggested that depression might be an important determinant of nonadherence in the AA population.[19]

Depressive symptoms have been reported in up to 75% of patients with SLE, and approximately 50% will have a diagnosis of major depressive disorder in their lifetime.[20–23] In addition, depression among AA individuals is often underdiagnosed and undertreated, leading to high burden of depression-related morbidity in this demographic group.[24–26]

Although depression is a treatable condition that may represent an important barrier for treatment adherence in AA patients with SLE, its impact on medication adherence has not been quantified. We aimed to describe medication adherence in a large AA cohort of patients with SLE and further examine whether the severity of depressive symptoms is associated with the odds of low adherence in this high-risk population.

METHODS

Study Design, Subjects, and Data Collection

We used a cross-sectional design to examine the association of depression with low medication adherence. Research subjects belong to the Georgians Organized Against Lupus (GOAL) cohort, whose recruitment has been previously described.[27] The GOAL cohort is a population-based, longitudinal cohort of adult SLE patients in metropolitan Atlanta,

Georgia. The GOAL study participants were recruited primarily from the Georgia Lupus Registry (GLR), a population-based registry funded by the Centers for Disease Control and Prevention with the primary aim of more accurately estimating the incidence and prevalence of SLE in metropolitan Atlanta. The population-based cohort was further enriched with additional patients receiving SLE treatment at Emory University, at Grady Memorial Hospital (the only safety net hospital in Atlanta), or from community rheumatologists in metropolitan Atlanta, who were recruited by mail, by telephone, and in person. Eligible participants were adult patients (aged ≥18 years) with a documented diagnosis of SLE [≥4 revised American College of Rheumatology (ACR) criteria, or 3 ACR criteria plus a diagnosis of SLE by the patient's treating board-certified rheumatologist]. Patient-reported data are collected at least annually. Human subjects' approval has been granted by Emory Institutional Review Board. We examined cross-sectional data collected between December 2014 and March 2016.

Variables

We selected from the GOAL questionnaire measures of individual, socioeconomic, health care, and disease-related that based on prior studies are relevant to medication adherence.

Medication Adherence

Medication adherence was assessed using the 8-item Morisky Medication Adherence Scale (MMAS), a patient-reported questionnaire that encompasses 7 medication-taking behaviors questions (yes/no answers), and one 5-point Likert scale question, which assesses how often the individual has difficulty remembering to take all his/her medication(s). The total scale ranges from 0 to 8, and has 3 levels of medication adherence: low (MMAS score <6), medium (MMAS score 6 to <8), and high (MMAS score = 8). The scale has been validated in a predominantly AA cohort of1400 individuals and found to be reliable and highly predictive of poorer outcomes.[28–30]

Depression

Depressive symptoms were assessed with the Patient Health Questionnaire (PHQ-9), a validated self-administered instrument that has been used in epidemiological studies and multiple settings.[31–33] PHQ-9 measures the frequency of symptoms of a major depressive episode in the last 2 weeks through scores that range from 0 to 27. A score of 10 or higher has excellent sensitivity and specificity to classify a major depressive episode. In addition, 5 categories of severity of depressive symptoms have been suggested as follows: minimal (PHQ-9 score, 0–4), mild (PHQ-9 score, 5–9), moderate (PHQ-9 score, 10–14), moderately severe (PHQ-9 score, 15–19), and severe (PHQ-9 score, ≥20).[32]

Individual, Sociodemographic, and Health Care Factors

Age at survey completion, sex, education, marital status, and insurance were self-reported. Living below the poverty threshold was estimated according to the 2011 Census Bureau data using self-reported data on household income and people living in the house.[34] Patients' satisfaction with lupus treatment was measured using an ad hoc Likert scale questionnaire that was further dichotomized to assess poor satisfaction (yes = very dissatisfied/somewhat

dissatisfied; no = neither satisfied nor dissatisfied/somewhat satisfied/very satisfied). We used the Interpersonal Processes of Care survey (IPC-29), a validated 29-item tool that has been used to assess 3 major physician-patient interaction domains (communication, shared decision-making, and interpersonal style) in broadly diverse populations.[35] For each item, participants are asked how often that type of care had been provided using a 5-point Likert scale. Each subscale is scored separately. Higher scores indicate higher frequency of the construct (either positive or negative). Self-efficacy for managing chronic disease was measured with a validated 6-item scale with scores range from 1 to 10 per item, with higher scores indicating greater self-efficacy.[36]

Disease and Health-Related Measures

The SLAQ (Systemic Lupus Activity Questionnaire), a validated self-reported tool was used to assess disease severity.[37] 24 SLAQ questions equate to scores that range from 0 to 47, with higher scores indicating greater SLE-related disease activity. The BILD (Brief Index of Lupus Damage), a validated survey of organ damage related to SLE,[38] was utilized in a self-administered format (SA-BILD), which has been validated in the context of the GOAL cohort.[39] The BILD scores range from 0 to 30, with higher scores indicating greater levels of damage.

Statistical Analysis

We performed descriptive analyses, univariate logistic regression, and multivariate logistic regressions. In descriptive analyses, patient characteristics were summarized using frequency and percentage for categorical variables, and mean and standard deviation (SD) for continuous variables. Because the distribution of PHQ-9 scores in our sample was skewed to the left, we merged the moderate-to-severe (PHQ-9 score, 15–19) with the severe (PHQ-9 score 20 or higher) categories, as suggested in prior epidemiologic studies.[40] Univariate logistic regression analyses were performed to examine depressive symptoms and other potential covariates associated with low medication adherence, using a dichotomous measure of adherence as the outcome: low (MMAS score <6) versus medium/high (MMAS score ≥6). Independent factors were grouped in 4 categories: (*a*) depressive symptoms; (*b*) individual factors (self-efficacy, poor satisfaction with care, sex, age); (*c*) socioeconomic and health care factors (education, insurance status, living below the poverty threshold, being single or living alone, quality of patient-physician communication, having visited a mental health provider within the last year); and (*d*) disease-related factors (self-reported health status; disease activity, organ damage, number of current SLE medications). Because prior data suggest an association between PHQ-9 and SLAQ,[41] we examined the potential correlation between PHQ-9 and SLAQ scores. We also explored whether PHQ-9 is correlated with self-efficacy or is associated with satisfaction with care. Multivariable regression analyses were then conducted with a full regression model, which included all the independent factors, and a reduced model with an entry criterion of $p < 0.20$ based on univariate analysis. Moreover, we used bootstrap bagging methods to create a parsimonious (final) model.[42] In brief, 1000 data sets were obtained by random sampling with replacement (bootstrap sampling). The bootstrap sample was analyzed using forward stepwise logistic regression with an entry criterion of $p < 0.20$ and a retention criterion of $p < 0.05$. Covariates were retained in the final model if they appeared in at least 50% of the models. The fit of the

final multivariate model was examined with the Hosmer-Lemeshow–type goodness of fit test. Odds ratios (OR) with 95% confidence intervals (CIs) were reported as measures of association. All statistical analyses were performed with SAS Software, version 9.4 (SAS Institute, Cary, NC) with a significance level of 0.05.

RESULTS

Of 632 AA individuals with SLE who were enrolled in the GOAL cohort, 375 were originally ascertained from the GLR and 257 from other sources. The sample includes 588 women (93%) with a mean age of 48 years. The mean number of years of education among respondents was 14.1. Nearly half of respondents who reported income characteristics lived below the poverty threshold (n = 276, 47.4%). Two hundred seventeen respondents (34.6%) had scores on the PHQ-9 that correspond to “moderate-severe” or “severe” depressive symptoms. Three hundred thirty-six (54%) of the respondents reported low, 188 (30%) medium/moderate, and 96 (16%) high medication adherence (Table 1). Means of age at diagnosis, educational attainment, number of medications and PHQ-9 score, as well as the proportion of females and participants who self-reported fair health and poor satisfaction with care were not significantly different between those enrolled from GLR and other sources (data not shown). The proportion of participants who were underinsured/uninsured was smaller among patients enrolled from the GLR, compared with those from other sources (37.0% and 52.9%, respectively, $p < 0.0001$). Similarly, the proportion of those living below the poverty line was smaller among patients enrolled from the GLR (39.0%), compared with other sources (59.7%), $p < 0.0001$.

In univariate regression analysis, having mild, moderate, and moderate-severe/severe depressive symptoms (versus minimal symptoms) was associated with increasingly greater ORs of having low medication adherence (ORs 2.59, 3.50, and 4.32, respectively). In addition, lower self-efficacy, poor satisfaction with care, female sex, younger age, hurried patient-physician communication, decreased shared decision-making, less compassionate physician communication style, poor/fair health, and higher disease activity score increased the odds of low medication adherence (Table 2). Education, insurance status, living below the poverty threshold, severe organ damage, and number of medications did not have significant effect on the odds of low medication adherence. We found significant correlations between the PHQ-9 score and both SLAQ and self-efficacy scores (Pearson coefficient 0.65 and −0.52, respectively, p value for both correlations <0.0001). Severity of depressive symptoms was also significantly associated with satisfaction with lupus care (χ^2 $p <$ 0.0001).

In multivariable models (full, reduced, and final), the only significant risk factors for low medication adherence were severity of depressive symptoms, female sex, and younger age (Table 3). Using minimal depressive symptoms as the reference group, all categories of depressive symptoms (mild, moderate, and moderately severe/severe) were significantly associated with low medication adherence. Moreover, when contrasting the risk across severity of depressive symptoms, the highest ORs for low medication adherence were conferred by moderate-severe/severe depressive symptoms, followed by moderate and mild depressive symptoms (ORs 4.22,3.34, and 2.67, respectively) versus the baseline of minimal

symptoms. The reliability of variables entered in the final model were 90.5% for age, 88.9% for depressive symptoms, and 64% for sex. Reliability was lower than 42% for all other covariates (data not shown). The final model provided a very good fit of the data (Hosmer-Lemeshow test, $p = 0.94$).

DISCUSSION

Our study underscores the substantial burden of medication nonadherence in a large AA population-based cohort with SLE. Only 96 (16%) of632 participants reported themselves as highly adherent to their medication regimens, and over half (n = 336, 54%) self-reported to have low adherence. Our observed rate of low adherence is considerably higher than those reported among patients with other chronic conditions such as hypertension and type 2 diabetes mellitus,[29,43] and is consistent with previous reports of medication nonadherence among patients with SLE.[44] Moreover, we were able to confirm the independent and negative impact of depressive symptom severity on medication adherence. Of note, we found an increasing risk of low medication adherence as we moved from mild to moderate to moderate-severe/severe depressive symptoms.

There were several significant factors associated with low medication adherence in the univariate analyses, such as high disease activity, poor self-efficacy, poor satisfaction with care, or poor patient-physician interactions. However, because some of the covariates correlated with depression, only a few factors independently increased the risk of low medication adherence in the multivariate models. Socioeconomic status, education, and insurance were not significant in either the univariate or multivariate models. Thus, severity of depressive symptoms, female sex, and younger age were the only significant independent risk factors of poor medication adherence in this population. Neither disease-related variables nor patient-physician communication were independently associated with low medication adherence.

To our knowledge, this is the first study that examined the independent impact of severity of depressive symptoms on medication adherence in a large and socioeconomically diverse sample of AA individuals with SLE. African Americans are disproportionately afflicted with SLE, and research examining their barriers to successful treatment is vitally important to better understanding how to effectively manage SLE and mitigate its complications. The GOAL cohort, as one of the largest AA-predominant SLE cohorts in the United States, fills a critical research gap in allowing us to address issues specific to this ethnic group.

Research on patient medication adherence across a variety of other chronic illnesses often shows depression to be a significant contributor to low medication adherence.[14,45] Data from studies that have explored racial differences with regards to medication adherence have been inconsistent, with some findings suggesting that the independent effect of depression on adherence may be higher in whites than in other ethnic groups,[46] and other studies indicating no racial differences on the impact of depression on medication adherence after controlling for confounders.[47,48] However, underdiagnosis and undertreatment of depression in members of the AA population with chronic illnesses may not only hinder adherence but also bias results.

The few studies that have examined depression as a possible predictor of low medication adherence in SLE have found it to be a significant factor.[12,17,49] However, because none of those studies have targeted large AAs populations of full socioeconomic and disease severity spectrum, their findings are difficult to extrapolate to this high-risk group.

Other significant risk factors for poor adherence in populations with SLE in the United States include longer disease duration, poverty, and lower performance on neurocognitive testing in the San Francisco cohort,[12] and number of pills per day in an Houston-based cohort.[49] Neither of these studies identified age or sex significantly associated with medication nonadherence, although women in the San Francisco cohort showed a nonsignificant trend toward lower rates of adherence. Education and socioeconomic status were significant factors in international studies but not in US studies.[16,17] These contrasting findings highlight the potential for interaction among social and demographic determinants with regards to medication adherence in populations affected by SLE. Differences between cohorts in sociocultural characteristics, age profiles, educational attainment, community support, regional and state health policies, and regional provider tendencies are all likely to play a role.

Despite this complexity, however, the consistent finding of depressive symptoms as a correlate of low medication adherence is powerful. It is the only modifiable factor associated with low medication adherence that we identified in multivariate analysis, indicating a potential role for depression diagnosis and treatment as part of improved management of AA patients with SLE, and suggesting that a biopsychosocial model of illness may better fit patients' realities. That depression remained statistically significant while controlling for other potential factors speaks to the primacy of depression in shaping an individual's perceptions of his/her disease severity, interactions with health care providers, and patient health behaviors. Of note, we did not find a significant role for having visited a mental health provider within the last year; however, this is an imperfect measurement of mental health care receipt and may reflect access to care and other resource issues.

Important strengths of our study are the use of data from the GOAL cohort, a large, predominantly AA population-based cohort of patients with a validated diagnosis of SLE, who are representative of the full socioeconomic status and clinical SLE spectrum; the use of survey tools that have been previously validated, including the SLAQ, SA-BILD (externally validated in this population), PHQ-9, and MMAS; and measurement of "depressive symptoms" rather than a provider's diagnosis of major depression, which is dependent on access to mental health care. Because we measured severity of depressive symptoms in 3 categories, we were able to demonstrate increasing odds of low medication adherence with higher severity of symptoms.

Limitations of our study are its cross-sectional design, which precludes us from drawing definitive conclusions about causality, and its use of self-reported measures, which may be influenced by incomplete patient recall and by social desirability bias toward more "acceptable" answers. Among these self-reported measures is the MMAS, that we have used as our outcome measure, and which relies on patient report of their medication-taking behaviors. Other adherence measures, such as measurement of drug levels in biologic fluids,

pill counts, direct monitoring of medication administration, and analysis of pharmacy records, have the advantage of not relying on patient report.[14,50] However, these methods are cost- and time-intensive and not feasible within our study design. In addition, the MMAS has been shown to correlate well with pharmacy prescription fill rates in a cross-sectional study of patients with hypertension[51]; was designed to avoid phrasing that would lead to "yes-saying" bias[28]; and has been repeatedly shown to have high predictive validity across illnesses.[28,52,53]

Potential confounders that were not measured in our study are cognitive function, health literacy, and medication adverse effects, which may all have some bearing on adherence. Finally, because of factors mentioned above unique to the GOAL cohort, these findings should be generalized with care to other populations of SLE patients.

Our study found high rates of medication nonadherence among AA SLE patients. Factors found to be significantly associated in multivariate models were depression, lower age, and female sex. Interventions aiming to improve medication adherence may increase efficiency by targeting people with depressive symptoms, particularly women and younger patients. These findings can be used to guide thoughtful interventions at the level of the individual, at an institutional level, and at a community-based level, as the WHO suggests that all are critical when confronting the problem of medication inadherence.[8] At a patient level, clinicians may work toward understanding the motivation guiding medication-taking behaviors of patients within these demographic groups; and at a more structural level, programs may work toward enrolling members of these groups in programmatic activities.

Moreover, our work suggests that depression screening should be considered in all SLE patients, particularly those SLE patients who do not adhere to their medications. Furthermore, SLE treatment may benefit from innovative interventions that include some degree of collaboration between mental health providers and rheumatologists, such as integrated care delivery models. These strategies to facilitate high-quality mental health care may result in increased levels of adherence in AA SLE patients.

ACKNOWLEDGMENT

We have used the ©MMAS tool. Use of the ©MMAS is protected by US copyright laws. Permission for use is required. A license agreement is available from Donald E. Morisky, ScD, ScM, MSPH, Professor, Department of Community Health Sciences, UCLA School of Public Health, 650 Charles E. Young Drive South, Los Angeles, CA 90095-1772, dmorisky@ucla.edu.

The GOAL cohort is supported by the Centers for Disease Control and Prevention grant 1U01DP005119 and by GlaxoSmithKline (GHO-11-3366). S.S.L. and C.D. are supported by the National Institutes of Health (R01AR065493-01; R01MD010455-01; R01AR070898-01) and the Centers for Disease Control and Prevention (U01DP005119).

REFERENCES

1. Somers EC, Marder W, Cagnoli P, et al. Population-based incidence and prevalence of systemic lupus erythematosus: the Michigan Lupus Epidemiology and Surveillance program. Arthritis Rheumatol. 2014;66:369–378. [PubMed: 24504809]

2. Lim SS, Bayakly AR, Helmick CG, et al. The incidence and prevalence of systemic lupus erythematosus, 2002–2004: The Georgia Lupus Registry. Arthritis Rheumatol. 2014;66:357–368. [PubMed: 24504808]

3. Feldman CH, Hiraki LT, Liu J, et al. Epidemiology and sociodemographics of systemic lupus erythematosus and lupus nephritis among US adults with Medicaid coverage, 2000–2004. Arthritis Rheum. 2013;65: 753–763. [PubMed: 23203603]

4. Demas KL, Costenbader KH. Disparities in lupus care and outcomes. Curr Opin Rheumatol. 2009;21:102–109. [PubMed: 19339919]

5. Nee R, Martinez-Osorio J, Yuan CM, et al. Survival disparity of African American versus non-African American patients with ESRD due to SLE. Am J Kidney Dis. 2015;66:630–637. [PubMed: 26002293]

6. Korbet SM, Schwartz MM, Evans J, et al. Severe lupus nephritis: racial differences in presentation and outcome. J Am Soc Nephrol. 2007;18:244–254. [PubMed: 17167111]

7. Centers for Disease Control and Prevention. Trends in deaths from systemic lupus erythematosus—United States, 1979–1998. MMWR Morb Mortal Wkly Rep. 2002;51:371–374. [PubMed: 12018384]

8. World Health Organization. Sabate E Adherence to Long-Term Therapies: Evidence for Action. Geneva, Switzerland: World Health Organization; 2003.

9. Gerber BS, Cho YI, Arozullah AM, et al. Racial differences in medication adherence: a cross-sectional study of Medicare enrollees. Am J Geriatr Pharmacother. 2010;8:136–145. [PubMed: 20439063]

10. Davis AM, Taitel MS, Jiang J, et al. A National Assessment of Medication Adherence to Statins by the Racial Composition of Neighborhoods. J Racial Ethn Health Disparities. 2017;4:462–471. [PubMed: 27352117]

11. Osborn CY, Cavanaugh K, Wallston KA, et al. Health literacy explains racial disparities in diabetes medication adherence. J Health Commun. 2011;16 Suppl 3:268–278. [PubMed: 21951257]

12. Julian LJ, Yelin E, Yazdany J, et al. Depression, medication adherence, and service utilization in systemic lupus erythematosus. Arthritis Rheum. 2009;61:240–246. [PubMed: 19177526]

13. Petri M, Perez-Gutthann S, Longenecker JC, et al. Morbidity of systemic lupus erythematosus: role of race and socioeconomic status. Am J Med. 1991;91:345–353. [PubMed: 1951378]

14. Martin LR, Williams SL, Haskard KB, et al. The challenge of patient adherence. Ther Clin Risk Manag. 2005;1:189–199. [PubMed: 18360559]

15. Garcia Popa-Lisseanu MG, Greisinger A, Richardson M, et al. Determinants of treatment adherence in ethnically diverse, economically disadvantaged patients with rheumatic disease. J Rheumatol. 2005;32:913–919. [PubMed: 15868630]

16. Oliveira-Santos M, Verani JF, Klumb EM, et al. Evaluation of adherence to drug treatment in patients with systemic lupus erythematosus in Brazil. Lupus. 2011;20:320–329. [PubMed: 21183558]

17. Abdul-Sattar AB, Abou El Magd SA. Determinants of medication non-adherence in Egyptian patients with systemic lupus erythematosus: Sharkia Governorate. Rheumatol Int. 2015;35:1045–1051. [PubMed: 25424491]

18. Feldman CH, Yazdany J, Guan H, et al. Medication nonadherence is associated with increased subsequent acute care utilization among medicaid beneficiaries with systemic lupus erythematosus. Arthritis Care Res (Hoboken). 2015;67:1712–1721. [PubMed: 26097166]

19. Mosley-Williams A, Lumley MA, Gillis M, et al. Barriers to treatment adherence among African American and white women with systemic lupus erythematosus. Arthritis Rheum. 2002;47:630–638. [PubMed: 12522837]

20. Bachen EA, Chesney MA, Criswell LA. Prevalence of mood and anxiety disorders in women with systemic lupus erythematosus. Arthritis Rheum. 2009;61:822–829. [PubMed: 19479699]

21. Maneeton B, Maneeton N, Louthrenoo W Prevalence and predictors of depression in patients with systemic lupus erythematosus: a cross-sectional study. Neuropsychiatr Dis. 2013;9:799–804.

22. Nery FG, Borba EF, Viana VS, et al. Prevalence of depressive and anxiety disorders in systemic lupus erythematosus and their association with anti-ribosomal P antibodies. Prog Neuropsychopharmacol Biol Psychiatry. 2008;32:695–700. [PubMed: 18077068]

23. Palagini L, Mosca M, Tani C, et al. Depression and systemic lupus erythematosus: a systematic review. Lupus. 2013;22:409–416. [PubMed: 23427220]
24. Williams DR, Gonzalez HM, Neighbors H, et al. Prevalence and distribution of major depressive disorder in African Americans, Caribbean blacks, and non-Hispanic whites: results from the National Survey of American Life. Arch Gen Psychiatry. 2007;64:305–315. [PubMed: 17339519]
25. Sclar DA, Robison LM, Schmidt JM, et al. Diagnosis of depression and use of antidepressant pharmacotherapy among adults in the United States: does a disparity persist by ethnicity/race? Clin Drug Investig. 2012;32:139–144.
26. Shao Z, Richie WD, Bailey RK. Racial and ethnic disparity in major depressive disorder. J Racial Ethn Health Disparities. 2016;3:692–705. [PubMed: 27294764]
27. Drenkard C, Rask KJ, Easley K, et al. Primary preventive services in patients with systemic lupus erythematosus: study from a population-based sample in Southeast U.S. Semin Arthritis Rheum. 2013;43:209–216. [PubMed: 23731530]
28. Morisky DE, Ang A, Krousel-Wood M, et al. Predictive validity of a medication adherence measure in an outpatient setting. J Clin Hypertens (Greenwich). 2008;10:348–354. [PubMed: 18453793]
29. Krousel-Wood MA, Islam T, Webber LS, et al. New Medication Adherence Scale Versus Pharmacy Fill Rates in Seniors With Hypertension. Am J Manag Care. 2009;15:59–66. [PubMed: 19146365]
30. Morisky DE, DiMatteo MR. Improving the measurement of self-reported medication nonadherence: response to authors. J Clin Epidemiol. 2011;64:255–257; discussion 8–63. [PubMed: 21144706]
31. Spitzer RL, Kroenke K, Williams JB. Validation and utility of a self-report version of PRIME-MD: the PHQ primary care study. Primary Care Evaluation of Mental Disorders. Patient Health Questionnaire. JAMA. 1999;282:1737–1744. [PubMed: 10568646]
32. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med. 2001;16:606–613. [PubMed: 11556941]
33. Hinz A, Mehnert A, Kocalevent RD, et al. Assessment of depression severity with the PHQ-9 in cancer patients and in the general population. BMC Psychiatry. 2016;16:22. [PubMed: 26831145]
34. Poverty Thresholds [database online] 2011.
35. Stewart AL, Nápoles-Springer AM, Gregorich SE, et al. Interpersonal processes of care survey: patient-reported measures for diverse groups. Health Serv Res. 2007;42(3 Pt 1):1235–1256. [PubMed: 17489912]
36. Ritter PL, Lorig K. The English and Spanish Self-Efficacy to Manage Chronic Disease Scale measures were validated using multiple studies. J Clin Epidemiol. 2014;67:1265–1273. [PubMed: 25091546]
37. Karlson EW Daltroy LH, Rivest C, et al. Validation of a Systemic Lupus Activity Questionnaire (SLAQ) for population studies. Lupus. 2003;12: 280–286. [PubMed: 12729051]
38. Yazdany J, Trupin L, Gansky SA, et al. Brief index of lupus damage: a patient-reported measure of damage in systemic lupus erythematosus. Arthritis Care Res (Hoboken). 2011;63:1170–1177. [PubMed: 21584946]
39. Drenkard C, Yazdany J, Trupin L, et al. Validity of a self-administered version of the brief index of lupus damage in a predominantly African American systemic lupus erythematosus cohort. Arthritis Care Res (Hoboken). 2014;66:888–896. [PubMed: 24249662]
40. Yeung A, Fung F, Yu SC, et al. Validation of the Patient Health Questionnaire-9 for depression screening among Chinese Americans. Compr Psychiatry. 2008;49:211–217. [PubMed: 18243896]
41. Carr FN, Nicassio PM, Ishimori ML, et al. Depression predicts self-reported disease activity in systemic lupus erythematosus. Lupus. 2011;20:80–84. [PubMed: 20937622]
42. Efron B Bootstrap methods: another look at the jackknife. Ann Stat. 1979;1:1–26.
43. Yang Y, Thumula V, Pace PF, et al. Predictors of medication nonadherence among patients with diabetes in Medicare Part D programs: a retrospective cohort study. Clin Ther. 2009;31:2178–2188; discussion 50–1. [PubMed: 19922889]
44. Mehat P, Atiquzzaman M, Esdaile JM, et al. Medication nonadherence in systemic lupus erythematosus: a systematic review. Arthritis Care Res (Hoboken). 2017;69:1706–1713. [PubMed: 28086003]

45. Grenard JL, Munjas BA, Adams JL, et al. Depression and medication adherence in the treatment of chronic diseases in the United States: a meta-analysis. J Gen Intern Med. 2011;26:1175–1182. [PubMed: 21533823]

46. Axon RN, Gebregziabher M, Hunt KJ, et al. Comorbid depression is differentially associated with longitudinal medication nonadherence by race/ethnicity in patients with type 2 diabetes. Medicine. 2016;95:e3983. [PubMed: 27336900]

47. Schoenthaler A, Ogedegbe G, Allegrante JP. Self-efficacy mediates the relationship between depressive symptoms and medication adherence among hypertensive African Americans. Health Educ Behav. 2009;36:127–137. [PubMed: 18077654]

48. Heckman BD, Ellis G. Preventive medication adherence in African American and Caucasian headache patients. Headache. 2011;51:520–532. [PubMed: 21457237]

49. Marengo MF, Waimann CA, de Achaval S, et al. Measuring therapeutic adherence in systemic lupus erythematosus with electronic monitoring. Lupus. 2012;21:1158–1165. [PubMed: 22588588]

50. Farmer KC. Methods for measuring and monitoring medication regimen adherence in clinical trials and clinical practice. Clin Ther. 1999;21: 1074–1090; discussion 3. [PubMed: 10440628]

51. Krousel-Wood M, Islam T, Webber LS, et al. New medication adherence scale versus pharmacy fill rates in seniors with hypertension. Am J Manag Care. 2009;15:59–66. [PubMed: 19146365]

52. Cohen HW, Shmukler C, Ullman R, et al. Measurements of medication adherence in diabetic patients with poorly controlled HbA(1c). Diabet Med. 2010;27:210–216. [PubMed: 20546266]

53. Janezic A, Locatelli I, Kos M. Criterion validity of 8-item Morisky Medication Adherence Scale in patients with asthma. PLoS One. 2017;12:e0187835. [PubMed: 29190693]

TABLE 1.

Description of the Sample (N = 632)

Characteristic	n (%)
Female, n (%)	588 (93.0)
Uninsured or underinsured, n (%)	271 (43.5)
Age in years, mean ± SD	48.0 ± 13.2
Education, mean ± SD, y	14.1 ±2.9
Education, n (%)	
High school or less	231 (37.3)
Some college	203 (32.7)
College or above	186 (30.0)
Living below the poverty line, n (%)	276 (47.4)
Single or living alone, n (%)	428 (69.4)
Severe disease activity (SLAQ ≥ 17), n (%)	314 (49.7)
Severe organ damage (SA-BILD ≥ 3), n (%)	328 (51.9)
Poor/fair health, n (%)	329 (52.6)
Patient-physician communication, mean ± SD	
Hurried communication	1.6 ± 0.6
Shared decision making	2.9 ± 1.0
Compassion and respect	3.6 ±0.6
Poor satisfaction with care, n (%)	69 (11.7)
Depressive symptoms[a], n (%)	
None/minimal (PHQ-9 score 0–4)	235 (37.5)
Mild (PHQ-9 score 5–9)	175 (27.9)
Moderate (PHQ-9 score 10–14)	113 (18.0)
Moderately severe/severe (PHQ-9 score ≥15)	104 (16.6)
Visited mental health providers in past year, n (%)	81 (14.1)
No. medications, mean ± SD	2.9 ± 1.6
Medication adherence[b]; n (%)	
Low (MMAS score < 6)	336 (54.2)
Medium (MMAS score 6 to <8)	188 (30.3)
High (MMAS score = 8)	96 (15.5)

[a] 5 missing values.

[b] 12 missing values.

TABLE 2.

Factors Associated With Low Medication Adherence: Univariate Analysis

Category	Factor	OR (95% CI)	*p* value
Depression	Depressive symptoms (ref: minimal)		
	Mild	2.59(1.72–3.88)	<0.0001
	Moderate	3.50(2.17–5.64)	<0.0001
	Moderately severe/Severe	4.32(2.61–7.13)	<0.0001
Individual factors	Self-efficacy (1-unit ↓)	1.18(1.10–1.26)	<0.0001
	Poor satisfaction with care	2.06(1.20–3.55)	0.009
	Sex (female)	2.72(1.41–5.23)	0.0028
	Age (1-year ↓)	1.02(1.01–1.03)	0.001
Socioeconomic and healthcare factors	Education (3-year ↑)	1.09(0.92–1.29)	0.32
	Uninsured or underinsured	1.18(0.86–1.63)	0.31
	Living below the poverty line	1.16(0.83–1.61)	0.39
	Single or living alone	1.13 (0.80–1.59)	0.5
	Patient-physician communication:		
	Hurried communication (1-unit ↑)	1.53 (1.18–1.99)	0.0012
	Shared decision-making (1-unit ↓)	1.25 (1.06–1.47)	0.0082
	Compassioned style (1-unit ↓)	1.60(1.21–2.10)	0.0009
	Visited mental health providers in past year	0.96(0.60–1.55)	0.87
Disease-related factors	Poor/fair health	1.77(1.28–2.44)	0.0005
	Disease activity score (3-unit ↑)	1.17(1.11–1.24)	<0.0001
	Severe organ damage	1.11 (0.81–1.52)	0.52
	No. medications (1-unit ↑)	0.96(0.87–1.06)	0.44

The symbols ↑ and ↓ in parenthesis do not represent longitudinal change of scores; they denote the model's response to the indicated changes in covariates.

TABLE 3.

Factors Associated With Low Medication Adherence: Multivariate Models

		Full Model	Reduced Model[a]	Final Model[b]			
Category	**Factor**	**OR (95% CI)**	***p* value**	**OR (95% CI)**	***p* value**	**OR (95% CI)**	***p* value**
Depression	Depressive symptoms (ref: minimal)						
	Mild	2.28 (1.34–3.85)	0.0022	2.42 (1.50–3.92)	0.001	2.67(1.76–4.04)	<0.0001
	Moderate	2.26 (1.16–4.39)	0.016	2.46 (1.35–4.49)	0.0025	3.34 (2.06–5.42)	<0.0001
	Moderately severe/Severe	3.02 (1.40–6.51)	0.0008	2.70 (1.37–5.29)	0.0001	4.22 (2.53–7.04)	<0.0001
	Self-efficacy (1-unit ↓)	1.00(0.91–1.11)	0.97	1.01 (0.93–1.11)	0.76		
Individual	Poor satisfaction with care	0.89 (0.45–1.75)	0.74	1.13 (0.61–2.08)	0.69		
factors	Sex (female)	2.58 (1.12–5.95)	0.026	2.65 (1.27–5.52)	0.0094	3.19(1.61–6.31)	0.0009
	Age (1-year ↓)	1.03 (1.01–1.05)	0.0038	1.03 (1.01–1.04)	0.0004	1.02(1.01–1.03)	0.0048
SES and healthcare factor	Education (3-year ↑)	1.23 (0.96–1.58)	0.11				
	Uninsured or underinsured factors	1.06(0.66–1.70)	0.82				
	Living below the poverty line	1.01 (0.60–1.70)	0.96				
	Single or living alone	1.04 (0.67–1.63)	0.86				
	Patient-physician communication:						
	Hurried communication (1-unit ↑)	1.12(0.76–1.66)	0.57	1.11 (0.79–1.55)	0.56		
	Shared decision-making (1-unit ↓)	1.22(0.94–1.57)	0.13	1.17(0.94–1.46)	0.16		
	Compassioned style (1-unit ↓)	0.92(0.59–1.42)	0.7	1.02 (0.68–1.51)	0.93		
	Visited mental health	0.71 (0.39–1.30)	0.27				
	providers in past year						
Disease-related factors	Poor/fair health	1.06 (0.66–1.69)	0.81	0.96(0.63–1.44)	0.83		
	Disease activity score (3-unit ↑)	1.09(0.99–1.19)	0.076	1.05 (0.96–1.13)	0.28		
	Severe organ damage	0.90(0.59–1.37)	0.62				
	No. medications (1-unit ↑)	0.92 (0.80–1.05)	0.2				

The symbols ↑ and ↓ in parenthesis do not represent longitudinal change of scores; they denote the model's response to the indicated changes in covariates.

[a] Reduced model included factors with p value < 0.2 in univariate logistic analysis.

[b] The final model was based on bootstrap analysis using forward stepwise logistic regression with an entry criterion of p value < 0.20 and a retention criterion of p value <0.05. The final model provided a very good fit of the data (Hosmer-Lemeshow goodness-of-fit test, $p = 0.94$).