Published in final edited form as:
J Rheumatol. 2008 May ; 35(5): 819–825.

Ethnic Disparities among Patients with Systemic Lupus Erythematosus in South Carolina

Erica Anderson, DO,
Medical University of South Carolina, Division of Rheumatology and Immunology, Charleston, South Carolina and Veterans Administration Medical Center, Charleston, South Carolina

Paul Nietert, PhD,
Medical University of South Carolina, Department of Biostatistics, Bioinformatics and Epidemiology

Diane Kamen, MD, and
Medical University of South Carolina, Division of Rheumatology and Immunology, Charleston, South Carolina

Gary Gilkeson, MD
Medical University of South Carolina, Division of Rheumatology and Immunology, Charleston, South Carolina and Veterans Administration Medical Center, Charleston, South Carolina

Abstract

Objective—To evaluate whether ethnic disparities in mortality exist among hospitalized SLE patients in South Carolina.

Methods—Administrative data was obtained on all SLE patients (ICD-9 code 710.0) hospitalized in South Carolina between 1996-2003. An SLE-specific comorbidity index, previously validated as a predictor of hospital mortality, was used as a measure of overall comorbidity (Ward, J Rheum 2000). Cox proportional hazards models were used to compare mortality rates between Caucasians and African-Americans. Post-hoc analyses focused on determining whether disparities were present across different risk strata.

Results—Of the 6,521 hospitalized SLE patients (5,728 female, 793 male), 1,280 (19.6%) died. Annual mortality rates were 21.9% among Caucasians and 25.0% among African-Americans. The comorbidity index score was significantly higher among African-Americans (median [interquartile range]: 2.0 [0.0 - 4.0]) versus Caucasians (0.0 [0.0 – 3.0], $p < 0.0001$, Wilcoxon rank sum test); however even after multivariate adjustment, African-Americans had a 15% increased mortality risk (hazard ratio [HR]: 1.15, 95% CI: 1.02 to 1.29, $p = 0.013$). The disparity was strongest among those with less comorbidity (HR: 1.39; 95% CI 1.05 to 1.81, $p = 0.017$). Among patients with low comorbidity index scores (n=3,485), the annual mortality rate was 8.1% among Caucasians and 9.7% among African-Americans. No ethnic differences in mortality were seen for patients with higher comorbidity.

Conclusions—In South Carolina, ethnic disparities in SLE mortality exist predominantly among those with the least illness severity. Future studies are planned to help clarify whether access and quality of care play a role.

Key Indexing Terms

systemic lupus; erytematosus; mortality; race; ethnicity; disparity

Requests for reprints: Erica Anderson, DO, Medical University of South Carolina, Division of Rheumatology and Immunology, 96 Jonathon Lucas, Suite 912, Charleston, SC 29425.

Introduction

Survival among patients with systemic lupus erythematosus (SLE) has progressively improved over the past several decades (1-6). Multiple factors are likely responsible for this improved prognosis including earlier detection, advances in therapies and more cautious monitoring for toxicity. However, this trend has not been consistent among all ethnic groups (3,8). Death due to SLE among African-American women between the ages of 45-64 has increased by nearly 70% from 1979-1998 in the United States (3).

SLE is a disease with striking ethnic disparities. African-Americans experience an increased incidence and increased morbidity and mortality related to SLE compared to Caucasians (1-11). Many factors likely contribute to this disparity including genetic differences, environmental exposures and socioeconomic factors. Unequal access to medical care and quality of care are also thought to play important roles in patient outcome. It has been shown that SLE patients cared for at hospitals with more experience in treating SLE patients have lower in-hospital mortality (12).

Mortality studies are often difficult to compare since they are composed of differing ethnic populations at various stages of disease. The population of South Carolina is approximately 30% African-American with very few other minority groups (13). In this study, we sought to assess whether ethnic disparities exist in mortality among hospitalized SLE patients in South Carolina and also to evaluate causes of death among SLE patients in our state.

Methods

Design

This study was a retrospective analysis of administrative hospitalization data in South Carolina. The South Carolina Office of Research and Statistics (ORS) routinely collects data on every hospital admission and emergency room visit in the state, excluding federal and military hospitals. All facilities are required to submit detailed data to ORS, including demographic information, dates and type of hospital admission and discharge, diagnostic and procedure codes, insurance status, and providers involved in patient care during the admission. ORS routinely generates edit reports on data submissions by each facility to ensure the highest possible level of completeness and accuracy. Hospitalization data is available to investigators for research purposes after approval from ORS. Personal identifiers are used to link multiple encounters across a number of statewide administrative databases for the same individual, and a unique identification number is assigned to each person. Vital statistic records were obtained from the South Carolina Department of Health and Environmental Control (DHEC) for SLE patients who died during the study period and linked to the hospitalization data by ORS using the unique patient identification numbers. All personal identifiers and protected health information were removed by ORS prior to release of the data to study investigators. The purpose of this study was to assess ethnic disparities in mortality among SLE patients in South Carolina by using inpatient hospitalization data linked with death certificate information.

Patient Selection

After the study was approved by the Medical University of South Carolina Institutional Review Board and the ORS data oversight committee, all patients with a diagnosis of SLE (ICD-9 code 710.0) in South Carolina between 1996 and 2003 were identified by ORS. This time frame was chosen based on availability of data. ORS then re-searched their databases for all hospital encounters by those patients. This approach was taken in order to capture hospital utilization among SLE patients for all causes, not just lupus-related events. For a given patient, the hospital

encounter became the unit observation. However, for patients with multiple hospital encounters during the study period, the most recent hospital encounter was selected for inclusion in our analysis. Patients residing outside of South Carolina were excluded, as vital statistics (i.e. follow-up mortality data) were not available from other states.

Data Collection/Study Variables

Demographic and socioeconomic data were obtained including age (in 5-year age groupings), gender, ethnicity, insurance type (private, public [including Medicaid, Medicare, etc.], and other [no insurance, self-pay, etc.]), and zip code-specific income and level of education. Ethnicity was recorded at each individual facility at the time of admission by self-report and was documented in > 99.8% of all hospital admissions in our dataset. Hospitalization characteristics included diagnosis-related group (DRG) codes, up to 10 ICD-9 diagnosis codes, medical versus surgical admission, length of stay, type of admission (transfer versus non-transfer, emergent versus elective), and teaching status of the hospital.

Income and education data were obtained from zip code-specific estimates from the 2000 U.S. Census Bureau records. For each hospitalization that occurred in the database, ORS linked the median household income and percentage of residents over age 25 with at least a high school education via the patient's zip code of residence.

Comorbid conditions coded during the hospital encounter were incorporated into an SLE-specific comorbidity index that was used as a measure of overall comorbidity. This index is a modification of the generic Charlson index and was developed as a measure of risk of in-hospital mortality. It is a weighted sum of common chronic medical conditions used to adjust for differences in illness severity among medical patients. The SLE-specific comorbidity index used in this study is a weighted sum of 14 comorbidities based on ICD-9 codes which has previously been validated (14). This index does not measure lupus severity; rather, it is an assessment of overall illness severity among hospitalized patients with SLE based on comorbidities. The comorbidities incorporated into the SLE-specific comorbidity index include heart failure, cerebrovascular disease, diabetes mellitus, myocardial infarction, peripheral vascular disease, pericarditis, pleuritis, nephritis, renal failure, AIDS, metastatic cancer, any malignancy, thrombocytopenia, and severe liver disease.

Statistical Analysis

Comparisons of demographic and clinical characteristics between Caucasians and African-American patients with SLE were performed using t-tests, chi-square tests, and Wilcoxon rank-sum tests, as appropriate. Patient and hospitalization characteristics were then used in a Cox proportional hazards model to compare study period survival rates between Caucasians and African-Americans with SLE. The model results were expressed as hazard ratios (HRs) and their 95% confidence intervals (CIs). The HR variance estimates were obtained using 1,000 bootstrap replications with bias correction. Bootstrapping is a technique used to estimate parameter variation by repeatedly sampling with replacement from the original study sample and calculating the parameter variation across these various samples (15), and the results are considered robust and not unduly swayed by outliers. The analysis was limited to African-Americans and Caucasians since the number of patients representing other ethnic groups was very low. *Post hoc* analyses focused on whether ethnic disparities were present across four different SLE-specific comorbidity index categories (category 1: index score = 0; category 2: index score = 1 to 2; category 3: index score = 3 to 5; category 4: index score > 5). These categories were chosen so as to ensure comparable numbers of study subjects in each category. All bivariate analyses were performed with SAS 9.1 (Cary, NC), while all Cox proportional hazards models were performed with Stata 9.1 (College Station, TX). For all variables included in the Cox models, the proportional hazards assumption was verified. For all statistical

comparisons, p-values < 0.05 were considered statistically significant. No statistical adjustment was made for the testing of multiple hypotheses.

Results

There were 6,521 unique SLE patients (3,288 Caucasian females, 2,440 African-American females, 454 Caucasian males, 339 African-American males) hospitalized in South Carolina from 1996 to 2003. Among these patients, 1,280 (19.6%) deaths occurred during the follow-up period. There were 102 hospitalized SLE patients from other ethnic minorities who were excluded from the analysis.

The demographic and clinical characteristics are summarized in Tables 1 and 2, respectively. African-American patients with SLE were significantly ($p < 0.0001$) more likely to be hospitalized at younger ages than Caucasian patients. Level of education and annual household income was significantly ($p < 0.0001$) lower among African-Americans compared to Caucasians, and Caucasians were also significantly ($p < 0.0001$) more likely to have private insurance.

A total of 1,280 (19.6%) patients died during the study period, of whom 744 (58.1%) died in the hospital. The crude (unadjusted) in-hospital death rate for hospitalized patients with SLE was significantly ($p < 0.001$) higher among African-Americans (12.9%) than among Caucasians (10.3%). The 1-year mortality rate defined as the percentage of patients who died within one year of the date of discharge was calculated, excluding patients discharged in the last year of the study (2003). The crude 1-year mortality rate was also significantly ($p < 0.05$) higher among African-Americans (25.3%) compared to Caucasians (22.5%).

There were a number of other striking significant differences between Caucasian and African-American hospitalized SLE patients. Compared to Caucasians, African-American patients experienced longer lengths of hospital stays, were more likely to have had a medical (rather than surgical) admission, were more likely to have been admitted to a teaching hospital, and were more likely to have had their admission classified as emergent ($p < 0.0001$). The average comorbidity index score was also significantly higher among African-Americans compared to Caucasians (mean ± s.d: 2.18 ± 2.70 versus 1.85 ± 2.83).

Of the hospitalized SLE patients who died during the study period, 715 (55.9%) were Caucasian and 565 (44.1%) were African-American. As seen in Table 3, African-Americans died at significantly ($p < 0.0001$) younger ages than Caucasians. For example, of the Caucasian patients who died, 13.5% were younger than 50 years old, compared to 43.5% of the African-American patients who died. Likewise, a large majority (62%) of Caucasians who died were above age 65, compared to only 23.9% of African-Americans who died above age 65.

The results of the multivariable Cox proportional hazards model are shown in Table 4. Compared with Caucasians, African-American patients had a significantly increased mortality hazard, even after adjusting for all other variables including indicators of illness severity during the study period (HR=1.15, CI=1.03-1.29, $p = 0.013$). Other characteristics associated with increased mortality included older age, public insurance, lower household income, less education, emergent admission, being transferred from another hospital, longer length of hospital stay, and higher SLE comorbidity index scores. Compared to other patients, patients with public insurance experienced a 56% increased mortality hazard ($p=0.011$). Patients with higher median annual household income experienced a significant decreased risk of death ($p < 0.001$); similarly, those with more education had a decreased chance of dying during the study period ($p=0.027$). The mortality hazard was increased by 44% among patients whose admission was classified as emergent compared to other patients ($p < 0.0001$), and the hazard was increased by 33% among patients who were transferred from another hospital ($p = 0.007$).

For each additional day in the hospital, the mortality hazard increased by 6% ($p < 0.0001$), and each additional 1-point increase in a patient's comorbidity index score corresponded to a 13% increased mortality hazard throughout the follow-up period ($p < 0.0001$). There was no significant mortality hazard difference by gender or by teaching status of the hospital.

As mentioned above, there were some interesting associations among race, SLE comorbidity index score, and mortality rates. The comorbidity index score was higher among African-American patients (2.18) compared to Caucasian patients (1.85) (Table 2), and each 1-point increase in a patient's comorbidity index score resulted in a 13% increased mortality hazard (Table 4). Additionally, the overall mortality hazard was increased by 15% among African-Americans compared to Caucasians (Table 4). These results led to *post hoc* analyses to consider whether the increased hazard among African-Americans was consistent across all comorbidity risk strata. Table 5 lists the 4 comorbidity risk strata and accompanying mortality data by race. The unadjusted 1-year crude mortality rates were higher among African-Americans in the lowest (African-Americans: 9.7% versus Caucasians: 8.3%) and highest (African-Americans: 59.2% versus Caucasians: 56.3%) comorbidity risk strata, but not in either of the middle comorbidity risk strata. After multivariable adjustment using the full study period follow-up mortality data, the Cox proportional hazards models demonstrated that only in the lowest comorbidity risk stratum was the mortality hazard significantly increased among African-Americans compared to Caucasians (HR = 1.39, 95% CI: 1.05 to 1.81, $p = 0.017$).

Further *post hoc* analyses led us to consider causes of death among SLE patients who died, and whether the causes of death differed significantly by race. The leading causes of death, as reported on death certificates, are listed in Table 6. Of all the African-American hospitalized SLE patients who died, 20.4% had SLE listed as the leading cause of death compared to 9.4% of Caucasians who died ($p < 0.0001$). When SLE was listed as the leading cause, SLE was replaced by the first contributing cause of death from the death certificate. Overall, cardiovascular disease was the leading cause of death, with ischemic heart disease representing 170 (36%) of all deaths. Malignancy was the second leading cause of death (13.4%), followed by infection (10.1%). Death due to cardiovascular disease was the leading cause of death across all age groups and increased with age among both race groups. While cause of death was similar among both race groups in patients 50 years and older, there were significant differences by race among those less than 50 years old. Among patients less than 50 years old, African-American patients were less likely to die of malignancy than Caucasians (7.3% of deaths versus 16.5%, $p = 0.007$) and more likely to die of infection (15.3% of deaths versus 6.2% of deaths, $p = 0.024$).

Discussion

This study of ethnic disparities in mortality among hospitalized SLE patients in South Carolina found that African-Americans with SLE experienced a greater chance of in-hospital and 1-year mortality following hospital discharge compared to Caucasians. African-Americans were hospitalized and also died at significantly younger ages than their Caucasian counterparts and the disparity was most pronounced among those with less overall comorbidity. African-Americans earned lower incomes, had less education and were more likely to have public insurance than Caucasian SLE patients emphasizing the important and complex role of socioeconomic factors in SLE mortality.

The SLE-specific comorbidity index used in this study was significantly higher among African-Americans showing that they had increased overall comorbidity and suggesting increased illness severity. Thus, it is not surprising that African-Americans were also more likely to have emergent admissions with longer hospitalization stays. However, after adjusting for all other variables, African-Americans had an increased risk of mortality, but this risk was not uniform

across the entire group. African-Americans with the least severe illness (comorbidity index score of zero) were significantly more likely to die than Caucasians with the same level of comorbidity. Among those with more severe illness (comorbidity index scores greater than 2), there was no significant difference, suggesting that African-American and Caucasian patients with higher levels of comorbidity have equal access to care, receive similar treatment and subsequently have similar clinical outcomes.

Ethnic disparities in SLE mortality have been documented for decades in the medical literature (4,7-11) and exist in other rheumatic diseases as well, such as systemic sclerosis (16,17). Nietert et al showed that among patients with systemic sclerosis hospitalized in South Carolina, in-hospital deaths among African-Americans (23.0%) were higher than among Caucasians (15.6%), a finding that remained after adjustment for other sociodemographic and clinical factors (odds ratio: 1.70, 95% confidence interval: 1.01-2.86) (17). In SLE, African-American women are particularly vulnerable to poorer outcomes. Similar to data from the CDC (3), Walsh et al (1995) showed diverging ethnic trends with African-American SLE patients experiencing increased mortality related to SLE compared to Caucasian SLE patients in the US (8).

Caution must be taken when comparing mortality studies due to cohort differences ranging from varied ethnic backgrounds and duration of disease but also due to differing study methods, time frame and years of follow-up. Thus, while direct comparisons are difficult, it appears that mortality among SLE patients in South Carolina is higher than that seen in other recently published large cohorts of SLE patients. For example, Krishnan (2006) recently reported on national mortality outcomes among hospitalized SLE patients regardless of cause of admission using similar methods to our study and found a low mortality rate of 3.1% (2454 deaths out of 76,961 hospitalized SLE patients) in the U.S. from 1998-2002, a time-frame similar to that of our study although the follow-up period was 2 years shorter (11). A national hospital database was used in this study and no information was provided on the racial background of subjects.

Bernatsky et al (2006) observed 1,255 deaths among a total of 9,547 (13.1%) patients with an average follow-up period of 8.1 years (5). This was an international cohort representing 23 centers across 7 countries. The authors report standardized mortality ratio (SMR) estimates consistently increased for SLE patients compared to the general population but some countries (Canada and England) had much higher SMR estimates compared to others (Sweden and South Korea) serving as an important reminder that genetic, demographic and socioeconomic factors play an important role in SLE mortality.

While survival for patients with SLE has improved over time, a shift in the causes of death among SLE patients has been widely reported (1-6). Our results are consistent with others showing cardiovascular disease as the leading cause of death among all age groups. Malignancy and infections were the second and third leading causes of death, respectively. The major difference in cause of death in our study was seen among the younger patients. African-Americans less than 50 years old were more likely to die of infection compared to Caucasians. African-American SLE patients have a higher frequency of lupus-specific comorbidities as shown in Table 2, particularly nephritis, that likely translates to a need for more aggressive therapy. Death related to infection among the younger African-American SLE patients may represent a complication of immunosuppressive therapy, inadequate monitoring and/or limited access to care while on immunosuppressant therapy. However, it is also possible that this finding is explained by complications related to non-SLE comobidities, such as diabetes mellitus.

Our study has multiple strengths including a large hospital population-based sample and the ability to link to multiple data sources, including vital statistics and U.S. Census Bureau

records. The population studied is not restricted to a tertiary academic center, which often implies a more severely ill patient population, but rather it is representative of SLE patients hospitalized across the entire state of South Carolina. While clinical data is limited in administrative databases, we were able to adjust for illness severity by using a previously validated comorbidity index specific for SLE. While this index does not measure lupus severity, it has been shown to predict in-hospital mortality (14) and allowed us to develop categories of mortality risk for comparison based on level of comorbidity.

There are limitations of using hospitalization administrative data for research purposes. As with all studies using administrative databases, our data relies heavily on ICD-9 coding practices. Some variables not directly associated with billing are likely under-reported. ORS documents the three leading provider specialty codes for any given admission so complete data on all specialists involved in a patients' care, specifically involvement of a rheumatologist, was missing from our dataset. In addition, coding errors at individual facilities may result in the inclusion of patients who do not have SLE if they were previously misclassified on a prior hospital encounter. For example, a non-rheumatology provider may assign ICD-9 code 710.0 to a patient with a positive ANA and arthralgias which would dilute the population of SLE patients. SLE is a disease with high rates of referral to specialists. A survey of 195 primary care providers in North and South Carolina showed that 93% routinely refer their SLE patients to a rheumatologist all or almost all of the time and only 7% reported that they did not refer SLE patients unless they were severely ill (18-19). Similarly, Felson et al showed that 72% of general practice physicians were likely to refer SLE patients to a rheumatologist with mild disease whereas 92% were likely to refer when other complications arose related to SLE (20). Despite the fact that the majority of SLE patients in our region are followed by a rheumatologist, misclassification during hospital admission likely still exists, and we are not able to validate statewide coding practices. Nevertheless, we do not believe that misclassification would have an impact on our study results since it would be unlikely for such mistakes to occur more frequently among one ethnic group than another. Additionally, other facility-specific factors, including experience in treating SLE patients, were also not evaluable given ORS-mandated data restrictions to ensure facilities' anonymity.

In summary, our results suggest that African-Americans with SLE experience increased mortality at younger ages which is most pronounced among those with the least severe illness. Mortality following hospitalization is a reflection of individual clinical characteristics and the effectiveness of a healthcare system including access and quality of care. Our data suggest that SLE patients with high comorbidity receive the same level of care and have a similar clinical response regardless of ethnicity. The disparity in younger women with less comorbidity and increased mortality due to infection and cardiovascular disease suggests that follow-up care is not equal to that of their Caucasian counterparts. This may reflect access to health care, noncompliance or possibly a lack of focus on treating the associated comorbidities in SLE, notably cardiovascular disease. Ongoing genetic and environmental studies may provide insight into these disparities, but will likely not provide all the answers. Future studies that focus on ensuring equal access to and quality of specialty care are needed to help clarify the cause of this disparity among patients with SLE.

Acknowledgements

Supported by Veterans Administration Research Enhancement Award Program (REAP) and grant # P60AR049459 from the National Institute of Arthritis and Musculoskeletal and Skin Diseases.

References

1. Trager J, Ward MM. Mortality and causes of death in systemic lupus erythematosus. Curr Opin Rheumatol 2001;13:345–351. [PubMed: 11604587]

2. Uramoto K, Michet C, Thumboo J, et al. Trends in the incidence and mortality of systemic lupus erythematosus, 1950-1992. Arthritis Rheum 1999;42:46–50. [PubMed: 9920013]
3. Center for Disease Control. Trends in deaths from systemic lupus erythematosus—United States, 1979-1998. cdc.gov
4. Borchers A, Keen C, Shoenfeld Y, et al. Surviving the butterfly and the wolf: mortality trends in systemic lupus erythematosus. Autoimmunity Reviews 2004;3:423–453. [PubMed: 15351310]
5. Bernatsky S, Boivin JF, Joseph L, et al. Mortality in Systemic Lupus Erythematosus. Arthritis Rheum 2006;54(8):2550–2557. [PubMed: 16868977]
6. Ward MM, Pyun E, Studenski S. Causes of death in systemic lupus erythematosus: Long-term follow-up of an inception cohort. Arthritis Rheum 1995;38:1492–1499. [PubMed: 7575699]
7. Petri M, Genovese M. Incidence of and risk factors for hospitalizations in systemic lupus erythematosus: a prospective study of the Hopkins Lupus Cohort. J Rheumatol 1992;19:1559–65. [PubMed: 1464868]
8. Walsh SJ, Algert C, Gregorio DI, et al. Divergent racial trends in mortality from systemic lupus erythematosus. J Rheumatol 1995;22:1663–1668. [PubMed: 8523342]
9. Alarcón GS, Roseman J, Bartolucci AA, et al. LUMINA Study Group. Systemic lupus erythematosus in three ethnic groups. II. Features predictive of disease activity early in its course. Arthritis Rheum 1998;41:1173–1180. [PubMed: 9663472]
10. Krishnan E, Hubert HB. Ethnicity and mortality from systemic lupus erythematosus in the US. Ann Rheum Dis 2006;65:1500–1505. [PubMed: 16627544]
11. Krishnan E. Hospitalization and mortality of patients with systemic lupus erythematosus. J Rheumatol 2006;33:1770–4. [PubMed: 16832848]
12. Ward MM. Association between physician volume and in-hospital mortality in patients with systemic lupus erythematosus. Arthritis Rheum 2005;6:1646–1654. [PubMed: 15934091]
13. United States Census Bureau. at www.census.gov
14. Ward MM. Development and testing of a systemic lupus-specific risk adjustment index for in-hospital mortality. J Rheumatol 2000;27:1408–13. [PubMed: 10852262]
15. Efron, B.; Tibshirani, RJ. An Introduction to the Bootstrap. Boca Raton, FL: CRC Press, LLC; 2003.
16. Nietert PJ, Silverstein MD, Silver RM. Hospital admissions, length of stay, charges, and in-hospital death among patients with systemic sclerosis. J Rheumatol 2001;28:2031–2037. [PubMed: 11550971]
17. Nietert PJ, Silver RM, Mitchell HC, Shaftman SR, Tilley BC. Demographic and clinical factors associated with in-hospital death among patients with systemic sclerosis. J Rheumatol 2005;32(10): 1888–1922. [PubMed: 16206342]
18. Cooper, GS. Unpublished observation.
19. Cooper GS, Dooley MA, Treadwell EL, et al. Hormonal and Reproductive Risk Factors for Development of Systemic Lupus Erythematosus: Results of a Population-Based, Case-Control Study. Arthritis Rheum 2002;46(7):1830–1839. [PubMed: 12124867]
20. Felson DT, Meenan R, Dayno SJ, et al. Referral of musculoskeletal disease patients by family and general practitioners. Arthritis Rheum 1985;28:1156–62. [PubMed: 4052127]

Table 1

Demographic characteristics by race.

Characteristic	Caucasian n = 3,742	African-American n = 2,779	Total n = 6,521
Female (%)	87.9	87.8	87.8
Age (years)*			
0-34 (%)	14.2	24.6	18.6
35-49 (%)	25.8	38.1	31.0
50-64 (%)	29.4	24.6	27.4
65+ (%)	30.6	12.7	23.0
Education (%)†*	56.5	55.1	55.9
Annual household income‡* (median, interquartile range)	$36,394 ($31,819 to $42,966)	$32,030 ($27,356 to $37,436)	$34,860 ($29,913 to $40,590)
Insurance*			
Private (%)	40.0	31.9	36.5
Public (%)	55.0	61.0	58.0
Other (%)	5.0	7.1	5.5

† Patients' level of education was defined by the percent with at least a high school education among adults over 25 years old in their zip code of residence (2000 U.S. Census).

‡ Patients' household income was defined by the median household income in their zip code of residence (2000 U.S. Census).

* $p < 0.0001$ comparing Caucasians to African-Americans by t-tests, chi-square tests, or Wilcoxon rank sum tests, as appropriate.

Table 2

Clinical characteristics by race

Characteristic	Caucasian n = 3,742	African-American n = 2,779	Total n = 6,521
In-hospital death (%)**	10.3	12.9	11.4
1-year mortality (%)*	22.5	25.3	23.7
Length of stay (in days):***	3.0	4.0	4.0
median (interquartile range)	(2.0 to 6.0)	(2.0 to 7.0)	(2.0 to 7.0)
Diagnosis-related group classification:***			
Medical (%)	66.8	71.9	69.0
Surgical (%)	33.2	28.1	31.0
Teaching hospital (%)***	40.3	46.8	43.1
Admission classified as emergent (%)***	43.5	52.4	47.3
Transferred from another hospital (%)	4.3	5.2	4.7
Comorbidity index score: mean (std. dev.) ***	1.85 (2.83)	2.18 (2.70)	1.99 (2.78)
Heart failure (%)	11.0	9.6	
Cerebrovascular disease (%)	5.9	6.3	
Diabetes mellitus (%) **	10.7	13.4	
Myocardial infaction (%) ***	6.6	4.0	
Perivascular disease (%)	3.3	2.6	
Renal failure (%) ***	4.5	14.2	
AIDS (%) *	0	0.3	
Metastatic cancer (%)	2.0	1.5	
Any malignancy (%) **	4.8	3.0	
Severe liver disease (%)	2.2	1.8	
Pericarditis (%) ***	0.6	1.9	
Pleuritis (%)	2.7	3.4	
Nephritis (%) ***	6.2	15.5	
Thrombocytopenia (%) ***	4.0	6.1	

* $p < 0.05$ comparing Caucasians to African-Americans by t-tests, chi-square tests, or Wilcoxon rank sum tests, as appropriate.

** $p < 0.001$ comparing Caucasians to African-Americans by t-tests, chi-square tests, or Wilcoxon rank sum tests, as appropriate.

*** $p < 0.0001$ comparing Caucasians to African-Americans by t-tests, chi-square tests, or Wilcoxon rank sum tests, as appropriate.

Table 3

Age at death by race

Age	Caucasian (n=715)	African-American (n=565)	Total (n=1,280)
<34	25 (3.5%)	99 (17.5%)	124 (9.7%)
35-49	72 (10.0%)	179 (25.0%)	251 (19.6%)
50-64	175 (24.5%)	152 (26.9%)	327 (25.5%)
>65	443 (62.0%)	135 (23.9%)	578 (45.2%)
Total	715 (100.0%)	565 (100.0%)	1,280 (100.0%)

Table 4

Results from the Cox proportional hazards model. All hazard ratios (HR) were based on a Cox proportional hazards model that adjusted for all the listed patient and hospitalization characteristics.

	Adjusted HR	95% Confidence Interval	p-value
Race			
Caucasian	1.00	-	-
African-American	1.15	1.03-1.29	0.013
Age	1.12*	1.10-1.14	<0.0001
Gender			
Female	1.00	-	-
Male	1.13	0.98-1.31	0.0914
Insurance			
Public	1.56	1.14-2.29	0.011
Private	1.01	0.72-1.43	0.947
Other	1.00	-	-
Income	0.88	0.83-0.94	<0.001
Education	0.39	0.17-0.90	0.027
Admission classified as emergent			
No	1.00	-	-
Yes	1.44	1.28-1.62	<0.0001
Transferred from another hospital			
No	1.00	-	-
Yes	1.33	1.08-1.64	0.007
Length of stay	1.06	1.01-1.02	<0.0001
Teaching hospital			
No	1.00	-	-
Yes	1.03	0.92-1.16	0.610
Comorbidity index	1.13	1.11-1.15	<0.0001

* The hazard ratio for age represents the increased hazard of dying at any given point in time associated with a 5 year increase in age.

Table 5

Associations between SLE mortality risk index, race, and mortality.

Comorbidity Index	N	1-year crude mortality rate (Caucasian)	1-year crude mortality rate (African-American)	Multi-year hazard ratio* (95% CI) comparing African-Americans to Caucasians
0	3,489	8.3%	9.7%	1.39† (1.05 to 1.81)
2	1,380	32.1%	27.9%	0.95 (0.75 to 1.21)
3-5	940	42.5%	42.4%	1.11 (0.87 to 1.37)
>5	812	56.3%	59.2%	0.98 (0.78 to 1.20)

*Adjusted for age, gender, income, education, and hospitalization characteristics in stratified (by comorbidity index score category) multivariable Cox proportional hazards models.

†p-value = 0.017

Table 6

Causes of death among the 1,280 hospitalized SLE patients in South Carolina from 1996-2003.

Cause	N (%)
Cardiovascular disease	464 (36.3)
Ischemic heart disease	170
Cerebrovascular disease	77
Hypertension	44
Congestive heart failure	34
Nonischemic cardiomyopathy	24
Pulmonary heart disease	20
Arterial disease	19
Valvular heart disease	11
Other cardiac causes	65
Malignancy	171 (13.4)
Infection	129 (10.1)
Respiratory disease	92 (7.2)
Digestive disease	79 (6.2)
Endocrine/metabolic disease	73 (5.7)
Musculoskeletal disease (non-SLE causes)	70 (5.5)
Genitourinary disease	53 (4.1)
External causes of mortality	33 (2.6)
Nervous system disease	27 (2.1)
Hematologic (nonmalignant) disease	27 (2.1)
Skin/subcutaneous disease	25 (1.9)
Mental/behavioral disease	19 (1.5)
Injury/poisoning	10 (0.8)
Abnormal clinical/lab finding	5 (0.3)
Congenital malformations	3 (0.2)
Total	1,280