Published in final edited form as:

Arthritis Rheum. 2007 April 15; 57(3): 508–515. doi:10.1002/art.22625.

Impact of Health Maintenance Organizations and Fee-For-Service on Health Care Utilization Among People With Systemic Lupus Erythematosus

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Abstract

Objective—To compare health care utilization in people with systemic lupus erythematosus (SLE) in health maintenance organizations (HMOs) and fee-for-service (FFS).

Methods—A structured survey was administered to a cohort of 982 people with SLE who were assembled between 2002 and early 2005. A total of 2,656 person-years of observation were completed by the end of 2005. In each year, respondents reported their health care utilization and whether they had HMO or FFS coverage. We compared health care utilization of those in HMOs and FFS, with and without adjustment for socioeconomic, demographic, and health characteristics using repeated-measures regression techniques.

Results—Compared with people with SLE who were in FFS, those in HMOs were younger (3.3 years), received a diagnosis at an earlier age (3.6 years), had slightly less disease activity (0.4 on a 10-point scale), were more likely to be nonwhite (8.8%), were less likely to be below the poverty line (7.8%), and were less likely to have public insurance (29.7%). The 2 groups did not differ in other characteristics. On an unadjusted basis, subjects with SLE in HMOs had significantly fewer physician visits (3.1; 95% confidence interval [95% CI] 1.7, 4.5) and were less likely to report one or more outpatient surgical visits (6.3%; 95% CI 2.5, 10.0), and hospital admissions (5.5%; 95% CI 1.7, 9.3) than those in FFS. Adjustment reduced the differences in physician visits (2.3; 95% CI 1.1, 3.5), outpatient surgical rates (4.4%; 95% CI 0.6, 8.1), and hospital admission rates (4.0%, 95% CI 0.4, 7.7).

Conclusion—Subjects with SLE in HMOs utilized substantially less ambulatory care and were less likely to have outpatient surgery and hospital admissions than those in FFS; the effects were not completely explained by socioeconomic, demographic, and health characteristics.

Keywords

Health care utilization; health maintenance organizations; Fee-for-service; Systemic lupus erythematosus

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AUTHOR CONTRIBUTIONS

Dr. Yelin had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study design. Yelin, Trupin, Katz, Criswell.

Acquisition of data. Yelin, Trupin, Criswell.

Analysis and interpretation of data. Yelin, Trupin, Katz, Criswell, Yazdany, Gillis, Panopalis.

Manuscript preparation. Yelin, Trupin, Katz, Criswell, Yazdany, Gillis, Panopalis.

Statistical analysis. Trupin.

INTRODUCTION

The expansion of health maintenance organizations (HMOs) has raised concerns that people with chronic diseases will not receive the health care services needed to monitor and treat their conditions. Most studies examining the impact of HMOs on utilization have concerned relatively healthy, employed populations (1–8). In these studies, HMOs have been found to lower hospital utilization by ~25%, but have little effect on ambulatory care utilization (8). However, results of studies of people with a range of discrete chronic diseases have not demonstrated the same lower utilization rate of expensive services such as hospital admissions or surgery (9).

Research in this area for the rheumatic diseases has largely focused on subjects with rheumatoid arthritis (RA). In these studies, there was no difference in hospital utilization, and inpatient and outpatient surgery (historically the most expensive services for patients with RA) between those with HMOs and those with fee-for-service (FFS) (10–14). However, 1 recent study did show that the use of biologic response modifiers was much lower in patients with HMOs than those with FFS with and without other forms of utilization control, primarily because rates of initiation of such agents were lower in HMOs (15).

The existing literature examining the impact of HMOs or other forms of managed care on health care utilization in people with systemic lupus erythematosus (SLE) is much sparser. In the only published study found, Stewart and Petri reported that the patients of a single physician with HMO coverage did not differ from the same physician's patients who had FFS in terms of treatment or outcomes of lupus nephritis (16). However, the Stewart and Petri study had a small sample size and involved a tertiary care provider. In contrast, our study was designed to examine differences in health care utilization between those in HMOs and those who are in FFS in a large sample of people with SLE from a greater range of health care environments and disease severity; most were not sampled from providers, let alone tertiary care providers.

SUBJECTS AND METHODS

Enrollment and followup

The analysis used data from the first 3 waves of the University of California at San Francisco (UCSF) Lupus Outcomes Study (LOS), an ongoing longitudinal survey of individuals with SLE who had previously participated in a study of SLE genetic risk factors. In the genetics study, SLE diagnoses were verified according to the American College of Rheumatology criteria (17,18) through medical records abstraction. Participants became eligible for the LOS upon completion of their enrollment in the genetics study. The initial LOS enrollment period was September 2002 through April 2005. During that period we attempted to enroll 1,519 individuals, of whom 1,265 (83%) were successfully contacted, and 982 completed at least 1 interview (65% of all eligible and 78% of those successfully contacted). The LOS participants were from 40 states, and represented over 50 HMOs. In 2004, a second annual interview was conducted with 832 (92%) of the 900 LOS participants who had enrolled prior to the end of 2003. In 2005, an additional followup interview was conducted, successfully interviewing 842 participants (92% of those eligible for the interview), of whom 765 were completing their third interview. Of the 140 persons not re-interviewed after either a first or second interview, 20 had died, 22 were medically unable to be interviewed, 63 declined further participation, and 35 were lost to followup. Followup rates did not differ between LOS participants in HMOs and FFS.

The original genetics study recruited participants from several clinical and community-based sources, including UCSF-affiliated clinics, non-UCSF rheumatology offices, lupus support

groups and conferences, and newsletters, Web sites, and other forms of publicity. Ultimately, two-thirds of the LOS participants were derived from non-clinical sources.

Data

The principal source of data for the LOS was a structured 1-hour telephone survey conducted by trained interviewers. The survey included well-validated items covering the following domains: demographics and socioeconomic status, SLE status, disability, general health status and social functioning, employment status, psychological and cognitive status, health care utilization, medications, and health insurance coverage.

The health care utilization section of the questionnaire asked participants about their medical care over the previous 12 months. It included an enumeration of all health care practitioner visits by specialty. The section also included information about emergency department use, hospitalizations, outpatient surgery, and diagnostic procedures. The medication section included an extensive list of prescription drugs for SLE and for other conditions. Participants were asked to report on current and prior use of these medications. The health insurance section was derived from the Medical Expenditures Panel Survey (MEPS) (19,20) and included items regarding the type of coverage (HMO versus FFS) and source of coverage (employment-based, individually purchased plan, or public program), as well as the specific aspects of coverage such as extent of copayments and deductibles, mode of access to specialty services, and nature of drug coverage. LOS participants reported HMO membership reliably across multiple interview waves; this was consistent with a validation study conducted by the Agency for Health Care Research and Quality prior to the initiation of the MEPS (20). The enrollment and data collection protocol was approved by the UCSF Committee on Human Research.

Independent and dependent variables

The primary independent variable for this analysis was coverage in an HMO versus an FFS plan, based on the participants' explicit report of being in an HMO. A secondary independent variable was the source of insurance, categorized as employer-based (including the participant's or a family member's current or former employer), government-based (primarily Medicare or Medicaid), or privately purchased (by the participant or a family member).

In addition, we considered 3 other types of covariates: socioeconomic and demographic characteristics, general health status variables, and SLE-specific variables. The socioeconomic and demographic characteristics included age in years at interview, sex, race/ethnicity (Hispanic, African American, Asian, or other, with white non-Hispanic as referent), marital status (never married or widowed/separated/divorced, with married as referent), education (less than high school, high school graduate, some college, or college graduate, with postgraduate degree as referent), and poverty status (above or below 125% of the federal poverty threshold).

General health status variables included a measure of health-related quality of life (12-Item Short Form Health Survey [SF-12] physical and mental component scores) (21), body mass index (BMI), smoking status (current or former smoker, with never smoked as referent), and co-morbid conditions (heart disease, cancer, pulmonary disease, or diabetes). Although some of these conditions may actually be SLE manifestations, they were included in the analyses because they were likely to contribute to the overall health status of the individual and to the need for medical care. Comorbidity was classified as 1 condition or > 1 condition, with 0 conditions as the referent.

SLE-specific variables included age in years at diagnosis, self-reported SLE flare in the 3 months prior to interview, self-reported SLE activity level in the preceding 3 months (on a 10-point scale, where 0 = no activity and 10 = highest level of activity) (22), and self-reported

kidney, lung, or vascular manifestations over the past year or the past 2–5 years. Evidence of kidney manifestations included transplant, kidney biopsy, or initiating dialysis. Evidence of pulmonary manifestations included lung biopsy, bronchoscopy, or hemoptysis. Evidence of vascular manifestations included myocardial infarction, stroke, transient ischemic attack, deep venous thrombosis, pulmonary embolism, or presence of other blood clots. At the first interview, participants reported the year in which each event or procedure occurred; in subsequent interviews, they reported events or procedures that occurred since the previous interview. From their responses, we determined whether there had been any relevant manifestations in the year preceding the interview or in the 2–5 year period preceding the interview. However, because of the ongoing need for followup care, individuals with a kidney transplant were considered to have had a kidney manifestation in the previous year, no matter when the transplant was actually performed.

The dependent variables for the present analysis were measures of ambulatory and inpatient health care services, diagnostic tests, and medications. Total physician visits were calculated as the sum of visits to all generalist and specialist physicians during the 12-month period preceding the interview. Because of the complex nature of SLE and the difficulty distinguishing between complications due to the disease and unrelated comorbidity, we did not separate health care utilization attributed to SLE from all other health care. The total number of visits to all physicians, nonphysician health care providers, rheumatologists, and generalists (family practitioners, internists, and general practitioners) were treated as continuous measures, because a large proportion of the cohort had at least 1 such visit. To address the skewed distribution of these variables, we truncated the values for each variable at the third standard deviation above the mean, resetting the upper limit of the variable, rather than dropping anyone from the analysis. An alternative to this method, a log transformation, was also considered, but because the results did not materially differ from the results using the truncated values, we used the latter because doing so permitted estimation of the confidence intervals for the difference in utilization between those in HMOs and FFS.

For visits to less common, but important specialists involved in the care of SLE patients (including nephrologists, pulmonologists, dermatologists, and physical therapists), we dichotomized the variables as any visits versus no visit. We treated emergency department visits, outpatient surgeries, and hospitalizations in the same manner, and also calculated the average length of stay among individuals with ≥ 1 night in the hospital. Procedures evaluated included magnetic resonance imaging and computed tomography scans, pulmonary function testing, and bone density scans. Medications were analyzed by category, including nonsteroidal antiinflammatory agents, cytotoxic agents, immunosuppressive agents (with mycophenolate mofetil examined as a special case because of its higher cost), antimalarial agents, oral steroids, pulse steroids, antihypertensive agents, and antidepressive agents. All categories of medications were treated as dichotomous variables, distinguishing between those who were taking the type of medication at the time of the interview and those who were not.

Analysis

Each time participants were interviewed, they contributed 1 observation to the analysis. Therefore, 765 participants who completed 3 interviews contributed 3 observations each (representing 85% of all those eligible for 3 waves), 144 participants contributed 2 observations each, and 73 participants with no followup interviews contributed 1 observation each, for a total of 2,656 person-years of observation. Fifty-one observations were excluded because participants had no health insurance coverage, 80 observations were excluded because the participant could not identify if their health plan was an HMO, and an additional 122 were excluded because of missing values for other key variables, leaving 2,403 observations (90% of the total) for the analysis.

Attrition adjustment

Re-interview rates were significantly higher in women than in men (93% versus 83%), in whites than in nonwhites (94% versus 88%), in those with higher rates of formal education (88% among those who had a high school degree or less, 93% among those with some college, 92% among those who had completed college, and 94% among those with post-baccalaureate training), but there was no difference in followup rates according to poverty status or age. Participants who reported end-stage renal disease and pulmonary manifestations and those with longer durations of disease were significantly less likely to be re-interviewed. There was no difference in followup rates by the following health measures: report of fair or poor health versus any other status, recent history of weight loss, fatigue, fevers, muscle pain or weakness, joint stiffness or swelling, history of clotting disorders, vision loss, or seizures.

Because of the potential impact of differential rates of followup, we developed attrition weights, using a logistic regression model that estimated the probability that an individual had been re-interviewed, based on characteristics ascertained in the baseline interview. The inverse of this probability was used as an attrition weight so that individuals with a lower probability of completing a second interview had larger weights. The resulting proportional attrition weights ranged from 0.95–1.6, with a mean (necessarily) of 1.0. For all analyses in which the person-year was the unit of analyses, we included this calculated attrition weight for wave 2 and wave 3 observations, and set the attrition weight to 1.0 for wave 1 observations.

The 982 participants in the study derive from 955 distinct families (~1.03 per family stratum). This small nesting effect reduced the effective sample size to ~2,375 observations (from 2,403). Because the change was so small, we did not incorporate this design effect into the analyses described below. However, we used SUDAAN software (23) to take into account the correlation among the multiple observations contributed by individuals and the attrition weight described above.

Specific analyses

We first described the socioeconomic, demographic, and health characteristics of the sample, and used those characteristics to compare individuals who reported that their principal health insurance coverage was an HMO with those who reported other types of health insurance, using *t*-tests for continuous variables (e.g., age, BMI, or SF-12 scores) and chi-square tests for categorical or dichotomous variables (e.g., race/ethnicity, smoking status, or sex). We next estimated the mean of the more common utilization measures (such as the total number of physician visits) and the proportion with any of the less common services (such as those with ≥ 1 hospital admission) for participants in HMOs versus FFS plans, on an unadjusted basis, and adjusted for the socioeconomic, demographic, and health characteristics listed above, with 2 modifications. The first modification occurred after we determined that SLE disease activity level and recent SLE flare were too highly correlated to be included in the same model ($r = 0.58$); therefore we dropped the latter variable from the models. Second, we combined the 3 types of SLE manifestations (kidney, pulmonary, and vascular) into a single variable with the following 3 levels: any manifestation in the year prior to interview, any manifestation in the 2–5 year period prior to interview, and no manifestations in the past 5 years. We found this combined variable to be equally predictive of utilization as the 3 separate variables.

For continuous measures, we estimated the least squares means from a linear regression model, calculating the difference and 95% confidence interval (95% CI) between those in HMOs and FFS. For dichotomous measures, including ambulatory and nonambulatory care, medications, and diagnostic procedures, we estimated the adjusted rates from logistic regression models. The adjusted rates were calculated from the predicted probability, also known as the predicted marginal, from which we also calculated the difference (and 95% CI) between those with HMO

and FFS plans. To estimate the differential impact of sets of independent variables on the relationship between HMO status and health care utilization, we showed a series of models for 2 important markers of utilization—total physician visits and proportion with hospitalizations. The models were built sequentially beginning with the bivariate model (HMO versus FFS only) and adding first health-related variables, then socioeconomic variables, then source of insurance, and finally, an interaction term for source of insurance by HMO status. In addition to estimating the adjusted mean physician visits and adjusted hospitalization rate for each model, we also compared the predictive power of each model with the immediately preceding one, by calculating the difference in the model R^2 or model chi-square for the linear and logistic models, respectively. In the final model, we compared the adjusted mean physician visits and adjusted hospitalization rate for HMO versus FFS for each of the 3 categories of source of insurance.

RESULTS

When comparing the sociodemographic and baseline health characteristics, the subjects with SLE that had HMOs were significantly, although marginally, younger and less likely to be non-Hispanic whites than those with FFS (Table 1). The HMO group was also less likely to have a household income of <125% of the federal poverty threshold, and to receive their insurance from Medicare and/or Medicaid. The HMO and FFS groups did not differ in terms of sex, marital status, or education. The people with SLE in HMOs and FFS were remarkably similar in their baseline health characteristics, differing significantly only in the age at diagnosis (those in HMOs were 3.6 years younger at diagnosis) and the reported current level of disease activity (4.1 versus 4.5 on a scale of 0–10) (Table 2). Of note, the 2 groups did not differ significantly in SF-12 physical or mental component scores, BMI, smoking status, comorbidity, disease duration, the proportion reporting a flare in the 3 months prior to survey, or reporting kidney manifestations, pulmonary manifestations, or vascular events in the 1 year or 5 years prior to interview.

On an unadjusted basis, compared with people in FFS, those in HMOs had significantly fewer total ambulatory visits to all physicians, generalist physicians, and nonphysician providers (Table 3). The HMO group was also significantly and substantially less likely to report 1 or more visits to pulmonologists (6.8% versus 11.1%), dermatologists (27.3% versus 35.6%), and physical therapists (16.8% versus 24.6%), and to have 1 or more outpatient surgical procedures (17.4% versus 23.7%) or hospital admission (18.4% versus 23.9%). Adjustment reduced the differences in utilization between subjects in HMOs and FFS somewhat, so that the difference in the number of generalist physician visits and in the proportion visiting a pulmonologist was no longer significant. Nevertheless, the overall pattern of lower utilization rates among those in HMOs remained.

Table 4 presents the extent to which health and socioeconomic characteristics, the source of insurance, and the interaction between source of insurance and HMO status mediate the relationship between HMO status and physician visits and hospital admissions. With respect to physician visits, all sets of variables contribute to explaining the variation in the number of visits. Clearly, health and sociodemographic characteristics and the source of insurance account for some of the difference between those in HMOs and FFS in medical care visits, reducing the difference from 3.1 to 1.5 visits per year. With respect to the proportion having 1 or more hospital admissions, health characteristics and the source of insurance account for some of the difference in admission rates between subjects with SLE in HMOs and FFS, but sociodemographic characteristics do not add significantly to the explanation of differences in admission rates between the 2 groups. All sets of variables combined, however, reduce the difference in admission rates between those in HMOs and FFS from 5.5% to 1.7%. The model including the interaction between HMO status and source of insurance (final set of rows in

Table 4) indicates that most of the difference in the number of physician visits and in the proportion with ≥ 1 hospital admission occurred among those with government-based insurance.

Among diagnostic tests and medications used in the year prior to interview (Table 5), on an unadjusted basis, people with SLE in HMOs are less likely to report a computed tomography scan, magnetic resonance imaging, pulmonary function test, bone density scan, and use of an antidepressive agent. Sociodemographic and health characteristics account for some of these differences; after adjustment, the only difference that remains statistically significant is the lower rate of bone density scans reported by people in HMOs. Nevertheless, it is noteworthy that the point estimates indicate that subjects with SLE in HMOs are less likely to receive each of the diagnostic tests. Overall, on an unadjusted basis, persons with SLE in HMOs are 10.4% less likely to report 1 or more of these tests in the year prior to interview; after adjustment the difference is 7.2%. With respect to medications, there is no clear pattern of usage among people with SLE in HMOs and FFS.

DISCUSSION

A substantial body of research has established that HMOs, particularly the prepaid group practice form, utilize hospital care ~25% less than FFS settings when caring for largely healthy populations (1–8). In contrast to these observations about healthy populations, studies indicate that there are no major differences in health care use among people with discrete chronic conditions in HMOs and FFS (7,8); included in this literature are studies examining people with RA (with the possible exception that subjects with RA in HMOs may use biologic response modifiers less frequently) (10–15). There is not a substantial body of research examining the impact of HMO versus FFS care for persons with SLE. The present study was designed to address this gap.

We found that people with SLE in HMOs used substantially less health care services than those in FFS, with and without adjustment for sociodemographic and health characteristics. Of note, the difference in the number of physician visits and in the probability of hospital admissions between subjects with HMOs and FFS was greatest for those with government-based insurance, suggesting that reduced utilization in HMOs is concentrated among the aged and disabled beneficiaries of Medicare and the poor and disabled beneficiaries of Medicaid. The largely middle-class employed population may be able to negotiate the rules of HMOs in a manner that minimizes the effects of HMO coverage.

When we evaluated the specific diagnostic tests and medications used for SLE, after adjustment the HMO group was significantly less likely to report a bone density scan, although the point estimates suggest a trend in the same direction for the other diagnostic tests. In contrast, there was no pattern to the results with respect to specific medications.

The strength of the present study derives from the relatively large sample size, the diversity of the clinical and community sources of the people with SLE, and the heterogeneity of their demographic backgrounds. The principal limitation of the study is that it is based on self-report of HMO versus FFS status and health care utilization, a limitation somewhat mitigated by the use of health care utilization measures developed for and validated in the Medical Expenditure Panel Survey and by the fact that we cross-validated the multiple responses of respondents about HMO and FFS status across years, increasing the confidence in the results. Nevertheless, one cannot rule out the possibility, however unlikely, that being in a HMO affected the report of utilization in a biased fashion (i.e., because those in HMOs hear negative publicity about HMOs and this affects their responses).

The lower utilization rate of ambulatory visits, the lower frequency of outpatient surgery and hospital admissions, and the trend toward lower frequency of diagnostic testing among people with SLE in HMOs is not an indication of better or poorer quality of care since there are no validated measures of the quality of care for SLE or published guidelines for SLE care. It is unlikely, however, that the utilization differences are due to differences in the characteristics of people with SLE in HMOs and FFS because we could find no evidence of substantial differences in health characteristics between those with HMOs and FFS (the only measure on which the 2 groups differed significantly was the level of current SLE activity, and on that measure, there was only a 4% difference). Assuming that the utilization differences are not a reflection of unmeasured differences in severity or quality of care, this suggests the hypothesis that outcomes may be obtained in a more cost-effective manner in HMOs, a hypothesis to be tested using longitudinal data from the current project over the next few years.

Acknowledgments

The authors gratefully acknowledge the assistance of Janet Stein, Jessica Spry, and Rosemary Prem.

Dr. Yelin's work was supported by the Agency for Health-care Research and Quality/National Institute of Arthritis and Musculoskeletal and Skin Diseases (1-R01-HS013893), the State of California Lupus Fund, and the Arthritis Foundation. Dr. Yazdany's work was supported by the American College of Rheumatology Research and Education Foundation Physician Scientist Development award. Dr. Criswell's work was supported by the NIH (grants K24-AR02175 and R01-AR44804).

References

1. Luft, H. HMOs: dimensions of performance. New York: Wiley & Sons; 1981.
2. Manning WG, Lebowitz A, Goldberg GA, Rogers WH, Newhouse JP. A controlled trial of the effect of prepaid group practice on use of services. *N Engl J Med* 1984;310:1505–10. [PubMed: 6717541]
3. Ware JE Jr, Brook RH, Rogers WH, Keeler EB, Davies AR, Sherbourne CD, et al. Comparison of health outcomes at a health maintenance organization with those of fee-for-service care. *Lancet* 1986;1:1017–22. [PubMed: 2871294]
4. Sloss EM, Keeler EB, Brook RH, Operskalski BH, Goldberg GA, Newhouse JP. Effect of health maintenance organization on physiologic health: results from a randomized trial. *Ann Intern Med* 1987;106:130–8. [PubMed: 3538964]
5. Lurie N, Moscovice IS, Finch M, Christianson JB, Popkin MK. Does capitation affect the health of the chronically mentally ill? Results from a randomized trial. *JAMA* 1992;267:3300–4. [PubMed: 1597911]
6. Lurie N, Christianson J, Finch M, Moscovice I. The effects of capitation on health and functional status of the Medicaid elderly: a randomized trial. *Ann Intern Med* 1994;120:506–11. [PubMed: 8311374]
7. Miller RH, Luft HS. Managed care plan performance since 1980: a literature analysis. *JAMA* 1994;271:1512–9. [PubMed: 8176832]
8. Miller, R.; Luft, H. Managed care plan performance: evidence from recently published studies. Speech before American Association of Health Plans; Washington (DC): 1997.
9. Miller RH, Luft HS. HMO plan performance update: an analysis of the literature, 1997–2001 [review]. *Health Aff (Millwood)* 2002;21:63–86. [PubMed: 12117154]
10. Yelin EH, Henke CJ, Kramer JS, Nevitt MC, Shearn M, Epstein WV. A comparison of the treatment of rheumatoid arthritis in health maintenance organizations and fee-for-service practices. *N Engl J Med* 1985;312:962–7. [PubMed: 3974686]
11. Manheim LM. Managed care and arthritis care: patients and providers under the new medical care organizations. *Arthritis Care Res* 1995;8:298–303. [PubMed: 8605270]
12. Yelin EH, Criswell LA, Feigenbaum PG. Health care utilization and outcomes among persons with rheumatoid arthritis in fee-for-service and prepaid group practices. *JAMA* 1996;276:1048–53. [PubMed: 8847766]

13. Ward MM, Lubeck D, Leigh JP. Longterm health outcomes of patients with rheumatoid arthritis treated in managed care and fee-for-service practice settings. *J Rheumatol* 1998;25:641–9. [PubMed: 9558163]
14. Yelin E, Trupin L, Katz P. The prevalence and impact of managed care for persons with RA in 1994 and 1999. *Arthritis Rheum* 2002;47:172–80. [PubMed: 11954011]
15. Yelin EH, Trupin LS, Katz PP. Impact of managed care on the use of biological agents for rheumatoid arthritis. *Arthritis Rheum* 2005;53:423–30. [PubMed: 15934109]
16. Stewart M, Petri M. Lupus nephritis outcomes: health maintenance organizations compared to non-health maintenance organizations. *J Rheumatol* 2000;27:900–2. [PubMed: 10782813]
17. Tan EM, Cohen AS, Fries JF, Masi AT, McShane DJ, Rothfield NF, et al. The 1982 revised criteria for the classification of systemic lupus erythematosus. *Arthritis Rheum* 1982;25:1271–7. [PubMed: 7138600]
18. Hochberg MC. Updating the American College of Rheumatology revised criteria for the classification of systemic lupus erythematosus [letter]. *Arthritis Rheum* 1997;40:1725. [PubMed: 9324032]
19. Cohen JW, Monheit AC, Beauregard KM, Cohen SB, Lefkowitz DC, Potter DE, et al. The Medical Expenditures Panel Survey: a national information resource. *Inquiry* 1996–1997;33:373–89.
20. Kerwin, J.; Cantor, D.; Sheridan, S. Results of rounds 3 and 4 of managed care cognitive interviews for the household portion of the MEPS. Bethesda (MD): Report to AHCPR from Westat, Inc; 1995.
21. Ware J Jr, Kosinski M, Keller SD. A 12-Item Short Form Health Survey: construction of scales and preliminary tests. *Med Care* 1996;34:220–33. [PubMed: 8628042]
22. Karlson EW, Daltroy LH, Rivest C, Ramsey-Goldman R, Wright EA, Partridge AJ, et al. Validation of a Systemic Lupus Activity Questionnaire (SLAQ) for population studies. *Lupus* 2003;12:280–6. [PubMed: 12729051]
23. Research Triangle Institute. SUDAAN user's manual, release 8.0. Research Triangle Park (NC): Research Triangle Institute; 2001.

Table 1

Baseline sociodemographic characteristics of people with SLE, by HMO status*

Characteristic	Total cohort (n = 887)	HMO (n = 303)	FFS (n = 584)	P [†]
Age, mean ± SD years	47.2 ± 3.1	45.0 ± 12.6	48.3 ± 13.3	< 0.001
Female	91.3	91.4	91.3	0.93
Race/ethnicity				0.02
Non-Hispanic white	68.2	62.4	71.2	
Hispanic	9.7	12.2	8.4	
African American	7.6	7.9	7.4	
Asian American	8.8	12.2	7.0	
Other	5.7	5.3	6.0	
Marital status				0.06
Married	62.0	65.3	60.3	
Widowed, separated, divorced	17.4	13.2	19.5	
Never married	20.6	21.5	20.2	
Education				0.41
Less than high school	3.5	3.0	3.8	
High school graduate	16.9	14.5	18.2	
Some college or trade school	41.7	44.6	40.2	
College graduate	24.4	24.1	24.5	
Postgraduate degree	13.5	13.9	13.4	
Income <125% of poverty threshold	11.7	6.6	14.4	< 0.001
Principal insurance source				< 0.001
Employer (self or family member)	61.0	78.2	52.1	
Medicare and/or Medicaid	31.5	11.9	41.6	
Privately purchased	7.6	9.9	6.3	

* Values are the percentage unless otherwise indicated. SLE = systemic lupus erythematosus; HMO = health maintenance organization; FFS = fee-for-service.

[†] Values from *t*-tests for continuous variables and chi-square tests for dichotomous or categorical variables.

Table 2

Baseline health characteristics of people with SLE by HMO status*

Characteristic	Total cohort (n = 887)	HMO (n = 303)	FFS (n = 584)	P [†]
Overall health status				
SF-12 physical component	39.6 ± 6.5	40.1 ± 6.5	39.3 ± 6.5	0.10
SF-12 mental component	42.0 ± 6.3	42.5 ± 6.2	41.8 ± 6.4	0.15
Body mass index	27.0 ± 6.7	26.7 ± 6.7	27.2 ± 6.8	0.31
Smoking status, %				0.19
Current smoker	10.2	9.2	10.7	
Former smoker	31.1	27.7	32.9	
Never smoked	58.9	63.0	56.7	
Comorbid conditions, %				0.13
None	48.0	51.5	46.2	
1	34.0	34.0	34.1	
≥2	17.9	14.5	19.7	
SLE status and history				
Age at diagnosis, years	34.3 ± 13.3	31.9 ± 12.5	35.5 ± 13.6	< 0.001
Disease duration, years	12.9 ± 8.6	13.1 ± 8.8	12.8 ± 8.5	0.65
Flare in past 3 months, %	47.1	45.5	47.9	0.50
Level of SLE activity	4.4 ± 3.1	4.1 ± 3.2	4.5 ± 3.1	0.04
Manifestations, %				
Kidney				
Past year	7.3	8.6	6.7	0.30
Past 2–5 years	5.4	6.3	5.0	0.42
Pulmonary				
Past year	4.5	4.6	4.5	0.91
Past 2–5 years	7.3	5.6	8.2	0.16
Vascular				
Past year	7.6	6.6	8.0	0.44
Past 2–5 years	8.6	7.9	8.9	0.62

* Values are the mean ± SD unless otherwise indicated. SF-12 = 12-Item Short Form Health Survey; Comorbid conditions = heart disease, lung disease, cancer, diabetes; Level of SLE activity = self-reported activity in past 3 months (on 10-point scale); Kidney = transplant, biopsy, or dialysis; Pulmonary = bronchoscopy, biopsy, hemoptysis; Vascular = blood clots, myocardial infarction, transient ischemic attack, or stroke. See Table 1 for additional definitions.

[†] Values from *t*-tests for continuous variables and chi-square tests for dichotomous or categorical variables.

Table 3

Health care utilization in people with SLE in HMO or other settings, with and without adjustment for sociodemographic and health characteristics*

Type of health care service	Model n [†]	Unadjusted			Adjusted			
		All	HMO	FFS	Difference (95% CI)	HMO	FFS	Difference (95% CI)
Ambulatory care								
Mean number of visits								
Any MD	2,403	17.2	15.2	18.3	3.1 (1.7, 4.5) [‡]	15.7	18.1	2.3 (1.1, 3.5) [‡]
Rheumatologist	2,401	3.6	3.5	3.7	0.1 (−0.3, 0.5)	3.5	3.7	0.1 (−0.2, 0.5)
Generalist	2,386	4.1	3.6	4.4	0.8 (0.3, 1.2) [‡]	4.0	4.2	0.3 (−0.2, 0.7)
Non-MD providers	2,403	8.5	6.0	9.7	3.7 (2.0, 5.4) [‡]	6.4	9.5	3.1 (1.4, 4.7) [‡]
% with one or more visits to								
Nephrologist	2,403	17.7	18.4	17.7	−0.7 (−5.1, 3.7)	16.4	18.8	2.4 (−1.2, 6.0)
Pulmonologist	2,403	9.7	6.8	11.1	4.3 (1.1, 7.6) [‡]	7.8	10.5	2.7 (−0.6, 5.9)
Dermatologist	2,403	32.8	27.3	35.6	8.3 (3.5, 13.1) [‡]	27.4	35.5	8.0 (3.3, 12.8) [‡]
Physical therapist	2,403	21.9	16.8	24.6	7.9 (3.9, 11.8) [‡]	17.9	23.9	6.0 (2.0, 9.9) [‡]
Any emergency department visit, %	2,372	40.6	37.8	42.3	4.5 (−0.4, 9.3)	39.4	41.5	2.0 (−2.6, 6.6)
Any outpatient surgical procedures, %	2,403	21.6	17.4	23.7	6.3 (2.5, 10.0) [‡]	18.6	22.9	4.4 (0.6, 8.1) [‡]
Hospital admission								
Any, %	2,403	21.9	18.4	23.9	5.5 (1.7, 9.3) [‡]	19.4	23.4	4.0 (0.4, 7.7) [‡]
Average length of stay among admissions	520	4.9	4.9	4.9	−0.1 (−1.3, 1.2)	4.9	4.9	0.0 (−1.2, 1.2)

* Dependent variables for all continuous (count) measures are truncated at the 3rd SD above the mean. 95% CI = 95% confidence interval. See Table 1 for additional definitions. Model adjusted for age at interview, age at SLE diagnosis, education, race/ethnicity, marital status, poverty status, 12-Item Short Form Health Survey mental and physical scores, body mass index, smoking status, SLE activity and recent kidney, pulmonary, or vascular manifestations, comorbidity, and HMO status.

[†] Sample includes 1 observation for each interview in which respondent had health insurance, up to 3 per person.

[‡] P values significant ($P < 0.05$) between HMO and other health insurance types.

Table 4

Medical visits and hospitalizations among people with SLE in HMO or FFS settings, with and without adjustment for race/ethnicity, socioeconomic status, health characteristics, and source of insurance*

Model (n = 2,403)	Total medical care visits				Hospital admissions			
	HMO, mean	FFS, mean	Difference (95% CI)	Model R ²	HMO, %	FFS, %	Difference (95% CI)	Model χ^2
Adjusted for HMO only	15.2	18.3	3.1 (1.7, 4.5) [†]	0.01	18.4	23.9	5.5 (1.7, 9.3) [†]	466.4
Adjusted for HMO and health characteristics	15.7	18.1	2.4 (1.1, 3.6) [†]	0.16 [‡]	18.9	23.7	4.8 (1.2, 8.4) [†]	578.0 [‡]
Adjusted for HMO, health characteristics, and SES/demographics	15.7	18.1	2.4 (1.1, 3.6) [†]	0.18 [‡]	19.4	23.3	3.9 (0.2, 7.5) [†]	596.9
Adjusted for HMO, health characteristics, SES/demographics, and source of insurance	16.3	17.8	1.5 (0.2, 2.7) [†]	0.19 [‡]	20.9	22.6	1.7 (-2.2, 5.6)	604.4 [‡]
Adjusted for HMO, medical characteristics, SES/demographics, source of insurance, and interaction between HMO and insurance source [§]				0.19 [‡]				605.2 [‡]
Employer-based insurance	15.2	16.6	1.4 (0.0, 2.8)		18.5	19.7	1.2 (-3.1, 5.6)	
Government-based insurance	17.2	20.5	3.4 (-0.2, 7.0)		24.8	28.3	3.4 (-5.9, 12.7)	
Privately purchased insurance	16.2	14.7	-1.5 (-4.9, 1.9)		15.5	16.4	0.9 (-9.1, 10.9)	

* 95% CI = 95% confidence interval; health characteristics = smoking status, number of comorbid conditions, body mass index, 12-Item Short Form Health Survey mental and physical scores, age at diagnosis, level of SLE activity, presence of kidney, pulmonary, and vascular manifestations in past year or past 2-5 years; SES = socioeconomic status. See Table 1 for additional definitions.

[†] Difference is significant ($P < 0.05$) between HMO and other health insurance types.

[‡] Model has significantly more predictive power ($P < 0.05$) than immediately preceding model.

[§] Interaction term is statistically significant.

Table 5

Frequency of diagnostic tests and treatments among people with SLE in HMO or FFS settings, with and without adjustment for sociodemographic and health characteristics*

	Unadjusted				Adjusted	
	All [†] (n = 2,403)	HMO	FFS	Difference (95% CI)	HMO	FFS Difference (95% CI)
Diagnostic tests in past year (%)						
Computed tomography scan	28.7	24.9	30.8	5.9 (1.3, 10.4) [‡]	26.2	30.0 3.8 (-0.5, 8.1)
Magnetic resonance imaging	29.0	24.7	31.3	6.6 (2.3, 10.9) [‡]	26.5	30.3 3.8 (-0.4, 8.0)
Pulmonary function tests	15.0	11.6	16.8	5.2 (1.8, 8.6) [‡]	12.8	16.0 3.2 (-0.3, 6.7)
Bone density scan	37.3	33.4	39.3	5.9 (1.2, 10.5) [‡]	34.1	38.9 4.8 (0.2, 9.4) [‡]
Any of the above diagnostic tests	62.8	56.0	66.4	10.4 (5.4, 15.3) [‡]	58.1	65.3 7.2 (2.6, 11.8) [‡]
Current medication usage (%)						
Nonsteroidal antiinflammatories	56.8	53.1	58.5	5.4 (-0.1, 10.9)	55.0	57.6 2.6 (-2.6, 7.8)
Cytotoxic agents	9.6	9.6	9.6	0.0 (-3.3, 3.3)	9.0	9.9 0.9 (-2.3, 4.1)
Immunosuppressive agents	18.6	20.1	18.0	-2.1 (-6.6, 2.4)	19.1	18.4 -0.7 (-5.0, 3.6)
Mycophenolate mofetil	9.2	9.9	9.0	-0.9 (-4.2, 2.4)	8.6	9.7 1.1 (-1.8, 4.0)
Antimalarial agents	49.8	52.3	48.4	-4.0 (-9.9, 2.0)	52.2	48.5 -3.7 (-9.4, 2.0)
Oral steroids	42.5	44.4	41.9	-2.5 (-8.3, 3.3)	43.8	42.1 -1.7 (-7.2, 3.8)
Pulse steroids	6.3	7.0	6.0	-0.9 (-3.2, 1.4)	7.4	5.9 -1.5 (-3.8, 0.8)
Antihypertensive agents	41.3	41.4	41.7	0.2 (-5.5, 6.0)	41.4	41.7 0.3 (-5.0, 5.6)
Antidepressant agents	39.6	32.8	43.0	10.2 (4.9, 15.6) [‡]	36.3	41.1 4.9 (0.0, 9.8)

* Model adjusted for age at interview, age at SLE diagnosis, education, race/ethnicity, marital status, poverty status, 12-Item Short Form Health Survey mental and physical scores, body mass index, smoking status, SLE disease activity and recent kidney, pulmonary, or vascular manifestations, comorbidity, and HMO status. Dependent variable for all continuous (count) measures are truncated at the 3rd SD above the mean. 95% CI = 95% confidence interval. See Table 1 for additional definitions.

[†] Sample includes 1 observation for each interview in which respondent had health insurance, up to 3 per person.

[‡] Difference is significant ($P < 0.05$) between HMO and other health insurance types.