

# Hospital Experience and Mortality in Patients with Systemic Lupus Erythematosus: Which Patients Benefit Most from Treatment at Highly Experienced Hospitals?

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**ABSTRACT. Objective.** To determine if hospitalization at a hospital experienced in the treatment of systemic lupus erythematosus (SLE), compared to hospitalization at a less experienced hospital, is associated with decreased in-hospital mortality in all subsets of patients with SLE, or if the decrease in mortality is greater for patients with particular demographic characteristics, manifestations of SLE, or reasons for hospitalization.

**Methods.** Data on in-hospital mortality were available for 9989 patients with SLE hospitalized in acute care hospitals in California from 1991 to 1994. Differences in in-hospital mortality between patients hospitalized at highly experienced hospitals (those hospitals with more than 50 urgent or emergent hospitalizations of patients with SLE per year) and those hospitalized at less experienced hospitals were compared in patient subgroups defined by age, sex, ethnicity, type of medical insurance, the presence of common SLE manifestations, and each of the 10 most common principal reasons for hospitalization.

**Results.** In univariate analyses, in-hospital mortality was lower among those hospitalized at a highly experienced hospital for women, blacks, and Hispanics, and those with public medical insurance or no insurance. The risk of in-hospital mortality was similar between highly experienced and less experienced hospitals for men, whites, and those with private insurance. Patients with nephritis also had lower risks of in-hospital mortality if they were hospitalized at highly experienced hospitals, but this risk did not differ in subgroups with other SLE manifestations or subgroups with different principal reasons for hospitalization. In multivariate analyses, only the interaction between medical insurance and hospitalization at a highly experienced hospital was significant. Results were similar in the subgroup of patients with an emergency hospitalization ( $n = 2372$ ), but more consistent benefits of hospitalization at a highly experienced hospital were found across subgroups of patients with an emergency hospitalization due to SLE ( $n = 405$ ).

**Conclusion.** Risks of in-hospital mortality for patients with SLE were similar between highly experienced hospitals and less experienced hospitals for patients with private medical insurance, but patients without private insurance had much lower risks of mortality if hospitalized at highly experienced hospitals. The benefit of hospitalization at highly experienced hospitals was more consistent across subgroups of patients with a hospitalization due to SLE, suggesting that differences specifically in the treatment of SLE, rather than differences in the general quality of medical care, account for the lower mortality among patients with SLE hospitalized at highly experienced hospitals. (J Rheumatol 2002;29:1198–206)

## Key Indexing Terms:

SYSTEMIC LUPUS ERYTHEMATOSUS  
HOSPITALIZATION

MORTALITY  
MEDICAL INSURANCE

For many surgical procedures and medical conditions, the health outcomes of patients are better when treatment is provided at hospitals that have greater experience treating patients with similar conditions<sup>1,2</sup>. I have reported that patients with systemic lupus erythematosus (SLE) who were

hospitalized at hospitals that admitted large numbers of patients with SLE had lower risks of in-hospital mortality than patients admitted to less experienced hospitals<sup>3</sup>. However, it is unclear if this survival benefit extends similarly to all types of patients with SLE, or if there are subgroups of patients with particular characteristics for which the risk of mortality differs greatly between highly experienced and less experienced hospitals, and other subgroups for which the mortality risks are similar between types of hospitals. If the benefit of treatment at highly experienced hospitals varies among patients with different characteristics or reasons for admission, this information may be useful in identifying the processes of care that are associated

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with differences in in-hospital mortality. Understanding how medical care differs between highly experienced and less experienced hospitals is needed to provide insight into ways to improve the care and outcomes of patients hospitalized at less experienced hospitals.

I determined if the decrease in in-hospital mortality associated with hospitalization at highly experienced hospitals differed among patients by their demographic characteristics, manifestations of SLE, or primary reason for hospitalization. Because the relative decrease in mortality in the previous study was larger for patients who were admitted for SLE than for those admitted for other reasons<sup>3</sup>, the benefit associated with hospitalization at highly experienced hospitals was hypothesized to be greater for subgroups of patients with more serious manifestations of SLE.

## MATERIALS AND METHODS

**Source of data.** The data used in this study were those used in the previous study of the association between hospital experience and mortality in patients with SLE<sup>3</sup>. Briefly, patients were identified through a search of data tapes compiled by the California Office of Statewide Health Planning and Development (OSHPD). All acute care, non-federal hospitals are mandated to provide this agency with discharge abstracts on each hospitalized patient. The discharge abstract included information on demographic characteristics, the principal diagnosis, defined as the condition chiefly responsible for the hospitalization, up to 24 additional diagnoses, major procedures, type of admission (elective, urgent, emergency, childbirth, or unknown), length of stay, total charges, and disposition. Diagnosis and procedure codes are those of the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM)<sup>4</sup>. Data were abstracted on all urgent or emergency hospitalizations of patients with SLE (identified by having ICD-9-CM code 710.0 as any one of their discharge diagnoses) age 18 or older for years 1991 to 1994. Of the 22,908 hospitalizations, I excluded 801 hospitalizations that resulted from an interhospital transfer and 894 hospitalizations for which the patient identifier was missing. Of the remaining 21,213 hospitalizations in 9989 patients, I included all hospitalizations of the 5904 patients who had only one hospitalization during this time, and included one hospitalization, chosen randomly, for each of the 4085 patients who had more than one hospitalization during these years. The final sample included 9989 patients, each with one hospitalization.

**Study variables.** As in the previous study<sup>3</sup>, hospitals were considered highly experienced if they admitted an average of > 50 patients with SLE on an urgent or emergency basis each year. Hospitals that admitted ≤ 50 patients were categorized as less experienced. Variables in the following categories were examined as factors that might alter the patient's risk of in-hospital mortality: demographic characteristics, manifestations of SLE, and reasons for hospitalization. The demographic characteristics were age (stratified at the median of 48 years), sex, race (white, black, Hispanic, Asian, Native American, other, and unknown), and medical insurance status (private insurance, Medicare, public insurance other than Medicare, and no insurance). The manifestations of SLE that were studied were both common and serious, and were recorded as present if they were included as any of the 25 discharge diagnoses. These manifestations included nephritis (ICD-9-CM codes 580.0–584.9), chronic renal failure (codes 585, 586), autoimmune hemolytic anemia (codes 283.0, 283.9), thrombocytopenia (codes 284.8, 284.9, 287.3, 287.4, 287.5), pericarditis (codes 420.9, 423.9), pleuritis (codes 511.0, 511.8, 511.9, 786.52), seizures (codes 345, 780.3), and psychosis (codes 293–298).

Risks of mortality were also examined among patients with different principal reasons for hospitalization, by examining subgroups of patients who had one of the 10 most common principal discharge diagnoses other

than SLE. These diagnoses were: dehydration (ICD-9-CM code 276.5), acute myocardial infarction (code 410), unstable angina (code 411), arrhythmia (code 427), congestive heart failure (code 428), cerebrovascular accident (code 434), sepsis (code 038), bacterial pneumonia (codes 481–482), pneumonia cause unspecified (code 486), and chest pain not otherwise specified (code 786).

Costs of hospitalization were computed by multiplying the charges of each hospitalization by the cost:charge ratio at the corresponding hospital, as provided by the hospitals to OSHPD. Costs were adjusted to 1994 dollars using the Consumer Price Index for medical care, and were adjusted for regional differences using the Health Care Financing Administration Hospital Wage Index<sup>3</sup>.

**Statistical analysis.** Within patient subgroups, the likelihood of in-hospital mortality was related to hospital experience using logistic regression analysis. Generalized estimating equations were used to adjust the standard errors of the regression coefficients for the between-patient correlations that arise due to clustering of patients treated at the same hospital<sup>5,6</sup>. For those patient subgroups for which there was a significant difference in in-hospital mortality between the highly experienced and less experienced hospitals, multivariate logistic regression analyses were performed that included an interaction term between the demographic or clinical variable and hospital experience. Covariates in these models included age, sex, ethnicity (white versus non-white), medical insurance (private versus other), and for models testing interactions of demographic characteristics or principal diagnoses other than SLE, an SLE-specific measure of comorbidity<sup>7</sup>. For models testing interactions between SLE manifestations and hospital experience, the comorbidity measure was not included because the comorbidity measure was, in part, made up of the SLE manifestations. These analyses were performed for the entire cohort (n = 9989), the subgroup with an emergency hospitalization (n = 2372), and the subgroup with an emergency hospitalization in which SLE was the principal discharge diagnosis (n = 405).

Mortality differences between patients treated at highly experienced and less experienced hospitals were hypothesized to be greatest for the subgroups of patients who had more serious SLE manifestations, including nephritis, chronic renal failure, thrombocytopenia, and seizures. In contrast, no differences were hypothesized for subgroups with principal diagnoses other than SLE. If the risks of in-hospital mortality were lower for patients hospitalized at highly experienced hospitals among those with principal diagnoses other than SLE, this finding would support the conclusion that the mortality differences between types of hospitals were due to differences in the quality of general medical care between types of hospitals, rather than differences in SLE treatment.

## RESULTS

The 9989 patients had a median age of 48 years, 8679 (87%) were women, 5690 (57%) were white, and 3985 (39.9%) had private medical insurance, 1870 (18.7%) had public insurance other than Medicare, 3691 (37%) had Medicare and 443 (4.4%) had no medical insurance. Nephritis (n = 1848, 18.5%) was the SLE manifestation most commonly recorded among these hospitalized patients. Overall, 1665 patients (16.7%) were hospitalized at highly experienced hospitals, and 63 (3.8%) of these patients died. Of the 8324 patients hospitalized at less experienced hospitals, 444 (5.3%) died (p = 0.009 for mortality difference between highly experienced and less experienced hospitals)<sup>3</sup>.

**Entire cohort.** In univariate analyses, in-hospital mortality was lower for those hospitalized at highly experienced hospitals for women, blacks, Hispanics, those with public insurance other than Medicare, those with no medical insur-

ance, and those with nephritis (Table 1). In contrast, the risk of in-hospital mortality between highly experienced and less experienced hospitals did not differ by age group, or for men, whites, those with private medical insurance or Medicare, or those with manifestations of SLE other than nephritis. Mortality risks also did not differ among subgroups of patients with different principal reasons for hospitalization.

In multivariate analyses, there was no significant interaction between sex and hospital experience, indicating that the risk of in-hospital mortality associated with hospitalization at a highly experienced hospital did not differ between women and men (Table 2). However, there were significant interactions between both ethnicity and medical insurance status and hospital experience. Non-whites hospitalized at highly experienced hospitals had lower risks of mortality than whites hospitalized at less experienced hospitals, but

the presence or absence of private medical insurance had a greater interaction effect than did ethnicity. Compared to patients with private medical insurance hospitalized at a less experienced hospital, the risk of in-hospital mortality was higher for those without private insurance hospitalized at a less experienced hospital (odds ratio 1.44), no different for those with private insurance hospitalized at a highly experienced hospital (OR 1.18), and significantly lower for those without private insurance hospitalized at a highly experienced hospital (OR 0.44). When interactions between ethnicity and hospital experience, and between insurance status and hospital experience, were included in the same model, the interaction between ethnicity and hospital experience was no longer statistically significant ( $p = 0.10$ ), while the magnitude of the interaction between public medical insurance and hospital experience was essentially unchanged (OR 0.48; 95% CI 0.26, 0.87;  $p = 0.02$ ).

*Table 1.* Univariate analyses of in-hospital mortality among all patients, by demographic characteristic, selected manifestations of SLE, and the most common principal discharge diagnoses. Data in parentheses are percentages.

	Less Experienced Hospitals	Highly Experienced Hospitals	Crude OR	95% CI	p
<b>Demographic characteristic</b>					
Age ≤ 48	149/4054 (3.7)	32/1113 (2.9)	0.77	0.52, 1.15	0.20
Age > 48	295/4270 (6.9)	31/552 (5.6)	0.80	0.54, 1.18	0.26
Women	370/7233 (5.1)	50/1446 (3.5)	0.66	0.49, 0.90	0.008
Men	74/1091 (6.8)	13/219 (5.9)	0.87	0.47, 1.60	0.65
White	261/5033 (5.2)	34/657 (5.2)	1.00	0.69, 1.44	0.99
Black	57/1353 (4.2)	8/414 (1.9)	0.45	0.21, 0.95	0.04
Hispanic	75/1317 (5.7)	12/402 (3.0)	0.51	0.27, 0.95	0.04
Asian	43/509 (8.5)	7/152 (4.6)	0.52	0.23, 1.19	0.13
Native American	2/26 (7.7)	0/1 (0)	NE	—	—
Other ethnicity	5/62 (8.1)	2/24 (8.3)	1.04	0.18, 5.75	0.97
Private insurance	125/3410 (3.7)	27/575 (4.7)	1.29	0.84, 1.99	0.24
Public insurance	73/1391 (5.3)	10/479 (2.1)	0.39	0.19, 0.76	0.006
Medicare	225/3199 (7.0)	25/492 (5.1)	0.71	0.46, 1.09	0.11
No insurance	21/324 (6.5)	1/119 (0.8)	0.12	0.01, 0.92	0.05
<b>SLE manifestations</b>					
Nephritis	156/1476 (10.6)	22/372 (5.9)	0.53	0.33, 0.85	0.008
Thrombocytopenia	84/591 (14.2)	14/108 (13.0)	0.90	0.49, 1.65	0.74
Chronic renal failure	54/477 (11.3)	13/143 (9.1)	0.78	0.41, 1.49	0.46
Pleuritis	49/486 (10.1)	11/124 (8.9)	0.87	0.43, 1.73	0.69
Seizures	46/462 (10.0)	9/87 (10.3)	1.04	0.49, 2.22	0.92
Psychosis	14/396 (3.5)	4/91 (4.4)	1.26	0.40, 3.91	0.70
Pericarditis	16/192 (8.3)	4/51 (7.8)	0.94	0.29, 2.94	0.91
Hemolytic anemia	10/95 (10.5)	4/19 (21.0)	2.27	0.62, 8.18	0.22
<b>Principal diagnosis</b>					
Pneumonia, unspecified	14/302 (4.6)	4/40 (10.0)	2.29	0.71, 7.33	0.17
Congestive heart failure	11/259 (4.3)	3/36 (8.3)	2.05	0.54, 7.73	0.29
Chest pain, unspecified	0/219 (0)	0/29 (0)	NE	—	—
Sepsis	48/217 (22.1)	6/31 (19.4)	0.85	0.32, 2.18	0.73
Bacterial pneumonia	24/173 (13.9)	2/19 (10.5)	0.73	0.15, 3.37	0.69
Arrhythmia	8/162 (4.9)	0/21 (0)	NE	—	—
Myocardial infarction	25/164 (15.2)	2/10 (20.0)	1.39	0.27, 6.94	0.69
Angina	0/148 (0)	0/15 (0)	NE	—	—
Dehydration	5/142 (3.5)	1/16 (6.3)	1.83	0.20, 16.69	0.60
Cerebrovascular accident	11/135 (8.2)	2/22 (9.1)	1.13	0.23, 5.47	0.89

NE: not estimable.

Table 2. Risks of in-hospital mortality in subgroups of all patients (n = 9989) defined by interactions of hospital type (highly experienced versus less experienced) and either sex, ethnicity, insurance type, or presence of nephritis.

Subgroup	Adjusted OR	95% CI	p
Less experienced hospital, men	1.00 (reference)*	—	—
Less experienced hospital, women	0.97	0.73, 1.28	0.83
Highly experienced hospital, men	1.05	0.55, 2.00	0.89
Highly experienced hospital, women	0.61	0.29, 1.26	0.19
Less experienced hospital, white	1.00 (reference)*	—	—
Less experienced hospital, nonwhite	1.10	0.88, 1.37	0.40
Highly experienced hospital, white	0.95	0.64, 1.41	0.80
Highly experienced hospital, nonwhite	0.55	0.31, 0.97	0.04
Less experienced hospital, private insurance	1.00 (reference)*	—	—
Less experienced hospital, no private insurance	1.44	1.14, 1.82	0.002
Highly experienced hospital, private insurance	1.18	0.75, 1.86	0.48
Highly experienced hospital, no private insurance	0.44	0.24, 0.80	0.007
Less experienced hospital, no nephritis	1.00 (reference) <sup>†</sup>	—	—
Less experienced hospital, nephritis	3.43	2.76, 4.27	< 0.0001
Highly experienced hospital, no nephritis	0.87	0.62, 1.23	0.44
Highly experienced hospital, nephritis	0.69	0.39, 1.23	0.21

\* Model adjusted for age, sex, ethnicity, and SLE-specific measure of comorbidity. <sup>†</sup>Model adjusted for age, sex, and ethnicity.

Although the risk of in-hospital mortality among patients with nephritis was significantly increased among those at less experienced hospitals and decreased among those at highly experienced hospitals, the interaction was not statistically significant in multivariate analyses (Table 2). Because of the suggested benefit in patients with nephritis, interactions between a principal diagnosis of acute renal failure or any diagnosis of chronic renal failure and hospital experience were also explored in multivariate analyses. Neither interaction was significant ( $p = 0.89$  for acute renal failure;  $p = 0.19$  for chronic renal failure).

*Patients with emergency hospitalizations.* In the subset of patients with an emergency hospitalization (n = 2372), in-hospital mortality was lower among those hospitalized at highly experienced hospitals in all demographic subgroups except those with private medical insurance, among whom the mortality risks were similar between types of hospitals (Table 3). However, mortality differences were somewhat greater among younger patients and non-whites than among older patients and whites. Patients with nephritis or thrombocytopenia also had lower risks of in-hospital mortality if hospitalized at highly experienced hospitals, but mortality risks did not differ for those with other SLE manifestations or with different principal diagnoses.

In multivariate analyses in this subgroup, there were significant interactions between ethnicity and hospital experience and between medical insurance and hospital experience (Table 4). When both interactions between ethnicity and insurance status and hospital experience were included in the same model, the interaction between ethnicity and hospital experience was no longer significant ( $p = 0.11$ ),

while the magnitude of the interaction between public medical insurance and hospital experience was essentially unchanged (OR 0.31; 95% CI 0.12, 0.75;  $p = 0.009$ ). There were no significant interactions between hospital type and patient age or sex.

As in the parent cohort, the risk of mortality was markedly increased among patients with nephritis who were hospitalized at less experienced hospitals and decreased among those with nephritis who were hospitalized at highly experienced hospitals, but the interaction was not statistically significant ( $p = 0.12$ ; Table 4). Results for the interaction of hospital type and thrombocytopenia were similar.

*Patients with emergency hospitalizations due to SLE.* Among patients with an emergency hospitalization due to SLE (n = 405), lower in-hospital mortality was experienced by patients hospitalized at highly experienced hospitals in general, regardless of demographic or clinical characteristics (Table 5). However, small numbers in some subgroups limited the power of these analyses to detect statistically significant differences between groups. One notable exception was the comparable risk of mortality among patients with private medical insurance hospitalized at highly experienced and less experienced hospitals, and the markedly lower risks of in-hospital mortality among patients with public insurance, Medicare, or no medical insurance who were hospitalized at highly experienced hospitals. Multivariate models that formally tested interactions between demographic and clinical characteristics and hospital experience could not be reliably estimated due to the small number of patients in these subsamples.

*Lengths of stay and costs.* To determine if the difference in

Table 3. Univariate analyses of in-hospital mortality among all patients with an emergency hospitalization, by demographic characteristic, selected manifestations of SLE, and the most common principal discharge diagnoses. Data in parentheses are percentages.

	Less Experienced Hospitals	Highly Experienced Hospitals	Crude OR	95% CI	P
<b>Demographic characteristic</b>					
Age ≤ 48	71/760 (9.3)	14/494 (2.8)	0.28	0.15, 0.51	< 0.0001
Age > 48	118/914 (12.9)	15/204 (7.4)	0.54	0.30, 0.94	0.03
Women	157/1415 (11.1)	24/596 (4.0)	0.34	0.21, 0.53	< 0.0001
Men	32/259 (12.4)	5/102 (4.9)	0.37	0.13, 0.97	0.05
White	100/1010 (9.9)	14/251 (5.6)	0.54	0.30, 0.96	0.04
Black	26/291 (8.9)	4/182 (2.2)	0.23	0.07, 0.67	0.007
Hispanic	36/252 (14.3)	7/198 (3.5)	0.22	0.09, 0.51	0.0004
Asian	20/96 (20.8)	2/47 (4.3)	0.17	0.03, 0.76	0.02
Native American	0	0	—	—	—
Other ethnicity	4/12 (33.3)	2/11 (18.2)	0.44	0.06, 3.12	0.42
Private insurance	55/583 (9.4)	14/179 (7.8)	0.82	0.44, 1.51	0.52
Public insurance	27/311 (8.7)	4/262 (1.5)	0.16	0.05, 0.48	0.0008
Medicare	97/681 (14.2)	11/187 (5.9)	0.37	0.19, 0.72	0.003
No insurance	10/99 (10.1)	0/70 (0)	NE	—	—
<b>SLE Manifestations</b>					
Nephritis	69/314 (22.0)	9/165 (5.5)	0.21	0.09, 0.43	< 0.0001
Thrombocytopenia	40/143 (28.0)	5/48 (10.4)	0.30	0.11, 0.81	0.02
Chronic renal failure	24/100 (24.0)	9/64 (14.1)	0.52	0.22, 1.21	0.13
Pleuritis	18/131 (13.7)	5/50 (10.0)	0.70	0.24, 2.00	0.51
Seizures	21/123 (17.1)	5/47 (10.6)	0.58	0.20, 1.64	0.31
Psychosis	5/95 (5.3)	2/55 (3.6)	0.68	0.12, 3.63	0.66
Pericarditis	5/50 (10.0)	2/19 (10.5)	1.06	0.18, 5.99	0.95
Hemolytic anemia	4/19 (21.1)	1/3 (33.3)	1.88	0.13, 26.32	0.65
<b>Principal diagnosis</b>					
Pneumonia, unspecified	4/52 (7.7)	2/16 (12.5)	1.71	0.28, 10.36	0.56
Congestive heart failure	4/70 (5.7)	2/20 (10.0)	1.83	0.31, 10.82	0.51
Chest pain, unspecified	0/66 (0)	0/13 (0)	NE	—	—
Sepsis	25/69 (36.2)	4/10 (40.0)	1.17	0.30, 4.56	0.82
Bacterial pneumonia	10/43 (23.3)	2/9 (22.2)	0.94	0.16, 5.29	0.95
Arrhythmia	5/47 (10.6)	0/8 (0)	NE	—	—
Myocardial infarction	15/92 (16.3)	1/7 (14.3)	0.86	0.09, 7.63	0.89
Angina	0/45 (0)	0/8 (0)	NE	—	—
Dehydration	1/17 (5.9)	1/3 (33.3)	8.00	0.34, 184.36	0.20
Cerebrovascular accident	5/33 (15.2)	0/9 (0)	NE	—	—

NE: not estimable.

mortality among patients without private insurance who were hospitalized at highly experienced and less experienced hospitals was associated with differences in the amount of health care resources used, lengths of stay and costs per hospital day were compared between patients at highly experienced and less experienced hospitals, in groups stratified by medical insurance status (Table 6). Among all patients, lengths of stay were slightly longer for patients with private insurance at highly experienced hospitals, but were similar for those without private insurance. Among patients with an emergency hospitalization or those with an emergency hospitalization due to SLE, there were no differences in lengths of stay between highly experienced and less experienced hospitals in either insurance subgroup. Among all patients, the median costs per hospital day were lower for patients without private insurance at less experienced hospitals (\$872 US) than for patients without private insurance at

highly experienced hospitals (\$981), but costs were also lower at the less experienced hospitals for patients with private insurance. Among patients with an emergency hospitalization and those with an emergency hospitalization due to SLE, costs per hospital day were similar between the highly experienced and the less experienced hospital among patients without private insurance. These results suggest that differences in the amount of resources used by highly experienced and less experienced hospitals to treat patients without private insurance do not account for the mortality difference observed in this patient subgroup.

## DISCUSSION

The results of this study indicate that for some subgroups of patients, hospitalization at a highly experienced hospital greatly influenced the risk of in-hospital mortality, while for other subgroups, mortality risks did not differ between

Table 4. Risks of in-hospital mortality in subgroups of patients with an emergency hospitalization (n = 2372) defined by interactions of hospital type (highly experienced versus less experienced) and either age, sex, ethnicity, insurance type, or presence of nephritis or thrombocytopenia.

Subgroup	Adjusted OR	95% CI	p
Less experienced hospital, age > 48	1.00 (reference)*	—	—
Less experienced hospital, age ≤ 48	0.67	0.47, 0.95	0.03
Highly experienced hospital, age > 48	0.43	0.23, 0.79	0.006
Highly experienced hospital, age ≤ 48	0.62	0.26, 1.47	0.28
Less experienced hospital, men	1.00 (reference)*	—	—
Less experienced hospital, women	0.93	0.60, 1.45	0.76
Highly experienced hospital, men	0.35	0.12, 1.00	0.05
Highly experienced hospital, women	0.96	0.31, 2.94	0.94
Less experienced hospital, white	1.00 (reference)*	—	—
Less experienced hospital, nonwhite	1.50	1.05, 2.13	0.03
Highly experienced hospital, white	0.56	0.30, 1.04	0.07
Highly experienced hospital, non-white	0.42	0.17, 0.99	0.05
Less experienced hospital, private insurance	1.00 (reference)*	—	—
Less experienced hospital, no private insurance	1.23	0.85, 1.77	0.28
Highly experienced hospital, private insurance	0.78	0.40, 1.52	0.47
Highly experienced hospital, no private insurance	0.28	0.11, 0.67	0.005
Less experienced hospital, no nephritis	1.00 (reference)†	—	—
Less experienced hospital, nephritis	3.43	2.43, 4.85	< 0.0001
Highly experienced hospital, no nephritis	0.47	0.28, 0.77	0.003
Highly experienced hospital, nephritis	0.50	0.20, 1.19	0.12
Less experienced hospital, no thrombocytopenia	1.00 (reference)†	—	—
Less experienced hospital, thrombocytopenia	3.98	2.63, 6.01	< 0.0001
Highly experienced hospital, no thrombocytopenia	0.40	0.25, 0.63	< 0.0001
Highly experienced hospital, thrombocytopenia	0.78	0.26, 2.35	0.67

\* Model adjusted for age, sex, ethnicity, and SLE-specific measure of comorbidity. † Model adjusted for age, sex, and ethnicity.

highly experienced and less experienced hospitals. Had the decrease in mortality associated with hospitalization at a highly experienced hospital been seen for all subgroups of patients, the difference in risk of in-hospital mortality between highly experienced and less experienced hospitals might be explained by differences in the general quality of medical care. Similarly, had the decrease in mortality associated with hospitalization at a highly experienced hospital been seen for patients with various different principal reasons for hospitalization, the difference in risk of in-hospital mortality between highly experienced and less experienced hospitals might be explained by differences in the general quality of medical care. That these associations were not found suggests that differences in the process of care more specifically related to the treatment of SLE account for the observed differences in mortality. Supporting this interpretation is the finding of more consistent benefits of hospitalization at a highly experienced hospital across patient subgroups in the subset of patients with an emergency hospitalization due to SLE. In summary, as the focus of investigation narrows from patients admitted for any reason to patients with an emergency admission due

to SLE, the differences between highly experienced and less experienced hospitals are sharpened.

The most striking difference in the risk of mortality between highly experienced and less experienced hospitals was associated with the type of medical insurance the patient had. While patients with private medical insurance fared similarly at highly experienced and less experienced hospitals, patients without private insurance had much lower risks of in-hospital mortality if they were hospitalized at highly experienced hospitals. Among all patients, the risk of in-hospital mortality among patients without private medical insurance at highly experienced hospitals was less than half that of patients with private insurance at less experienced hospitals. The benefit was even greater among those with an emergency hospitalization. Based on the findings among all patients, those with Medicare may have less of a mortality differential than those with other types of public insurance or no medical insurance, but the findings in the subgroups of patients with an emergency hospitalization or an emergency hospitalization due to SLE indicate that the major distinction is likely the presence or absence of private insurance. There was also evidence for lower mortality

Table 5. Univariate analyses of in-hospital mortality among all patients with an emergency hospitalization due to SLE, by demographic characteristic and selected manifestations of SLE. Data in parentheses are percentages.

	Less Experienced Hospitals	Highly Experienced Hospitals	Crude OR	95% CI	p
Demographic characteristics					
Age ≤ 48	14/155 (9.0)	2/157 (1.3)	0.13	0.03, 0.59	0.008
Age > 48	9/74 (12.2)	1/19 (5.3)	0.40	0.04, 3.38	0.41
Women	22/202 (10.9)	3/157 (1.9)	0.16	0.04, 0.55	0.004
Men	1/27 (3.7)	0/19 (0)	NE	—	—
White	10/102 (9.8)	6/33 (0)	NE	—	—
Black	4/56 (7.1)	0/55 (0)	NE	—	—
Hispanic	6/43 (14.0)	3/68 (4.4)	0.29	0.06, 1.21	0.09
Asian	2/24 (8.3)	0/19 (0)	NE	—	—
Native American	0	0	NE	—	—
Other ethnicity	1/2 (50.0)	0/1 (0)	NE	—	—
Private insurance	5/83 (6.0)	2/36 (5.6)	0.92	0.17, 4.97	0.93
Public insurance	6/71 (8.5)	1/100 (1.0)	0.11	0.01, 0.93	0.05
Medicare	11/50 (22.0)	0/11 (0)	NE	—	—
No insurance	1/25 (4.0)	0/29 (0)	NE	—	—
SLE Manifestations					
Nephritis	13/67 (19.4)	3/57 (5.3)	0.23	0.06, 0.86	0.03
Thrombocytopenia	10/35 (28.6)	1/16 (6.3)	0.17	0.01, 1.44	0.11
Chronic renal failure	2/8 (25.0)	1/7 (14.3)	0.50	0.03, 7.11	0.61
Pleuritis	4/34 (11.8)	1/13 (7.7)	0.63	0.06, 6.18	0.69
Seizures	5/28 (17.9)	1/12 (8.3)	0.42	0.04, 4.03	0.45
Psychosis	0/16 (0)	1/22 (4.6)	NE	—	—
Pericarditis	1/11 (9.1)	0/10 (0)	NE	—	—
Hemolytic anemia	1/9 (11.1)	0/1 (0)	NE	—	—

NE: not estimable.

among ethnic minorities hospitalized at highly experienced hospitals, but these interactions were not significant in analyses that also considered the type of medical insurance.

Previous studies of the association between hospital experience and patient outcomes in conditions other than SLE have not described differences by patients' medical insurance status. Few previous studies reported stratified analyses. Many studies included only patients with particular types of medical insurance or sources of care (e.g.

Medicare or U.S. Department of Veteran Affairs), or were performed in countries with national health insurance, and did not have the opportunity to examine differential outcomes by insurance status. Many studies also examined outcomes of elective procedures, and therefore may have included groups of patients with less heterogeneity in insurance status. Therefore it is difficult to know how generalizable these findings may be.

There are several potential reasons why insurance status

Table 6. Lengths of stay and costs per hospital day (in 1994 US dollars) among patients hospitalized at highly experienced and less experienced hospitals, stratified by type of medical insurance. All values are medians (interquartile range). P values were based on Wilcoxon rank-sum tests.

	Length of Stay (days)		p	Costs per Hospital Day, \$		p
	Highly Experienced Hospitals	Less Experienced Hospitals		Highly Experienced Hospitals	Less Experienced Hospitals	
All patients	5 (2–9)	5 (3–8)	0.05	995 (819–1425)	881 (642–1239)	< 0.0001
Private insurance	4 (2–8)	4 (2–7)	0.06	1111 (840–1721)	893 (658–1246)	< 0.0001
No private insurance	5 (3–10)	5 (3–9)	0.59	981 (810–1331)	872 (635–1234)	< 0.0001
Patients with emergency hospitalizations	5 (2–10)	5 (3–9)	0.72	989 (820–1452)	1045 (761–1456)	0.62
Private insurance	5 (2–11)	4 (2–8)	0.31	1366 (968–2033)	1093 (761–1585)	< 0.0001
No private insurance	5 (2–10)	5 (3–10)	0.55	898 (806–1256)	1035 (761–1424)	0.18
Patients with emergency hospitalizations due to SLE	6 (3–12)	6 (3–13)	0.26	866 (817–1028)	888 (716–1202)	0.35
Private insurance	8 (3–14)	7 (3–12)	0.80	1484 (975–2019)	1116 (710–1316)	0.003
No private insurance	5 (2–11)	6 (3–13)	0.19	866 (811–978)	857 (722–1131)	0.66

may be associated with the risk of in-hospital mortality differently in highly experienced and less experienced hospitals. Lack of private medical insurance may be a marker of lower socioeconomic status, and poorer patients may have higher risks of mortality<sup>8-10</sup>. However, this association would not explain why poorer patients hospitalized at highly experienced hospitals had better outcomes than poorer patients at less experienced hospitals. Patients without private medical insurance may have higher risks of in-hospital mortality because they may delay seeking care for serious health problems<sup>11-14</sup>. However, delay in care-seeking might not apply to patients with Medicare or other public insurance as much as those without insurance, and also would not explain why those without private insurance had better outcomes if hospitalized at highly experienced hospitals. Differences in continuity of care between patients treated at highly experienced and less experienced hospitals may account for the observed difference in in-hospital mortality. Patients without private insurance who were hospitalized at highly experienced hospitals may have been more likely to also have been receiving their outpatient care at clinics associated with these hospitals, and this familiarity may have translated into better outcomes of hospitalization<sup>15</sup>. In contrast, it is possible that outpatient and inpatient care was more fragmented among those without private insurance who were hospitalized at less experienced hospitals. Unfortunately, no data were available on the sources or nature of outpatient care, and this hypothesis could not be tested. Lastly, differences in the types of medical care provided to patients without private insurance may have existed between the highly experienced and less experienced hospitals. These differences may have included differences in testing, consultation, or treatment, or in the timing of these services. No data were available on the details of inpatient care, so this question could not be addressed directly. However, the available data on lengths of stay and costs suggest that restrictions in health care resource use for patients without private insurance at less experienced hospitals do not likely account for the differences in outcomes.

The hypothesis that differences between highly experienced and less experienced hospitals would be more evident in subgroups of patients with more severe SLE was not supported. In-hospital mortality was markedly lower among patients with nephritis hospitalized at highly experienced hospitals, but in a multivariate analysis this association was not statistically significant. Similarly, among the subset of patients with emergency hospitalizations, those with thrombocytopenia had lower risks of in-hospital mortality when hospitalized at highly experienced hospitals, but this association was also not significant in multivariate analyses. Among patients with an emergency hospitalization due to SLE, the risk of in-hospital mortality in patients with nephritis, thrombocytopenia, chronic renal failure, seizures,

pericarditis, and hemolytic anemia hospitalized at highly experienced hospitals was one-half or less than that of similar patients hospitalized at less experienced hospitals. However, because of the small numbers of patients with some of these manifestations, these differences were also not statistically significant. Nonetheless, these results, along with the absence of differences in subgroups of patients hospitalized with common medical conditions other than SLE, suggest that experience in the treatment of SLE, rather than differences in the quality of general medical care, was the main difference between the highly experienced and less experienced hospitals.

The strengths of this study include the large population based sample, and the availability of data on patients with different demographic characteristics and types of medical insurance, and with different SLE manifestations and primary reasons for hospitalization. The limitations of the study include the need to rely on physician reported diagnoses of SLE, rather than on current classification criteria<sup>16</sup>, little available information on the clinical care provided, and limited statistical power for analyses of patients with an emergency hospitalization due to SLE.

This study indicates that patients without private insurance and those with an emergency hospitalization due to SLE, regardless of the particular manifestations of SLE, benefit greatly from hospitalization at a highly experienced hospital. Comparing the types of care provided patients in these subgroups at highly experienced and less experienced hospitals may yield insight into ways to improve the care and decrease the risk of in-hospital mortality for all patients with SLE.

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