Medical Insurance, Socioeconomic Status, and Age of Onset of Endstage Renal Disease in Patients with Lupus Nephritis

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ABSTRACT. ***Objective.*** Limited access to care may hasten progression to endstage renal disease (ESRD) in patients with lupus nephritis. We examined associations between type of medical insurance, socioeconomic status (SES), and age at onset of ESRD in a national, population-based cohort.

Methods. Using the United States Renal Data System, incident cases of ESRD due to lupus nephritis in the US from January 1, 1996, to June 30, 2004, were examined in this cross-sectional study (n = 7971). Age at onset of ESRD was compared among patients with different types of medical insurance and by SES.

Results. In each ethnic group, patients with private insurance were older at the onset of ESRD than those with no insurance or Medicaid. For example, whites with private insurance were on average 7.5 years older than those with no insurance and 8.2 years older than those with Medicaid. There were no differences in age at onset of ESRD between those with no insurance and those with Medicaid. SES, based on the socioeconomic characteristics of the patient's area of residence, was associated with age of onset of ESRD only in whites.

Conclusion. Among patients with lupus nephritis who develop ESRD, those with private medical insurance are older when they begin ESRD treatment than those with Medicaid or no insurance. Given that medical insurance is unrelated to the age at onset of lupus nephritis, these findings suggest that progression to ESRD varies with medical insurance status, possibly because of differences in quality of care or access to care. (First Release August 1 2007; J Rheumatol 2007;34:2024–7)

Key Indexing Terms:
MEDICAL INSURANCE SOCIOECONOMIC STATUS HEALTH DISPARITIES
ENDSTAGE RENAL DISEASE SYSTEMIC LUPUS ERYTHEMATOSUS

Ten percent to 30% of patients with lupus nephritis develop endstage renal disease (ESRD) within 15 years of onset of nephritis[1-8]. Treatment with immunosuppressive medications may prevent or delay the development of ESRD[9,10], and poor access to treatment may hasten its development. Low socioeconomic status (SES) has been inconsistently associated with progression to ESRD[2,8,11-14]. This inconsistency may be related to the examination of incident patients in some studies and prevalent patients in other studies, or to differences in the measures of SES, which have included education level, income, medical insurance, and residence in poor neighborhoods. The question of whether insurance status, and by inference access to treatment, is associated with the onset of ESRD in patients with lupus nephritis has not been examined recently. We examined differences in the age of onset of ESRD by the type of medical insurance and by SES in patients with lupus nephritis entering treatment for ESRD in the US from 1996 to 2004.

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MATERIALS AND METHODS

Source of data. Information on patients with incident ESRD was obtained from the United States Renal Data System (USRDS), a national population based registry of all patients with ESRD[15]. Patients are enrolled in the USRDS after being certified as needing chronic renal replacement therapy by their nephrologist. The USRDS includes information on patient demographic characteristics, the primary renal disease causing ESRD (by attribution of the attending nephrologist), renal replacement therapy, and outcomes.

Data were abstracted on all patients with incident ESRD due to lupus nephritis from January 1, 1996, to June 30, 2004, (the most recent date for which complete data were available) who resided in one of the 50 states or the District of Columbia (n = 8766). This information included patient age, sex, race (white, black, Asian or Pacific Islander, Native American, or other, as recorded by the attending nephrologist), Hispanic ethnicity, and ZIP code of residence at the time of initiation of ESRD treatment. Thirteen patients with missing data on sex or race and 238 patients (2.7%) for whom data on ZIP code were missing or invalid were excluded. Because associations between insurance status, SES, and ESRD may differ between children and adults, the analysis was limited to those age 20 or older at the onset of ESRD (n = 7971).

The study protocol was exempted from human subjects review by the National Institutes of Health Office of Human Subjects Research.

Analysis plan. The outcome was the age at which ESRD treatment began, and the independent variables of interest were the type of medical insurance prior to ESRD, and SES. Because lupus nephritis tends to occur at younger ages in ethnic minorities than in Caucasians, all analyses were stratified by ethnic group[2,16]. The analysis is based on the position that the age at onset of lupus nephritis would not be associated with the type of medical insurance or SES, and that any differences in age at ESRD would be due to differences in rates of progression to ESRD among these groups. This position is supported by data from an inception cohort of 160 patients with lupus nephritis, in which the age at onset of nephritis was similar between those with private insurance and those without private insurance [39.8 ± 16.7 yrs vs 43.4 ± 13.3 yrs, respectively, among whites (p = 0.53); 35.7 ± 14.3 yrs vs 34.1 ± 13.7 yrs, respectively, among blacks (p = 0.59)][2]. The USRDS does not include information on the clinical course or treatment prior to the onset of ESRD.

Study variables. Type of medical insurance was classified as none, Medicaid (with or without Medicare), private insurance (with or without Medicare), and Medicare alone. Medicaid is a publicly-funded state-administered medical insurance program for people of low income or limited financial resources. It covers the costs of inpatient and outpatient care, diagnostic tests, and medications, although the range of services covered and eligibility may vary by state. Medicare is a publicly-funded federally-administered medical insurance program for people age 65 or older and for people younger than 65 with certain disabilities. It provides partial coverage for the costs of inpatient and outpatient care, diagnostic tests, and as of 2006, medications.

Because the USRDS does not include patient-level measures of SES, a composite area-based measure of SES was developed that assigned an SES score to each patient based on the characteristics of their ZIP code of residence, using a previously described approach[17,18]. First, using principal components analysis of socioeconomic indicators from the 2000 US Census files, 7 measures were identified to be included in a composite measure of SES (log of median household income, proportion with income below 200% of the federal poverty level, log of median house value, log of median monthly rent, mean education level, proportion of people age 25 or older who were college graduates, and proportion of employed persons with a professional occupation). Each of these measures loaded strongly on a single factor, with all factor loads greater than 0.75, and together explained 70% of the variance across ZIP codes. Second, means and standard deviations (SD) were computed for each measure among all ZIP codes, and along with corresponding z scores for each ZIP code. The SES score was then computed as the sum of the z scores for all 7 measures. This measure was highly correlated with education level in a sample of 2394 patients with all-cause ESRD who participated in a USRDS substudy that collected information on educational attainment[18].

The number of comorbid medical conditions (hypertension, diabetes mellitus, cancer, congestive heart failure, stroke, chronic obstructive pulmonary disease, coronary artery disease, peripheral vascular disease, alcohol abuse, drug abuse, as reported by the attending nephrologist) was included as a potential confounding variable.

Statistical analysis. Analysis of variance was used to compare age at onset of ESRD among patients with different types of medical insurance and among quartiles of SES score, adjusting for sex and the number of comorbid conditions, and stratified by ethnic group. SAS programs (SAS Institute, Cary, NC, USA) were used for analysis. Hypothesis testing was 2-tailed, and p values < 0.05 were considered statistically significant.

RESULTS

The study included 2590 non-Hispanic whites, 3791 non-Hispanic blacks, 1143 Hispanics, and 334 Asian/Pacific Islanders with ESRD due to lupus nephritis. There were too few Native Americans (n = 67) and patients of other ethnicity (n = 46) for meaningful analysis by type of medical insurance or SES. Eighty-two percent of patients were women; the proportion of women ranged from 76.7% among whites to 86.2% among Asian/Pacific Islanders. The most common comorbid conditions were hypertension (73%), congestive heart failure (16%), diabetes (8%), and coronary artery disease (8%). The mean (± SD) age at the onset of ESRD was 42.3 ± 14.7 years, but this varied from 37.5 ± 13.1 years among Hispanics to 48.0 ± 16.1 years among whites.

In all ethnic groups, the mean age at the onset of ESRD was significantly associated with the type of medical insurance, and followed a similar pattern: those without medical insurance were youngest, those with Medicaid were slightly older, those with private insurance were substantially older, and Medicare recipients were, not unexpectedly, the oldest (Table 1). There were no significant differences in mean age between those without insurance and those with Medicaid among whites (p = 0.99), blacks (p = 0.21), or Hispanics (p = 0.99). The area-based measure of SES was associated with age at ESRD only among whites. There were no significant interactions between type of medical insurance and quartile of SES score. Age at onset of ESRD was similar between women and men in all ethnic groups. Alternative models that adjusted for the presence of the 4 most common comorbid conditions, instead of the number of conditions, produced very similar results.

Adjusted mean differences in age at onset of ESRD were computed to assess the magnitude of differences between insurance groups (Figure 1). Whites with private insurance were on average 7.5 years older than those with no medical insurance, and 8.2 years older than those with Medicaid. Among blacks, these differences were 5.6 years and 4.1 years, respectively. Among Hispanics, those with private insurance were more than 2.5 years older at the onset of ESRD than those without insurance or with Medicaid. Findings were similar among Asian/Pacific Islanders, but the confidence intervals were wide due to the smaller number of patients.

DISCUSSION

The 3 main findings of the study are that, among patients with ESRD due to lupus nephritis, those with private insurance develop ESRD at an older age than those with no medical insurance or those with Medicaid; age at onset of ESRD was similar between those with Medicaid and those with no insurance; and the type of insurance was more important than SES in its association with age at onset of ESRD. SES was weakly associated with age at onset of ESRD among whites only, and associations with medical insurance were present despite adjustment for SES. These findings suggest that medical insurance itself, or associated differences in care, were the factors mediating differences in age of onset of ESRD, moreso than health beliefs or behaviors related to social class.

Older age at onset of ESRD among those with private insurance may reflect an older age at onset of lupus nephritis, with no difference in the rate of progression to ESRD compared to those without private insurance. Alternatively, an

Table 1. Adjusted mean age (95% confidence interval) at onset of endstage renal disease by type of medical insurance and quartile of socioeconomic status score, among non-Hispanic whites, non-Hispanic blacks, Hispanics, and Asian/Pacific Islanders. Valus adjusted for sex and number of comorbid conditions; values for type of medical insurance adjusted for socioeconomic status score; values for socioeconomic status score adjusted for type of medical insurance. P values are those associated with statistical tests of any difference between groups.

	White		Black		Hispanic		Asian/Pacific Islander	
	n	Mean age	n	Mean age	n	Mean age	n	Mean age
No medical insurance	134	42.4 (39.9, 45.0)	444	36.0 (34.7, 37.2)	183	35.5 (33.5, 37.6)	27	31.8 (26.6, 37.0)
Medicaid	417	41.7 (40.1, 43.2)	1315	37.4 (36.6, 38.3)	400	35.2 (33.7, 36.8)	78	35.5 (32.1, 38.8)
Private insurance	1771	50.0 (49.0, 50.7)	1652	41.5 (40.8, 42.3)	501	38.2 (36.9, 39.4)	213	38.9 (36.4, 41.4)
Medicare	195	52.9 (50.8, 55.1)	286	47.1 (45.6, 48.7)	34	45.6 (41.3, 49.9)	6	51.5 (41.0, 62.0)
Insurance data missing	73	47.6 (44.0, 51.3)	94	45.1 (42.4, 47.7)	25	39.3 (34.3, 44.4)	10	34.4 (25.8, 43.1)
p		< 0.0001		< 0.0001		< 0.0001		0.003
Quartile of socioeconomic status score								
1 (lowest)	588	45.7 (44.1, 47.3)	1502	41.6 (40.7, 42.6)	464	38.8 (37.0, 40.6)	29	37.9 (32.5, 43.4)
2	671	46.6 (45.1, 48.0)	1034	41.3 (40.2, 42.3)	294	39.3 (37.2, 41.3)	59	37.5 (33.1, 41.9)
3	709	47.2 (45.7, 48.7)	789	41.2 (40.1, 42.3)	239	38.0 (35.9, 40.2)	112	37.4 (33.8, 41.1)
4 (highest)	622	48.2 (46.7, 49.7)	466	41.6 (40.3, 43.0)	146	39.0 (36.5, 41.5)	134	40.8 (37.0, 44.6)
p		0.03		0.84		0.72		0.18

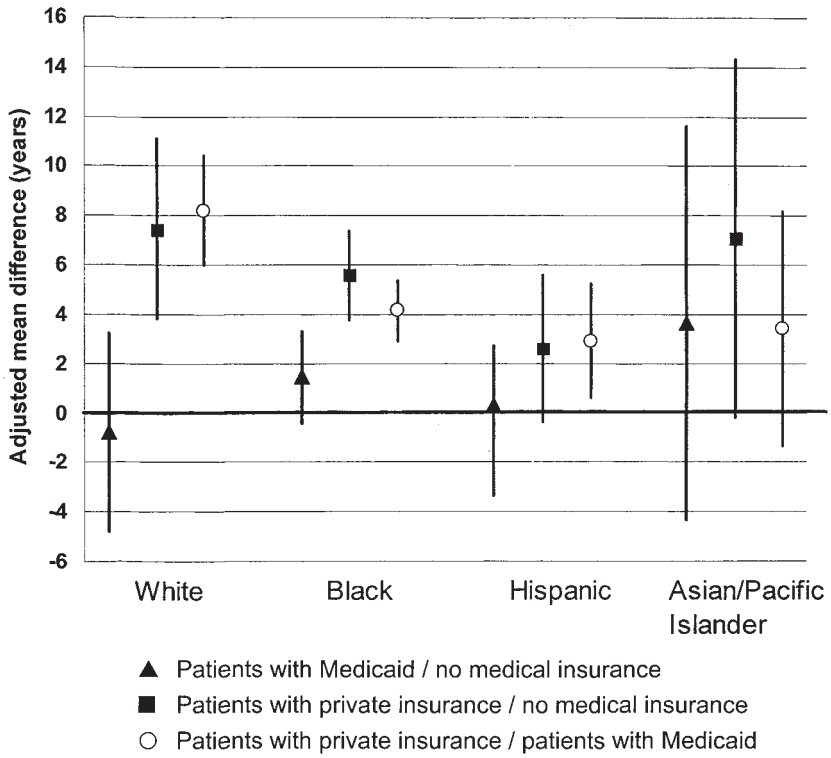

Figure 1. Adjusted mean differences in age at onset of endstage renal disease between patients with Medicaid and those with no medical insurance (▲), patients with private insurance and those with no medical insurance (■), and patients with private insurance and those with Medicaid (○). Values are adjusted for sex, number of comorbid conditions, and socioeconomic status score. Error bars represent 95% confidence intervals.

older age at onset of ESRD may be due to a slower rate of progression to ESRD among patients with private insurance, whose age of onset of lupus nephritis was no different from that of patients with other types of insurance. Insurance status would not be expected to be related to the age of onset of lupus nephritis, and the available evidence indicates this is the case[2]. Differences in severity of lupus nephritis by insurance status would also be an unlikely explanation, as all patients had nephritis that was severe enough to result in ESRD. Together, these findings suggest that private medical insurance is associated with a slower progression to ESRD among patients with lupus nephritis. This difference may be related to better access to care or better quality of care. Importantly, the age at onset of ESRD was similar between those with Medicaid and those without insurance, suggesting that the financial access afforded by Medicaid was not sufficient to

distinguish these patients from those without insurance or to match the postponement in age at ESRD observed for those with private insurance.

In previous studies, patients with private insurance were somewhat less likely than those with public insurance[2] or Medicare[13] to progress to ESRD, but the statistical power of these studies may not have been adequate to detect moderate differences in progression. Other studies considered type of insurance as a confounding variable of ethnic differences in prevalence of renal complications, rather than as a variable of interest[11]. Each was a single-center study of patients treated at academic medical centers, which may have reduced the heterogeneity of treatment received by patients with different types of insurance, and consequently reduced differences in outcomes. Our results represent the experience of patients treated in diverse locations and practice settings. In addition, the requirement in some studies that lupus nephritis be biopsy-proven may also have biased the spectrum of subjects, because insurance status may affect the likelihood that a biopsy was performed[13]. Level of formal education has been associated with the risk of ESRD in one study[12], but not in another[14].

The strengths of our study include the large, national, population-based sample, the use of stratification to control for ethnic differences in age of onset of lupus nephritis, and the consistency of results across ethnic groups. Rate of progression to ESRD might be considered the preferred endpoint. However, this endpoint would likely be affected by lead-time bias, with lupus nephritis detected at an earlier stage in patients with private insurance. Age at onset of ESRD would not be subject to lead-time bias. This study was limited in that we could not verify that patients met classification criteria for systemic lupus erythematosus, but all had ESRD attributed to lupus nephritis by their nephrologists. Data on the type of insurance was limited to that present at the onset of ESRD, which might have been different from the insurance patients had earlier in their disease. Since patients more often lose private insurance than gain private insurance as their illness progresses, patients classified as having no insurance or Medicaid might have had private insurance earlier in their course. Therefore, the age differences presented here may underestimate the difference in age of onset of ESRD between those who had private insurance, no insurance, or Medicaid throughout their course. Patient-level measures of SES were not available, but the area-based measure was validated in a companion sample of patients. Also, the number of patients in some ethnic groups was too small to be included in the analysis.

ESRD treatment carries large personal, social, and economic costs[15,19]. The substantial difference in mean age of onset of ESRD between those with and those without private insurance raises the question of whether the costs of insurance and associated treatments would be offset by cost-saving from the delay or prevention of ESRD.

REFERENCES

1. Grupo Italiano per lo Studio della Nefrite Lupica (GISNEL). Lupus nephritis: prognostic factors and probability of maintaining life-supporting renal function 10 years after the diagnosis. Am J Kidney Dis 1992;19:473-9.
2. Ward MM, Studenski S. Clinical prognostic factors in lupus nephritis. The importance of hypertension and smoking. Arch Intern Med 1992;152:2082-8.
3. Iseki K, Miyasato F, Oura T, Uehara H, Nihsime K, Fukiyama K. An epidemiological analysis of end-stage lupus nephritis. Am J Kidney Dis 1994;23:547-54.
4. Donadio JV Jr, Hart GM, Bergstralh EJ, Holley KE. Prognostic determinants in lupus nephritis: a long-term clinicopathological study. Lupus 1995;4:109-15.
5. Neumann K, Wallace DJ, Azen C, et al. Lupus in the 1980s: III. Influence of clinical variables, biopsy, and treatment on the outcome in 150 patients with lupus nephritis seen at a single center. Semin Arthritis Rheum 1995;25:47-55.
6. Huong DL, Papo T, Beaufils H, et al. Renal involvement in systemic lupus erythematosus. A study of 180 patients from a single center. Medicine (Baltimore) 1999;78:148-66.
7. Cervera R, Khamashta MA, Font J, et al. Morbidity and mortality in systemic lupus erythematosus during a 10-year period: a comparison of early and late manifestations in a cohort of 1,000 patients. Medicine (Baltimore) 2003;82:299-308.
8. Adler M, Chambers S, Edwards C, Neild G, Isenberg D. An assessment of renal failure in an SLE cohort with specific reference to ethnicity, over a 25-year period. Rheumatology Oxford 2006;45:1144-7.
9. Illei GG, Austin HA, Crane M, et al. Combination therapy with pulse cyclophosphamide plus pulse methylprednisolone improves long-term renal outcome without adding toxicity in patients with lupus nephritis. Ann Intern Med 2001;135:248-57.
10. Contreras G, Pardo V, Leclercq B, et al. Sequential therapies for proliferative lupus nephritis. N Engl J Med 2004;350:971-80.
11. Petri M, Perez-Guthann S, Longenecker JC, Hochberg M. Morbidity of systemic lupus erythematosus: role of race and socioeconomic status. Am J Med 1991;91:345-53.
12. Arce-Salinas CA, Villa AR, Martinez-Rueda JO, et al. Factors associated with chronic renal failure in 121 patients with diffuse proliferative lupus nephritis: a case-control study. Lupus 1995;4:197-203.
13. Barr RG, Seliger S, Appel GB, et al. Prognosis in proliferative lupus nephritis: the role of socio-economic status and race/ethnicity. Nephrol Dial Transplant 2003;18:2039-46.
14. Alarcon GS, McGwin G Jr, Petri M, et al. Time to renal disease and end-stage renal disease in PROFILE: A multiethnic lupus cohort. PLoS Med 2006;4:e396.
15. United States Renal Data System. USRDS 2005 annual data report: Atlas of end-stage renal disease in the United States. Bethesda, MD: National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases; 2005.
16. Patel M, Clarke AM, Bruce IN, Symmons DP. The prevalence and incidence of biopsy-proven lupus nephritis in the UK: evidence of an ethnic gradient. Arthritis Rheum 2006;54:2963-9.
17. Diez Roux AV, Kiefe CI, Jacobs DR Jr, et al. Area characteristics and individual-level socioeconomic position indicators in three population-based epidemiologic studies. Ann Epidemiol 2001;11:395-405.
18. Ward MM. Laboratory abnormalities at the onset of treatment of end-stage renal disease: Are there racial or socioeconomic disparities in care? Arch Intern Med 2007;167:1083-91.
19. Joyce AT, Iacoviello JM, Nag S, et al. End-stage renal disease-associated managed care costs among patients with and without diabetes. Diabetes Care 2004;27:2829-35.