Quality of Care in Systemic Lupus Erythematosus: Application of Quality Measures to Understand Gaps in Care

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BACKGROUND: Systemic lupus erythematosus (SLE) affects 1 in 2500 Americans and is associated with significant morbidity and mortality. The recent development of SLE quality measures provides an opportunity to understand gaps in clinical care and to identify modifiable factors associated with variations in quality.

OBJECTIVE: To evaluate performance on SLE quality measures as well as differences in quality of care by demographic, socioeconomic, disease, and health system characteristics.

DESIGN AND PATIENTS: Cross-sectional analysis of data derived from the Lupus Outcomes Study, a prospective, longitudinal study of 814 individuals. Principal data collection was through annual structured telephone surveys between 2009–2010. Data on 13 SLE quality measures was collected. We used regression models to estimate demographic, socioeconomic, disease, and health system characteristics associated with performance on individual and overall quality measures.

OUTCOME MEASURES: Performance on each quality measure and overall performance on all measures for which participants were eligible (pass rate).

RESULTS: Participants were eligible for a mean of five measures (range 2–12). Performance varied from 29 % (assessment of cardiovascular risk factors) to 90 % (sun avoidance counseling). The overall pass rate was 65 % (95 % CI 64 %, 65 %). In unadjusted analyses, younger age, minority race/ethnicity, poverty, shorter disease duration, fewer physician visits, and lack of health insurance, were associated with lower pass rates. Receiving care in public sector managed care organizations was associated with

higher pass rates. After adjustment, younger age, having fewer physician visits and lacking health insurance remained significantly associated with lower performance; receiving care in public sector managed care organizations remained associated with higher performance.

CONCLUSIONS: We identified a number of gaps in clinical care for SLE. Factors associated with the health care system, including presence and type of health insurance, were the primary determinants of performance on quality measures in SLE.

KEY WORDS: systemic lupus erythematosus; studies; outcomes; quality of health care.

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Creating high quality, high value systems of care and reducing disparities are priorities for health care reform in the United States. These goals partially depend on developing definitions of quality and rigorous methods for measuring and improving care across medical conditions and populations. Although for some conditions advances in this area are occurring rapidly, evidence on quality of care for many long-term medical conditions, including most rheumatic diseases such as systemic lupus erythematosus (SLE), is sparse.

SLE is a prototypic inflammatory rheumatic condition affecting approximately 1 in 2500 Americans, and is most prevalent in racial/ethnic minorities; estimated prevalence in African-Americans is 3–4 times higher than in Caucasians.^{1–3} Morbidity and mortality in SLE remain high. SLE accounts for 2 % of all end-stage renal disease in the United States, and premature mortality from both the disease itself and associated co-morbidities, such as cardiovascular disease, are significant.^{4,5} Because SLE can affect virtually any organ in the body, care for the condition often spans numerous medical specialties, and

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requires coordination between the patient's primary care team and specialists.

We recently developed a SLE quality indicator (QI) set using a validated method that combined systematic literature reviews and expert consensus.¹⁰ The QIs define standards of care for specific aspects of SLE diagnosis, monitoring, treatment, and preventive services, much of which can be performed in the primary care setting.

Although no prior studies have comprehensively examined performance on quality measures in SLE, existing literature suggests significant gaps in clinical care for key preventive services, such as immunizations and cancer screening, and for co-morbidities associated with SLE, such as osteoporosis.^{6–9} Because these prior studies have focused on a limited number of process measures in SLE, no information is available for many important aspects of care for the condition, and the primary determinants of quality in SLE remain unknown.

In this study, we apply SLE performance measures amenable to self-report to a large, diverse cohort of individuals with SLE to assess gaps in health care quality, and investigate demographic, socioeconomic, disease and health care system characteristics associated with higher quality health care.

METHODS

Data Source

Data derive from the University of California, San Francisco (UCSF) Lupus Outcomes Study (LOS), an observational cohort of 1204 English-speaking individuals with SLE designed to investigate health, quality of life, and employment outcomes over time. The LOS sample was originally drawn from a large, ongoing study of genetic risk factors for SLE outcomes that used convenience sampling to recruit patients from a variety of clinical and non-clinical sources, including academic rheumatology offices, community rheumatology offices and non-clinical sources.¹¹ Participants became eligible for the LOS upon completion of their involvement in the genetics study; 65 % of patients were successfully contacted and enrolled between 2002 and 2004 (n=982). All SLE diagnoses for LOS participants were confirmed by a formal medical record review to document American College of Rheumatology criteria for SLE.¹² Participants complete a structured telephone interview each year conducted by trained survey workers covering topics such as sociodemographics, disease status, medications, health care utilization, and health insurance coverage. The present study incorporates data from 814 respondents in the LOS interview conducted between February 2009 and March 2010. A majority of respondents resided in California at the time of the interview (n=576); the remainder resided in 36 other states.

The UCSF Committee on Human Research approved the study protocol.

Quality of Care Measures

We applied measures derived from the SLE Quality Indicator (QI) Project, in which a validated method combining systematic literature reviews and expert panel ratings were used.¹⁰ In that project, potential QIs were extracted from a systematic literature review of clinical practice guidelines pertaining to SLE. An advisory panel revised and augmented these candidate indicators. A modification of the RAND/UCLA Appropriateness Method was then employed. Systematic literature reviews were performed for each QI, linking the proposed processes of care to potential improved health outcomes. After reviewing this evidence, a second interdisciplinary expert panel convened to discuss the evidence and provide final ratings on the validity and feasibility of each QI. Twenty QIs were rated as both valid and feasible.¹⁰

Thirteen of the original 20 SLE QIs were amenable to self-report, and we created detailed interview algorithms for those QIs (technical details of measure specifications and chart validation are provided in the supplementary Appendix). Draft survey items were piloted among 50 LOS participants whose annual interviews were conducted at the end of 2008 and revisions were made as necessary as outlined in the Appendix. The 13 revised items were added to the 2009–2010 interview.

Sociodemographic, SLE and Health Care System Measures

Independent variables assessed include age, sex, race/ethnicity (Caucasian, African-American, Latino, Asian/Pacific Islander, other), disease duration, SLE disease activity as measured by the Systemic Lupus Activity Questionnaire (SLAQ; range 0–44),^{13,14} educational attainment, and poverty (household income <125 % of the Federal poverty limit). We also included the level of health care utilization, defined as total number of physician visits reported in the prior year, as those with a higher level of utilization might have more opportunity to receive care consistent with the QIs. Health insurance was categorized as having no coverage, or, for those with coverage, by stratifying respondents into those with and without managed care plans in both the public and private sectors.¹⁵ In additional analyses, we investigated the effect of different forms of managed care, separating members of large, not-for-profit prepaid health plans from those in other managed care plans. Finally, we examined the types of physicians seen by participants, categorizing individuals based on whether a generalist, rheumatologist, both of these providers, or neither of these providers were involved in care; the latter category includes all medical specialists other than rheumatologists.

Statistical Analyses

Data on quality measures were analyzed for 801 of 814 participants. Reasons for exclusion were residence outside the United States during the study year, no physician visits during the study year, and missing data on income or SLAQ score.

We examined two primary dependent variables: receipt of care advocated in each SLE quality measure (scored as yes/no), and the overall "pass rate" for the measures, defined as the percentage of times that care consistent with the measure was received among eligible individuals. In these analyses, each measure was given equal weight rather than trying to make judgments about the relative importance of the individual measures since the empirical and theoretical basis for such judgments are lacking. We report the frequency with which LOS participants were eligible for each quality measure and the percent of patients reporting receiving care consistent with the measure. We use logistic regression to estimate the impact of demographic (age, gender, race/ethnicity, education, and poverty) and SLE characteristics (SLAQ and disease duration) on receiving care consistent with each quality measure. In the foregoing estimations, the unit of analysis is the person, and we calculate adjusted rates and 95 % CIs from the predicted marginals derived from logistic regression models. In the regression models for individual measures, we present the fit of each model and also statistical significance at both the 0.05 and 0.01 levels given multiple comparisons.

Subsequently, we estimate overall pass rates defined as the percentage of times that care consistent with the quality measures was received among eligible individuals. In examining overall pass rates, each participant contributes one observation per eligible measure, and we account for the correlation between repeated measures within individuals using generalized estimating equations. In total, we analyzed 4107 observations for the 801 participants (mean 5.1 eligible measures per participant).

RESULTS

Characteristics of participants are listed in Table 1. Respondents averaged 14.6 physician visits in the year prior to interview (range 1–41). Only 2 % reported no health insurance in the prior year. Among the remainder, 7 % were in publicly-funded managed care organizations, e.g. Medicare Advantage plans or Medicaid managed care plans, 20 % were in privately-funded managed care plans, with the remainder roughly equally divided between public and private fee-for-service care.

Among those eligible for the various measures, more than 90 % received counseling regarding sun avoidance, 83 % received recommendations for vitamin D and

Table 1. Sociodemographic, Lupus and Health Care Characteristics of Participants in the Lupus Outcomes Study

	n=801 (%)
Sociodemographic Characteristics	
Age, years	
18–34	101 (13)
35–54	384 (48)
55–64	208 (26)
≥65	108 (13)
Gender	
Male	59 (7)
Female	742 (93)
Race/ethnicity	
Caucasian	511 (64)
Latino	77 (10)
African-American	75 (9)
Asian/Pacific Islander	83 (10)
Other	55 (7)
Education	
≤High school graduate	134 (17)
Some college/vocational	335 (42)
College degree	332 (41)
Poverty status	
>125 % of Federal Poverty Level	684 (85)
≤125 % of Federal Poverty Level	117 (15)
SLE Characteristics	
SLAQ score, mean (SD), range	11.5 (7.8) 0–46
Years since diagnosis, mean (SD), range	17.2 (8.7) 0–52
Health Care Characteristics	
Physician visits in past year, mean (SD), range	14.6 (9.8) 1–41
Kind of insurance	
No health insurance	19 (2)
HMO, public sector	56 (7)
HMO, private sector	159 (20)
Non-HMO, public sector	275 (34)
Non-HMO, private sector	292 (36)
Physician specialties visited	
Generalist and rheumatologist	505 (63)
Generalist, no rheumatologist	155 (19)
Rheumatologist, no generalist	118 (15)
No Rheumatologist or generalist (other MD)	23 (3)

SLAQ = Systemic Lupus Activity Questionnaire

supplemental calcium if on moderate dose glucocorticoids (prednisone ≥7.5 mg/day), while 80 % on immunosuppressive therapy received recommendations for annual influenza vaccinations (Table 2). In contrast, only 29 % reported annual evaluations for a composite measure of cardiovascular risk factors. A relatively small proportion, 40 %, of women at risk for pregnancy reported receiving counseling regarding risks and contraception when first prescribed potentially teratogenic medications.

Table 3 displays factors associated with performance on the five quality measures for which ≥500 persons were eligible. We present adjusted rates of receiving each measure among eligible persons, calculated from regression models. Younger individuals were significantly less likely to report care consistent with three measures: recommendation for pneumococcal vaccination, drug toxicity monitoring, and cardiovascular risk factor evaluation. Caucasians were significantly more likely to report pneumococcal vaccination, and those with incomes below poverty were significantly less likely to report appropriate drug toxicity monitoring and evaluation of cardiovascular risk factors. Finally, education was associated with evaluation of

Table 2. Performance on 13 SLE Quality Measures in the Lupus Outcome Study

Quality Measure summary ¹ , time frame (in last year unless noted)	Number Eligible	% Rec'd
Sun avoidance counseling, <i>ever</i>	801	90
Calcium and vitamin D if receiving prednisone ≥ 7.5 mg/day	144	83
Influenza vaccination if taking immunosuppressive medications	504	80
Pneumococcal vaccination if taking immunosuppressive medications, <i>ever</i>	504	69
Appropriate drug monitoring for NSAID, DMARD or glucocorticoid, <i>varies</i>	676	69
Counseling regarding risks if initiating new medication	146	68
Glucocorticoid management plan communicated to patient if receiving prednisone ≥ 10 mg/day for ≥ 3 months	51	65
Antiresorptive or anabolic agent in patients with osteoporosis receiving prednisone ≥ 7.5 mg/day	97	61
Bone mineral density testing if receiving prednisone ≥ 7.5 mg/day	144	56
Management of hypertension if renal disease and consecutively elevated blood pressures	26	54
ACE inhibitor or ARB if proteinuric renal disease	180	49
Counseling regarding risks and contraception if reproductive age woman initiating potentially teratogenic medication	25	40
Assessment of traditional cardiovascular risk factors	801	29

NSAID = non-steroidal anti-inflammatory drug, DMARD = disease-modifying anti-rheumatic drug, ACE = angiotensin-converting enzyme, ARB = angiotensin receptor blocker

¹See Supplemental Appendix and Yazdany J, et al., *Arthritis Rheum* 2009; 61: 370–377, for more detailed description of SLE quality indicators

cardiovascular risk factors, with the highest rates among those with some college education.

The overall pass rate was 0.65 for the 13 quality measures using 4107 observations among the 801 individuals (95 % CI 0.64, 0.67). Table 4 presents pass rates as a function of sociodemographic, disease, and health care characteristics, with and without adjustment. Unadjusted pass rates were lower for younger individuals, non-whites, individuals with poverty-level incomes and those with shorter disease durations.

In analyses examining health care system characteristics, individuals with more physician visits experienced significantly, albeit only slightly higher, pass rates (Table 4). Differences in pass rates by insurance status and physician specialties were more pronounced than those observed for sociodemographic (except for age), SLE disease characteristics, or number of physician visits. Persons without health insurance had a pass rate of 0.51 (95%CI 0.42, 0.60), far lower than all groups with insurance coverage. Those in publicly funded managed care plans experienced the highest pass rate, 0.75 (95%CI 0.70, 0.80), while those in privately funded managed care plans and public and private fee-for-service plans had pass rates from 0.63–0.66. To better

understand the effect of managed care participation, we performed additional analyses examining the type of managed care plan: the highest performance was observed among participants enrolled in large, prepaid, not-for-profit health plans (adjusted pass rate of 0.70 [95 % CI 0.64,0.59]), compared with other managed care plans (0.64[0.59,0.67]), non-managed care plans (0.65[0.63,0.67]), and no insurance (0.51[0.42,0.60]); data not shown.

With respect to specialties of physicians seen in the year prior to interview, persons who reported visits only with specialists other than rheumatologists or primary care providers had far lower pass rates (0.51[0.38–0.64]). Those who saw both rheumatologists and generalists had the highest overall pass rates.

After adjustment, only age among the demographic and disease characteristics remained significantly associated with pass rates, suggesting that the effects of race/ethnicity and poverty were due to confounding with health care characteristics. Physician visits and the presence and kind of insurance remained strongly associated with the overall pass rate. Adjustment narrowed differences in pass rates by provider specialties so that the relationship was no longer statistically significant ($p=0.06$), but a trend remained, with those reporting both rheumatologist and generalist care having the highest pass rates.

DISCUSSION

We found significant gaps in performance on quality measures for many aspects of clinical care for individuals with SLE. Overall, respondents reported receipt of only 65 % of recommended services. Characteristics associated with the health care system (e.g., presence and type of health insurance) were the factors most strongly associated with quality in SLE. In contrast, most sociodemographic factors, except for age, were at most weakly associated with performance on quality measures in SLE care.

We observed significant differences in performance among the individual processes of care examined. For some measures, such as sun-avoidance counseling, performance was very high (90 %), while for other aspects of care, such as cardiovascular risk assessment or counseling reproductive-age women initiating potentially teratogenic medications, receiving care consistent with quality measures was quite low (29 and 40 %, respectively). Acceptable passing rates for these quality measures was expected to be high (i.e. between 80 and 100 percent) given that our study was specifically designed to give clinicians credit for recommending care, even if the patient did not follow that recommendation. Gaps in quality therefore likely reflect either gaps in clinical information, such as underestimating the significantly increased risk of accelerated atherosclerosis in SLE and not initiating screening for cardiovascular

Table 3. Performance on Most Common SLE Quality Measures, Adjusted for Select Demographic and Disease Characteristics

	Sun avoidance	Influenza vaccination	Pneumococcal vaccination	Drug toxicity monitoring	Cardio-vascular risk assessment
Number Eligible	801	504	504	676	801
Percent Received	0.90 (0.88, 0.92)	0.80 (0.76, 0.83)	0.69 (0.65, 0.73)	0.69 (0.65, 0.72)	0.29 (0.26, 0.32)
Characteristics					
Age, years					
18–34	0.93 (0.88, 0.98)	0.78 (0.68, 0.88)	0.48 (0.35, 0.61)*	0.51 (0.40, 0.62)**	0.17 (0.09, 0.26)**
35–54	0.89 (0.86, 0.92)	0.80 (0.75, 0.85)	0.70 (0.64, 0.76)	0.66 (0.61, 0.71)	0.25 (0.21, 0.30)
55–64	0.91 (0.87, 0.95)	0.79 (0.72, 0.87)	0.70 (0.62, 0.79)	0.76 (0.70, 0.83)	0.34 (0.28, 0.40)
≥ 65	0.84 (0.77, 0.92)	0.80 (0.68, 0.91)	0.89 (0.79, 0.98)	0.83 (0.75, 0.91)	0.42 (0.32, 0.52)
Gender					
Male	0.94 (0.87, 1.00)	0.83 (0.70, 0.95)	0.66 (0.50, 0.82)	0.63 (0.50, 0.77)	0.26 (0.15, 0.37)
Female	0.89 (0.87, 0.92)	0.79 (0.76, 0.83)	0.69 (0.65, 0.73)	0.69 (0.66, 0.73)	0.29 (0.26, 0.32)
Race/ethnicity					
White	0.90 (0.88, 0.93)	0.78 (0.73, 0.82)	0.73 (0.67, 0.78)*	0.71 (0.67, 0.76)	0.30 (0.26, 0.34)
Non-white	0.89 (0.85, 0.93)	0.82 (0.77, 0.87)	0.63 (0.57, 0.70)	0.65 (0.59, 0.71)	0.26 (0.21, 0.31)
Education					
≤High school	0.92 (0.87, 0.96)	0.74 (0.64, 0.84)	0.65 (0.54, 0.75)	0.65 (0.56, 0.73)	0.23 (0.16, 0.31)*
Some college	0.87 (0.84, 0.91)	0.78 (0.73, 0.84)	0.67 (0.61, 0.73)	0.68 (0.63, 0.74)	0.34 (0.29, 0.39)
≥College grad	0.91 (0.88, 0.94)	0.83 (0.78, 0.88)	0.72 (0.66, 0.78)	0.71 (0.66, 0.77)	0.26 (0.21, 0.31)
Poverty status					
>125 % FPL	0.89 (0.87, 0.92)	0.79 (0.75, 0.83)	0.68 (0.64, 0.73)	0.71 (0.67, 0.74)*	0.30 (0.27, 0.34)*
≤125 % FPL	0.92 (0.87, 0.97)	0.83 (0.75, 0.91)	0.71 (0.61, 0.81)	0.59 (0.49, 0.69)	0.20 (0.13, 0.28)
Model p value	0.23	0.47	<.0001	< .0001	< .0001

* $p < 0.05$. ** $p < 0.01$. Quality measures with at least 500 eligible patients included. FPL=Federal Poverty Level. All models also include the Systemic Lupus Activity Questionnaire (SLAQ) score and disease duration

risk in patients, or systems-related problems, in which many of these aspects of care fall between specialties and clinicians are unsure whose responsibility it is to perform them. The importance of these data is therefore to identify areas of SLE care with the greatest variations where future quality measurement and improvement efforts are likely to have the greatest impact. Moreover because many of the measures cover aspects of clinical care that are often provided in the primary care setting, dissemination of these measures to primary care physicians is important, and finding ways to effectively coordinate provision of these services is needed.

For many individual quality measures, age was the most significant sociodemographic or disease-related factor associated with receiving services. Younger patients were less likely to receive a variety of services, including vaccinations, drug toxicity monitoring and cardiovascular risk assessment. Many of these services are recommended with increasing age in the general population, and higher rates among older LOS participants may reflect convergence of the SLE quality measures with age-appropriate recommendations. Our findings suggest that among younger SLE patients, greater attention to many routine preventive services associated with significant morbidities may be required.

One of the unique aspects of the LOS cohort is that patients from many health care systems and with various types of health insurance participate in the study. This allows us to investigate health care system factors associated with performance on quality measures in this less common disease in ways that would not be possible with administrative data that often include patients with limited

forms of health insurance, or from clinical cohorts from a single institution's specialty clinic wherein the types of providers involved in care are uniform. Our results suggest that health care system factors have an important influence on health care quality in SLE, beyond sociodemographic characteristics or disease status. We note that, despite having small numbers of persons without insurance in our study, lack of health insurance is associated with significant decrements in performance on SLE quality measures, even though all had at least some access to care (i.e. physician visits) during the previous year. The importance of health insurance, which may reflect socioeconomic status (SES), rather than race/ethnicity, in determining quality is especially noteworthy given numerous studies linking low SES to the disparate outcomes observed in SLE.

Consistent with literature in general medical conditions, the number of physician visits is significantly associated with quality^{16,17}; those with more visits report higher performance on the SLE quality measures. Those enrolled in public sector managed care plans reported higher quality care. In other chronic conditions, such as diabetes or heart disease, some studies have found quality of care in public sector managed care plans to be lower.^{18–20} Given our discrepant findings, we examined differences in quality among different managed care models. Approximately half of patients enrolled in public sector managed care plans belonged to large, prepaid, not-for-profit plans for which performance on SLE quality measures was significantly higher than for other forms of health insurance. Although recent data suggest such plans have made great strides in improving quality for common chronic conditions,²¹ our

Table 4. Performance on all Quality Measures for Which Individuals Are Eligible, with and Without Adjustment for Demographic, Disease and Health Care Characteristics

	Unadjusted Pass Rates (95 % CI)	Adjusted Pass Rates (95 % CI)
Overall pass rate (n=4,107)	0.65 (0.63,0.67)	
Sociodemographic Characteristics		
Age, years		
18–34	0.56 (0.52, 0.59)	0.56 (0.52, 0.61)
35–54	0.64 (0.62, 0.67)	0.65 (0.62, 0.67)
55–64	0.69 (0.66, 0.72)	0.69 (0.66, 0.72)
≥65	0.72 (0.67, 0.76)	0.69 (0.64, 0.74)
Gender		
Male	0.66 (0.59, 0.73)	0.68 (0.62, 0.74)
Female	0.65 (0.63, 0.67)	0.65 (0.63, 0.67)
Race/ethnicity		
White	0.67 (0.65, 0.69)	0.66 (0.63, 0.68)
Non-white	0.62 (0.60, 0.65)	0.64 (0.62, 0.67)
Education		
≤High school graduate	0.63 (0.59, 0.67)	0.63 (0.59, 0.66)
Some college/vocational	0.66 (0.63, 0.68)	0.65 (0.63, 0.68)
College degree	0.65 (0.63, 0.68)	0.66 (0.64, 0.69)
Poverty status		
>125 % of Federal Poverty Level	0.66 (0.64, 0.68)	0.66 (0.64, 0.67)
≤125 % of Federal Poverty Level	0.61 (0.57, 0.65)	0.63 (0.58, 0.67)
SLE Characteristics		
SLAQ score		
1st quartile (score=5)	0.64 (0.62, 0.66)	0.66 (0.64, 0.68)
Median (score=10)	0.65 (0.63, 0.66)	0.65 (0.64, 0.67)
3rd quartile (score=16)	0.65 (0.64, 0.67)	
Disease duration		
1st quartile (11 years)	0.64 (0.62, 0.66)	0.65 (0.63, 0.67)
Median (15 years)	0.65 (0.63, 0.66)	0.65 (0.63, 0.67)
3rd quartile (22 years)	0.66 (0.64, 0.68)	0.65 (0.63, 0.67)
Health Care Characteristics		
Physician visits in past year		
1st quartile (7 visits)	0.62 (0.60, 0.64)	0.63 (0.61, 0.65)
Median (12 visits)	0.64 (0.62, 0.66)	0.64 (0.62, 0.66)
3rd quartile (19 visits)	0.66 (0.65, 0.68)	0.66 (0.64, 0.68)
Kind of insurance		
No health insurance	0.51 (0.42, 0.60)	0.57 (0.47, 0.66)
HMO, public sector	0.75 (0.70, 0.80)	0.74 (0.68, 0.79)
HMO, private sector	0.63 (0.59, 0.67)	0.64 (0.60, 0.67)
Non-HMO, public sector	0.66 (0.64, 0.69)	0.66 (0.63, 0.69)
Non-HMO, private sector	0.64 (0.61, 0.67)	0.64 (0.61, 0.67)
Physician specialties visited		
Generalist and rheumatologist	0.67 (0.65, 0.69)	0.67 (0.65, 0.69)
Generalist, no rheumatologist	0.63 (0.59, 0.67)	0.62 (0.58, 0.67)
Rheumatologist, no generalist	0.61 (0.57, 0.65)	0.64 (0.60, 0.68)
No Rheumatologist or generalist (other MD)	0.51 (0.38, 0.64)	0.53 (0.39, 0.67)

SLAQ = Systemic Lupus Activity Questionnaire, HMO = Health Maintenance Organization. Bolded values indicate $p < 0.05$

findings that these plans are also outperforming others in a complex, less common condition are noteworthy.

Few studies have examined health care quality in SLE. We and others have previously reported variations in routine SLE care, such as antimalarial use, osteoporosis treatment and prevention, and preventive services (e.g. cancer screening, immunizations, contraception).^{6–9,22,23} Demas applied SLE

quality measures regarding cardiovascular risk assessment and osteoporosis prevention, monitoring and treatment to data extracted from electronic medical records of patients at a single center, with results similar to those reported here.⁷ Other studies have indirectly suggested variations in quality. For example, studies using administrative data have found that the experience of providers or hospitals influences inpatient SLE mortality, and that lack of health insurance or public insurance is associated with earlier onset of end-stage renal disease.^{24–28} This literature is provocative because it implies that variations in quality may at least partially explain the striking disparities in SLE outcomes across populations. Insofar as the processes of care advocated by the SLE quality measures are linked to improved patient outcomes, our findings suggest that factors associated with the health care system may be an important mediator of outcomes. Creating health care systems responsive to the needs of patients with SLE may therefore be one mechanism of decreasing the public health impact of the condition in the United States.

Strengths of this study include the relatively large sample size, socio-demographically diverse population, and varied health care systems and factors captured in the study. In addition, many aspects of SLE care are not adequately represented in administrative data; therefore, medical chart review or patient self-report likely allow more thorough assessments of care. While medical chart review remains the gold standard for many studies evaluating performance on quality measures, for less common chronic conditions like SLE, such reviews may be not be feasible given that outside of highly specialized university SLE research centers, the typical rheumatologist's practice has only has a handful of SLE patients; physicians other than rheumatologists are likely to see even fewer. Therefore, case ascertainment and chart review across a very large number of practices would be required for adequate sample sizes. Accordingly, our approach to assess quality of care in SLE is novel and pragmatic, and may have relevance to other uncommon chronic conditions.

However, this approach also has limitations, most importantly that performance on quality measures was assessed by patient self-report. While this methodology has been used extensively to assess quality across chronic conditions, many studies comparing self-report to medical record review suggest that patients often over-report receipt of health care services.^{29–33} In the subgroup evaluated in our sample (supplementary Appendix), respondents generally identified their eligibility for quality measure (denominator inclusion) with excellent accuracy. Agreement regarding receipt of services (numerator inclusion) was more variable, and we cannot rule out the possibility that receipt of care consistent with some measures was misclassified because of inaccurate patient self-report, decreasing the precision of our estimates. In addition, we were not able to assess performance at the individual clinician level because the number of patients per provider in the sample was small, and therefore reliable

estimates were not possible. During the interview year presented in our analysis, there were 493 physicians that patients identified as primarily responsible for their SLE. Of these, 388 had only one patient in the dataset, and only 24 had five or more patients. This is consistent with the relatively low prevalence of the disease, and suggests that assessing performance at the individual clinician level may not be possible outside of large referral centers. Finally, while the LOS is a large sample of individuals with SLE, it is not a random sample. Moreover, most patients reside in California. These factors raise the possibility that our results may not be generalizable to the larger population of patients with SLE in the United States.

Progress has been made in measuring and improving quality for important aspects of health care, including hospital care and ambulatory care for some common chronic conditions. The experience gained over the last decade can inform expansion of these efforts to chronic conditions associated with high morbidity, mortality and health care costs. Here, we applied a recently developed set of QIs to describe gaps in health care quality in SLE and to investigate factors associated with higher quality. The SLE quality measures provide a list of relatively low cost, high impact things that physicians can do to improve outcomes for patients with this complex condition. Moreover, since factors associated with the health care system have the largest impact on quality in SLE, interventions targeted to the health care system may also hold promise in improving quality for this condition.

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