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Disease Outcomes and Care Fragmentation among Patients with Systemic Lupus Erythematosus

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Abstract

Objective—To examine the impact of care fragmentation across multiple healthcare institutions on disease outcomes in patients with systemic lupus erythematosus (SLE).

Methods—Using the Chicago HealthLNK Data Repository (HDR), an assembly of electronic health records from six institutions, we identified patients with SLE, using ICD-9 codes, whose care was delivered at more than one organization. We examined whether patients had severe infections or comorbidities (ICD-9 code defined) that indicate SLE-induced damage. T-tests and chi-squared tests were used to examine differences between fragmentation groups. Logistic regression was used to assess factors contributing to the occurrence of disease outcomes.

Results—We identified 4,276 patients with SLE. 856 (20%) received care from more than one healthcare institution. African American patients and patients with public insurance were more likely to experience care fragmentation compared to white and private insurance patients (OR 1.66; 95% CI 1.44, 1.97 and OR 1.63; 95% CI 1.42, 1.95). We identified increased risk of infections (OR 1.57; 95% CI 1.30, 1.88), cardiovascular disease (OR 1.51; 95% CI 1.23, 1.86), end stage renal disease (OR 1.34; 95% CI 1.05, 1.70), nephritis (OR 1.28; 95% CI 1.07, 1.54) and stroke (OR 1.28; 95% CI 1.01, 1.62) among patients with fragmented care, adjusted for age, sex, race, insurance status, length of follow-up time, and total visit count.

Conclusion—In this cross-site cohort of SLE patients, care fragmentation is associated with increased risk of severe infection and comorbidities. These results suggest that improved health information exchange could positively impact outcomes for SLE patients.

The exchange of health information that helps to provide a more complete picture of care for a patient is believed to be an important pillar of improving care and reducing the cost of care for many patient populations, particularly those with chronic illness, such as systemic lupus erythematosus (SLE) that are high utilizers of care (1), (2). Recent Federal initiatives in support of this goal, including the HITECH Act have encouraged health care organizations to adopt and use electronic health record (EHR) systems to manage and share patient

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information (3). However, in many parts of the United States, including Chicago, while there has been widespread adoption of EHR technology, there are few mechanisms for data exchange. Patients who receive care at multiple healthcare institutions and from multiple care providers when data sharing does not exist may be at a disadvantage when it comes to ensuring that all their healthcare providers have access to the information necessary to help them make effective care decisions and manage healthcare needs, potentially increasing care inequalities for patient populations that already experience disparities in care.

Systemic lupus erythematosus is a complex multi-system autoimmune disease that disproportionately affects women, non-whites (particularly African Americans) and those with lower socioeconomic status (4), (5). The multi-organ system involvement in SLE often results in clinical care that includes multiple specialties and locations of care as well as extensive coordination between health care providers, which can be challenging for both providers and patients, especially for those patients without adequate insurance or insurance that limits options for access to care (6), (7). In addition, studies of SLE patients have demonstrated that patients with low SES and insured primarily by Medicaid have an increased incidence of severe infections (8), higher prevalence of comorbidities (9), (10) (11), may be less likely to receive immunosuppressive therapy and renal-protective medications (12), have poorer adherence to medication orders (13), and have to travel farther and receive more care from general practitioners and in emergency departments than non-Medicaid patients (14), (15). However, there is little information available to understand how receiving care from multiple institutions can impact disease outcomes for patients with SLE.

Many of the previous studies of the epidemiology and quality of care surrounding SLE in Medicaid patient populations have relied on local and national Medicaid claims databases (8), (12), (16) as a source of comprehensive care information. While national claims and health care utilization data presents an important picture for the beneficiaries of Medicaid, it often reflects just a subset of care events as beneficiaries often have changes in status that result in changes in payer type, insurance eligibility and access to insurance. EHR systems have become increasingly prevalent in health care institutions across the country, with 97% of hospitals and 83% of ambulatory providers estimated to be using EHR as of 2014 (17), (18), (19). EHR data, which, in addition to billing codes, also include outcomes, test results and richer narrative information about patient care, has the promise to provide significant insights into understanding the epidemiology, quality and management of care. However, as with claims data, in the absence of robust health information exchange, it also often reflects just the subset of care: that provided at the institution hosting the EHR. This makes it difficult to examine care for patient populations, such as SLE patients, who may have multi-institutional care and complex care coordination needs.

A small number of studies have examined the effect of care fragmentation on health outcomes in patients with chronic illness (20), (21), (22) and, to our knowledge, no studies have examined the impact of care fragmentation on patients with SLE. SLE often progresses over long periods of time (23), with multiple providers (14) making it difficult to create a clear picture of overall care for an individual patient. To better understand the impact of care fragmentation on patients with a chronic autoimmune disease, we examined the relationship between care fragmentation and indicators of disease damage in patients with systemic lupus

erythematosus using the Chicago HealthLNK data repository (HDR), a database that aggregates de-identified patient information and simulates a health information exchange between six large healthcare institutions in Chicago (24). The HDR provides a unique opportunity to understand the role of care fragmentation and health data exchange in the frequency of risk factors related to disease severity and outcomes in SLE patients. With this dataset, we were able to estimate the frequency of severe infections and common comorbidities for SLE that are indicators of damage due to disease.

Patients and Methods

Data Sources and Study Subjects

The HealthLNK Data Repository (HDR) is an assembly of electronic health records from six health care institutions: five large Academic Medical Centers (Northwestern Medicine, University of Chicago Hospitals and Clinic, Rush University Medical Center, University of Illinois at Chicago Medical Center, and Loyola University Medical Center) and one large county health care system (Cook County Health and Hospital Systems). The HealthLNK Data Repository currently contains records for encounters between January 1, 2006 and December 31, 2012 for patients residing in the city of Chicago and surrounding suburbs. The EHR data contains de-duplicated, de-identified, merged, patient-level data that includes patient demographics, insurance status (at the time of last visit), and visit specific information, including diagnoses, medications ordered, and test results. To be included in the database, patients had to be between 18 and 89 at the time of data collection. Details of database creation have been outlined previously (24). The database contains 2.3 million unique patients, 23.1 million total visits, and has sex, race, and geographic distribution consistent with 2010 United States Census data (24). For this study, subjects were patients with SLE, identified in the HDR as having 3 International Classification of Diseases, 9th revision (ICD-9) codes for SLE (710.0) in three separate months as described in previous studies (25).

Outcome Definitions

Serious Infections—ICD-9 diagnosis codes for bacterial infections, mycobacterial infections, fungal infections and viral infections (8) were used to determine if a patient experienced a serious infection ever during the study period (Supplemental Table 1), from 1/1/2006-12/31/2012. All types of infections grouped together and bacterial infection alone were assessed overall and for inpatient encounters alone. Infections did not have to be associated with inpatient encounters. Our analyses were not restricted to primary diagnosis, but included any diagnosis for serious infections in the database.

Comorbidities Associated with SLE—Previous studies have identified comorbidities and indicators of organ and tissue damage which correlate with increased likelihood of additional disease-related damage in patients with SLE (9) (12) (26) and have also shown that SLE-related disease damage is a predictor of accrual of long term disease damage (10). ICD-9 codes were used to identify if patients were ever diagnosed with the following comorbidities: cardiovascular disease (CVD) (acute myocardial infarction, angina, heart

failure, and/or ischemic heart disease), stroke, nephritis, and end stage renal disease (ESRD) (Supplemental Table 1) from 1/1/2006-12/31/2012.

Study Measures

Care Fragmentation—Care fragmentation was defined as having one or more visits with a 710.0 ICD-9 code at two or more institutions in the HDR (27) from 1/1/2006-12/31/2012. We chose to limit our analysis to fragmentation of care related to SLE in order to reduce the likelihood that visits to additional institutions were unrelated to SLE.

Race—Race was based on definitions based on data from electronic medical records contained in HDR. In this study, we describe race categories white, African American, and other, which includes all other racial and ethnic identifiers.

Insurance Status—Insurance information was collected at the time of the last visit in the HDR. Insurance status was defined as “no insurance” (no insurance provided or known), “public insurance” (Medicare or Medicaid), or “private insurance” (all other insurance not in the public category).

Covariates—Patient sex, age at end of data collection, length of time in HDR, and total number of SLE visits were included as covariates.

Statistical Analysis

Descriptive statistics, including general demographic information, breakdown of visits and frequency of outcomes were generated for the overall cohort and separately for fragmented and non-fragmented subgroups. Differences in these variables by fragmentation group were calculated using t-tests for continuous variables, chi-squared tests for categorical variables, and Mood’s test for differences in medians. We used logistic regression to determine the effect of fragmentation, race, and insurance status on each outcome individually. To examine the contribution of each of these effects on the increased frequency of infections, comorbidities and medication orders, and determine whether fragmentation of care was an independent contributor, we performed a multivariate logistic regression analysis, both unadjusted and adjusted for relevant covariates. Non-fragmented, white patients with private insurance were considered the reference population. Results are presented as odds ratios (OR) with 95% confidence intervals (CIs).

All analyses were conducted using SAS software version 9.4 (SAS Institute). The Northwestern University Institutional Review Board approved this study.

Results

In the HDR, we identified 4,276 patients who met the criteria for SLE (Table 1). Analysis of prevalence in our sample per year ranges from 165.7 to 202.5 per 100,000 person years (crude). This is similar to the 143.7 per 100,000 person years observed in a previous study using Medicaid claims data (16). Of the total number of patients with SLE, the average age was 49 ($\pm$ 14.6) years, 90.1% were female, 52.1% were African American and 44.6% were beneficiaries of public insurance. Fragmentation of care occurred for 856 (20%) of SLE

patients. Fragmented patients visited an average of 2 institutions, and were more likely to be African American (OR 1.66; 95% CI 1.40, 1.97) and the beneficiaries of public insurance (OR 1.63; 95% CI 1.42, 1.95) (results not shown). Patients with fragmented care had a significantly higher median number of months in the HDR (66 vs 61, $p < 0.0001$), and a higher median number of visits for care related to SLE (15 vs 10, $p < 0.0001$). However, patients with both fragmented and non-fragmented care had no differences in the average number of visits per month for SLE related care (0.47 vs 0.48, $p = 0.3742$).

Table 2 shows the breakdown of fragmentation status for all outcomes. Patients with fragmented care were more likely to experience a severe infection overall (OR 1.76; 95% CI 1.49, 2.08) and when inpatient infections were assessed separately (OR 1.61; 95% CI 1.38, 1.88) compared to patients receiving care within only one health system. Overall, bacterial infections made up the majority of infections in both the total (1350 of 1494 patients with SLE) and inpatient settings (930 out of 987). When we assessed common indicators of SLE-derived damage, we observed that patients with care fragmentation were more likely to have been documented with cardiovascular disease (OR 1.70; 95% CI 1.42, 2.05), stroke (OR 1.49; 95% CI 1.19, 1.85), nephritis (OR 1.78; 95% CI 1.51, 2.09), and end stage renal disease (OR 1.85; 95% CI 1.48, 2.31).

Table 3 shows results of the unadjusted single-effect models and the fully adjusted multivariate model containing all three effects and covariates. In unadjusted analyses, fragmentation, public insurance and African American race each independently resulted in an increased likelihood that a patient would experience a severe infection. In the fully adjusted model, odds ratios for increased likelihood of experiencing a severe infection were reduced, but still significant for fragmentation (OR 1.56; 95% CI 1.30, 1.88), public vs. private insurance (OR 2.09; 95% CI 1.74, 2.50), and African American vs. white race (OR 1.54; 95% CI 1.28, 1.86). Similar results were observed for inpatient infections alone and bacterial infections (data not shown). This data suggests that fragmentation, race and public insurance all play a role in the increased likelihood of a severe infection.

Next, we examined how fragmentation, race and insurance impacted the likelihood of comorbidities that are indicators of the degree of SLE-related damage to the cardiovascular system and kidneys. In unadjusted analyses of cardiovascular disease and stroke, fragmentation, African American race and public insurance were all associated with increased odds of CVD (Table 3). In the fully adjusted model, odds ratios for having CVD remained significant: fragmentation (OR 1.51; 95% CI 1.23, 1.86), African American vs. white race (OR 1.85; 95% CI 1.49, 2.29) and public vs. private insurance (OR 2.67; 95% CI 2.16, 3.21). Similar results were observed for stroke (see Table 3), suggesting that fragmentation, race and public insurance are associated with increased odds of experiencing these comorbidities.

When we examined prevalent ESRD, unadjusted analysis demonstrated that fragmentation, race, and public insurance were associated with increased odds of ESRD (Table 3). In our fully adjusted models, odds of ESRD were reduced, but still significant for fragmentation (OR 1.31; 95% CI 1.03, 1.68), African American vs. white race (OR 2.41; 95% CI 1.81, 3.21) and public vs. private insurance (OR 3.05; 95% CI 2.34, 3.97). In unadjusted analysis

of nephritis, all three main effects were associated with increased odds of having nephritis. After full adjustment, fragmentation (OR 1.28, CI 1.06, 1.54) and African American vs. white race (OR 1.69; 95% CI 1.39, 2.04), and public vs. private insurance (OR 1.39; 95% CI 1.12, 1.66) remained significantly associated with the odds of nephritis.

Given the importance of establishing the temporal relationship between fragmentation and outcomes, we repeated the analysis, removing patients whose fragmentation occurred before SLE diagnosis. After removing patients whose fragmentation occurred before first SLE diagnosis in the HDR, 4173 (98%) patients remained. The median number of visits for these patients in both groups was 34. Not surprisingly given the small reduction in the number of patients who were included, the regression analysis using only patients with fragmentation after first SLE diagnosis returned similar results (see Supplemental Table 2), further supporting the suggestion that fragmentation is associated with increased odds of experiencing a negative outcome.

To better understand how fragmentation, race, and insurance status associate with increased odds of experiencing an indicator of SLE disease severity, we used our fully adjusted models to examine the effect of combinations of these variables on the odds of having a given outcome. Figure 1 shows the odds of three different patient populations with and without care fragmentation (African American patients with private insurance, white patients with public insurance and African American patients with public insurance) experiencing a particular indicator of SLE-derived damage relative to the reference population of white patients using private insurance and receiving all care for their SLE in one health system.

African American patients with private or public insurance and no care fragmentation had increased odds of experiencing a severe infection, nephritis or CVD compared to white patients with the private insurance receiving care in one health system. Similarly, both white and African American patients using public insurance and receiving care with no fragmentation had increased odds of experiencing an indicator of more severe SLE than white patients with no care fragmentation using private insurance. When we examined how fragmentation of care impacted disease severity indicators for all three groups of interest, we observed that patients with fragmented care had increased odds of a severe infection, nephritis or CVD, compared to the reference population. When examining the association of care fragmentation to the odds of having a negative health outcome in each individual population, fragmentation only significantly increased the odds of infections in two populations (African American and private, and white and public). Although the other comparisons were not statistically significant, the addition of fragmentation as a risk factor does increase the odds of having a negative health outcome in all populations. African American patients with public insurance and fragmented care experienced the highest likelihoods. Compared to the reference population, they were almost five times more likely to experience a severe infection, three times more likely to have nephritis and over seven times more likely to have cardiovascular disease. Taken together, these data suggest that that race, public insurance and fragmentation are all independently associated with the increased likelihood of experiencing an indicator of increased SLE-derived damage. All ORs and 95% CIs are provided in Supplemental Table 3.

Discussion

Our data, showing an independent association of care fragmentation with increased frequency of damage indicators suggests that care fragmentation could have a long term negative impact on the health and severity of disease in SLE patients. In addition, our data suggest that for patients with SLE, care fragmentation has a relationship with race and insurance use, particularly for African American patients and those who are public insurance beneficiaries. This is consistent with studies that have examined the role of public insurance in and fragmentation in ectopic pregnancy care in Chicago (28) and frequent hospitalizations in New York City (22). Previous studies of Medicaid beneficiaries with SLE have shown that there was a higher frequency of severe infections among African American patients and patients with lower socioeconomic status (8) and that non-white patients with SLE were more likely to experience chronic renal failure, nephritis, congestive heart failure, pericarditis, diabetes and pleuritis (11). Recent studies also suggest that African American race, existing damage, steroid use and hypertension in patients with SLE predict future damage accrual and mortality (10). Consistent with this work, in our study African American patients were more likely to have fragmented care, and both white and African American patients using public insurance (Medicaid and Medicare) were more likely to have fragmented care than those with access to private insurance. When we examined the relationship of fragmentation to indicators of morbidity in SLE, we determined that care fragmentation is correlated with increased frequency of severe infections (particularly bacterial infections), increased frequency of kidney disease (ESRD, and nephritis), cardiovascular disease and stroke. These correlations remained for all indicators after adjusting for race and insurance, indicating that these related factors are independently associated with increasing the frequency of morbidity related outcomes in the patient population we examined.

Medicaid beneficiaries with SLE have been shown to travel longer distances for care and were more likely to receive care by a general practitioner or in the emergency room (14), (15). Our data showing a strong correlation between public insurance and care fragmentation is also consistent with these studies. In Chicago, it has been previously shown that Medicaid beneficiaries experience challenges in finding providers that will accept their insurance, and, even when they do, it often takes a long time to get appointments (6). Thus, it is possible that accessibility and availability of care providers may have an impact on care fragmentation for patients with Medicaid, regardless of race.

It is possible that increased odds of infection and comorbidities among patients who had fragmented care for their SLE were simply due to these patients being represented in the HDR dataset for a longer duration than the patients who received care only in one system. To address this issue, we examined the number of months over which patients in the fragmented and non-fragmented care cohorts had data in the HDR (Table 1). While patients with fragmented care had a significantly higher median number of months in the HDR and a higher median number of visits for care related to SLE, there were no differences in the average number of visits per month. Similarly, in the fully adjusted logistic regression models, removal of length of time and number of visits in the HDR only minimally attenuates the effect of fragmentation on any outcome, and does not affect the significance

of the fragmentation effect (data not shown). This suggests that, while the patients with fragmented care were present for a longer period of time and had more visits in the HDR, there was no difference in the rate at which care was received between the populations, and that time and visit numbers are not likely the drivers behind the outcomes we have observed.

Our study has a number of strengths. The HDR includes data from 6 major healthcare networks in Chicago and information for 2.3 million patients. This database has been shown to have a distribution of age, sex, race and ethnicity consistent with the 2010 U.S. Census data for the regions (24) and is likely highly representative of the patient population in the city. Because it includes more than one healthcare institution, it also provides broader and more complete picture of the care SLE patients are receiving and reflects care from academic medical centers, public hospitals and community health organizations as well as access to more SLE patients than would be found at one institution alone. However, there are also some limitations to our study. First, while the HDR contains information about clinical events, to preserve patient privacy, dates of service are limited to month and year. This makes it difficult to measure intra-month temporal relationships between events. Thus, we have focused on demonstrating association of fragmentation with outcomes rather than causation. Next, while the HDR contains information about a large population of patients, it is a regionally focused database with a primarily urban patient population and some of our results may not be applicable to all other geographic regions or to patients in rural areas. In addition, while it provides information for the majority of the population of the city of Chicago (2.7 million people reported in the 2010 Census), it is not a comprehensive collection of all the medical records in Chicago and it is possible that there are absent data that could impact our findings. In particular, since there are a number of health systems that are not present in the HDR and the repository also lacks data from the majority of community primary care settings, it is likely that there is more fragmentation of care than we were able to identify with this dataset. Also, the HDR only stores insurance status for the most recent data entry and this information may not be representative of the insurance used by the patient throughout the visits tracked for the entire study. In addition, we identified clinical visits associated with SLE by the presence of the ICD-9 code for SLE. SLE could be documented without being the cause of a visit, thus the number of SLE-related visits could be overstated. Finally, while our multivariate modelling suggests independent effects of care fragmentation, race and insurance status on our outcomes, because race, insurance status and fragmentation have complicated relationships we cannot exclude the possibility of residual confounding as well as the contribution of other, unmeasured factors (such as satisfaction with care, transportation access, relocation during care and changes in economic and/or insurance status) to our results.

In conclusion, we have demonstrated that care fragmentation in SLE patients can be identified using a city-wide database of integrated EHR data. Our data suggests that care fragmentation plays an independent role in increasing the frequency of disease related morbidity damage in the SLE patients from an urban environment, and worsens existing disparities already experienced by African American patients and patients who are the beneficiaries of public insurance. Combined with previous research suggesting that existing damage is a predictor of future damage accrual for SLE patients, our study suggests that improving care coordination and access to a more complete set of medical record data may

be a key strategy for improving health outcomes for SLE patients. While true health information exchange (HIE) is available in limited regions of the United States, other solutions that integrate EHR data, may increase data sharing. Previous work has shown success in reductions in readmissions and unnecessary imaging when data was exchanged (29), and patients with HIV who were monitored via HIE showed improved outcomes (30), suggesting that there could be significant benefits to EHR data sharing for patients with chronic and complicated autoimmune disease.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Significance and Innovations

- A city-wide integrated database of de-identified patient information was used to examine the association between receiving care in multiple health care institutions and disease outcomes for patients with systemic lupus erythematosus.
- Care fragmentation appears to be associated with experiencing a severe infection or comorbidity associated with systemic lupus erythematosus.
- Care fragmentation is associated with an increase in the risk of experiencing a severe infection or comorbidity associated with systemic lupus erythematosus, particularly when combined with African American race and the beneficiary of public insurance.

*AA = African-American

Figure 1.

Fragmentation of Care Increases Odds of Experiencing Indicators of SLE-Derived Damage for SLE Patients in the HDR. Multivariate analysis was performed using white patients with private insurance and without fragmented care as our reference population. Our reference population was compared to three additional populations: African American patients with private insurance, white patients with public insurance and African American patients with public insurance. We examined the likelihood of any of these populations experiencing a severe infection, nephritis or a cardiovascular disease (CVD) with and without fragmented care. The contribution of each variable to the frequency of severe infections, nephritis and CVD are shown. Data are presented as the odds ratio of the event occurring in the given population with the 95% confidence interval. All data are significant to $p < .05$ or less.

Table 1

Demographic characteristics of SLE patients overall and by fragmentation status.

	Overall N=4276	Frag N=856 (20.0%)	Not Frag. N=3420 (80.0%)
Age, mean (SD)	49 (14.6)	47 (14.4)	49 (14.6)
Race (%)			
African American	52.1	63.8	49.2
White	33.1	27.1	34.6
Other	14.7	9.1	16.1
Sex (%)			
Male	9.9	7.5	10.6
Female	90.1	92.5	89.4
Insurance (%)			
None	14.9	5.7	17.1
Public	44.6	58.5	41.1
Private	40.6	35.7	41.8
HealthLNK			
Months	40	53	36
Sites	1.23	2.1	1
Visits	11	15	10
Visits/Mo	.97	.47	.48

Table 2

Rate of serious infections and comorbidities by fragmentation status. All data represented as the % of the patients who have experienced a given infection event or comorbidity at least once within the study period.

	Overall N=4276	Frag N=856 (20.0%)	Not Frag. N=3420 (80.0%)	P value
Serious Infections				
Infections	34.9	43.9	32.7	<0.0001
Bacterial Infection	31.6	41.2	29.2	<0.0001
Inpatient Infection	23.1	31.8	20.9	<0.0001
Inpatient Bacterial Infection	21.7	30.6	19.5	<0.0001
Damage Indicators				
End Stage Renal Disease	10.1	15.2	8.8	<0.0001
Nephritis	24.1	33.2	21.8	<0.0001
CVD	16.9	23.5	15.3	<0.0001
Stroke	11.3	14.7	10.4	0.0004

Table 3

Logistic regression examining the contribution of fragmentation, insurance status and race to prevalence of infections, comorbidities for patients in the HDR. Data are expressed as Odds Ratios with 95% Confidence Interval. Fully adjusted model contains Fragmentation, Race, and Insurance Status, adjusted for covariates.

	Unadjusted			Fully Adjusted ^a		
	OR	95% CI	p-value	OR	95% CI	p-value
Race						
Any Infection	2.072	(1.749,2.454)	<.0001	1.538	(1.275,1.855)	<.0001
CVD (Any)	2.166	(1.790,2.621)	<.0001	1.85	(1.492,2.294)	<.0001
Stroke	1.711	(1.376,2.128)	<.0001	1.548	(1.219,1.967)	0.0003
Nephritis	2.094	(1.77,2.476)	<.0001	1.685	(1.393,2.038)	<.0001
ESRD	3.074	(2.358,4.008)	<.0001	2.411	(1.812,3.208)	<.0001
Insurance						
Any Infection	3.074	(2.358,4.008)	<.0001	2.087	(1.744,2.498)	<.0001
CVD (Any)	2.935	(2.289,3.764)	0.125	2.677	(2.166,3.308)	<.0001
Stroke	2.648	(2.128,3.294)	<.0001	1.789	(1.414,2.263)	<.0001
Nephritis	1.271	(0.936,1.727)	<.0001	1.391	(1.168,1.657)	<.001
ESRD	3.897	(3.038,4.998)	<.0001	3.045	(2.338,3.965)	<.0001
Fragmentation						
Any Infection	1.762	(1.493,2.08)	<.0001	1.559	(1.299,1.871)	<.0001
CVD (Any)	1.704	(1.418,2.047)	<.0001	1.513	(1.234,1.856)	<.0001
Stroke	1.486	(1.194,1.849)	<.001	1.277	(1.01,1.614)	0.0412
Nephritis	1.777	(1.508,2.093)	<.0001	1.276	(1.061,1.535)	0.0098
ESRD	1.849	(1.482,2.306)	<.0001	1.317	(1.034,1.678)	0.0255

^aModel includes Fragmentation, Insurance Status, Race, Sex, Age, Length of time in HDR, and total number of SLE visits