Published in final edited form as:

Spine J. 2017 March ; 17(3): 338–345. doi:10.1016/j.spinee.2016.10.005.

Association Between Insurance Status and Patient Safety in the Lumbar Spine Fusion Population

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Abstract

BACKGROUND CONTEXT—Lumbar fusion is a common and costly procedure in the United States. Reimbursement for surgical procedures is increasingly tied to care quality and patient safety as part of value-based reimbursement programs. The incidence of adverse quality events among lumbar fusion patients is unknown using the definition of care quality (patient safety indicators [PSI]) utilized by the Centers for Medicare and Medicaid Services (CMS). The association between insurance status and the incidence of PSI is similarly unknown in lumbar fusion patients.

PURPOSE—This study sought to determine the incidence of PSI in patients undergoing inpatient lumbar fusion and to quantify the association between primary payer status and PSI in this population.

STUDY DESIGN—Retrospective cohort study.

PATIENT SAMPLE—All adult patients aged eighteen years and older included in the nationwide inpatient sample (NIS) that underwent lumbar fusion from 1998–2011.

OUTCOME MEASURES—Incidence of one or more PSI, a validated and widely used metric of inpatient healthcare quality and patient safety.

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Level of evidence: Level III

METHODS—NIS data were queried for all cases of inpatient lumbar fusion from 1998–2011. Incidence of adverse patient safety events (PSI) was determined using publicly available lists of ICD-9-CM diagnosis codes. Logistic regression models were used to determine the association between primary payer status (Medicaid/self-pay relative to private insurance) and the incidence of PSI.

RESULTS—539,172 adult lumbar fusion procedures were recorded in the NIS from 1998–2011. Patients were excluded from the secondary analysis if “other” or “missing” was listed for primary insurance status. The national incidence of PSI was calculated to be 2,445 per 100,000 patient years of observation, or approximately 2.5%. In a secondary analysis, after adjusting for patient demographics and hospital characteristics, Medicaid/self-pay patients had significantly greater odds of experiencing one or more PSI during the inpatient episode relative to privately insured patients (OR 1.16 95% CI 1.07 – 1.27).

CONCLUSION—Among patients undergoing inpatient lumbar fusion, insurance status is associated with the adverse healthcare quality events used to determine hospital reimbursement by CMS. The source of this disparity must be studied to improve the quality of care delivered to vulnerable patient populations.

Keywords

lumbar fusion; NIS; patient safety; AHRQ; CMS; PSI; insurance status; health disparities

Introduction

In the United States, lumbar fusion surgery has become increasingly common over the past two decades. In a study of Medicare beneficiaries, Weinstein et al. reported that the rate of lumbar fusion increased significantly from 0.3 per 1,000 Medicare beneficiaries in 1993 to 1.1 per 1,000 in 2003.^[39] Among adult patients in the Nationwide Inpatient Sample (NIS), Rajaei et al. observed that the incidence of primary lumbar fusion increased 2.7-fold (170.9%) from 1998 to 2008.^[34] As the incidence of lumbar fusion increases in the United States, it becomes increasingly important to identify populations at-risk for adverse in-hospital outcomes.

After adjusting for patient-level covariates, Medicare patients have superior outcomes relative to Medicaid patients following craniotomy for brain tumor,^[12] endovascular aneurysm treatment,^[23] and lumbar spinal stenosis surgery.^[27] Prior studies demonstrated that improving insurance access does not ensure improved outcomes, as this access does not guarantee the receipt of high quality care.^[4, 10] The Oregon Medicaid experiment and MetroHealth Care-Plus initiative describe this relationship in detail.^[4, 10] The Centers for Medicare and Medicaid Services (CMS) recently implemented two initiatives outlined in the Affordable Care Act that are designed to connect healthcare reimbursement to healthcare quality.^[15]

CMS measures healthcare quality in part by using patient safety indicators (PSI) first developed by the Agency for Healthcare Research and Quality (AHRQ).^[2, 31] PSI are assigned to a patient's discharge record if a patient experienced an adverse event during the

inpatient episode. CMS use PSI to determine the annual incidence of adverse inpatient healthcare quality events, including post-surgical wound infection and deep vein thrombosis, at the provider, hospital, and regional healthcare market levels. Despite extensive study of patient safety and risk factors for poor outcome following spinal surgery, the relationship between insurance status and PSI following lumbar fusion is unknown.

As the U.S. healthcare system continues to adopt value-based reimbursement systems, identifying predictors of adverse quality outcomes for common and costly procedures such as lumbar fusion becomes increasingly important for patients, providers, and hospital systems.

Quantifying the relationship between healthcare quality and insurance status among patients undergoing lumbar fusion may identify vulnerable populations at-risk for poor outcomes, enabling the creation and implementation of initiatives designed to reduce disparities. Nationwide administrative databases are uniquely positioned to answer these questions because of their potential for large patient samples inclusive of a diverse array of pathologies, primary payers, and geographic locations. The present study utilizes a nationally representative, all-payer database to quantify the relationship between insurance status and adverse quality outcomes in patients undergoing lumbar spinal fusion. We hypothesize that the odds of PSI will be significantly greater for Medicaid or self-pay patients undergoing lumbar fusion relative to privately insured patients.

Materials and Methods

Overview and Study Design

This study employs a retrospective cohort design and uses a nationally representative, all-payer database to quantify the national incidence of PSI among lumbar fusion patients and to determine the association between insurance status and PSI in this patient population.

Data Source

This study used NIS data from 1998–2011. The NIS is the largest all-payer healthcare database in the United States and was established by AHRQ.^[22] Compiled annually beginning in 1988, the NIS is a nationally representative sample from across the United States and NIS data comprise a 20% stratified sample of all hospital discharges in the United States. Single inpatient episodes correspond to a single entry in the database. The NIS provides sampling weights that enable the generation of national estimates. Specifically, the NIS records patient-level data on demographics, comorbidities, diagnoses, procedures, outcomes (such as length of hospital stay, hospital charges, and mortality), in-hospital complications, and hospital characteristics (e.g., hospital size, geographic location, hospital teaching status).^[22] All admission diagnoses, procedures, and in-hospital complications are recorded in the NIS using International Classification of Disease, Ninth Revision, Clinical Modification (ICD-9-CM) codes. The NIS began recording Elixhauser comorbidity data in 1998.^[15, 28] Thirty comorbidities associated with in-hospital mortality are included in the Elixhauser comorbidity index. Using the Elixhauser comorbidity index allows for

standardized risk adjustment in administrative databases. Twenty-nine of the original thirty Elixhauser comorbidities are recorded in the NIS (an administrative database).^[15]

Study Population

Data were obtained based on the presence of an inpatient episode listing an ICD-9-CM procedure code for index or revision lumbar spinal fusion (81.04–81.08 and 81.34–81.38).^[20, 25, 26, 35] All patients recorded in the NIS that underwent inpatient lumbar fusion from 1998–2011 were initially included in the present study. The sampling strategy AHRQ uses to create the NIS changed in 1998. Therefore, the present study only included data from 1998 onward to mitigate bias.^[32] Exclusion criteria were patients under 18 years of age.

In our secondary analysis, we omitted patients with “missing” or “other” primary insurance status, as well as Medicare patients to better understand the effect of insurance status on PSI incidence. Two reasons drove our decision to omit Medicare patients. First, the Medicare population is clinically and statistically significantly older than other insured populations and is therefore not directly comparable to other insured populations secondary to higher PSI incidence. Second, greater differences in the extent of healthcare access and insurance coverage likely exist between the privately insured and Medicaid/self-pay populations than between either population and Medicare beneficiaries. Accordingly, comparing Medicaid/self-pay patients to privately insured patients permits the identification of the independent effect of insured status on PSI incidence. Hooten et al. used an identical analytical framework.^[24]

Outcome of Interest

Incidence of one or more PSI during an inpatient episode served as our primary outcome variable. Patients were recorded as experiencing a PSI if their discharge record included specific ICD-9-CM diagnosis codes published by AHRQ.^[1, 11] In our secondary analysis, the independent variable of interest was insurance status (privately insured relative to Medicaid/self-pay). Covariates in this secondary analysis included demographic data (patient age, gender, race [black, Hispanic, Asian, Native American, and other, all relative to white]), hospital characteristics (academic hospital setting, admission source [elective versus non-elective], hospital bed size [medium and large, both relative to small], hospital region [South, West, and Midwest, all relative to Northeast]), and 29 Elixhauser comorbidities. Age was recorded and analyzed as a continuous variable.

Analytic Approach

In our primary analysis, discharge weights provided in the NIS were used to generate national estimates of the incidence of PSI among lumbar fusion patients. In our secondary analysis, a generalized estimating equation multivariable logistic regression model was created using incidence of one or more PSI as our outcome variable and insurance status, gender, age, Elixhauser comorbidities, hospital teaching status, hospital bed size, hospital region, and admission status as covariates.^[24] Each of these covariates were chosen for inclusion in our model a priori because we felt that the association between insurance status and PSI incidence may be confounded by patient-and hospital-level characteristics. This list of included covariates is an exhaustive list of patient-and hospital-level characteristics

included in the NIS. To adjust for clustering of observations on hospitals, an exchangeable working correlation was assumed by labeling each hospital as a repeated factor. Due to the large sample size in the NIS, we set our threshold for statistical significance at $p < 0.001$.^[24]

We used the SAS statistical software package (version 9.4, SAS Institute Inc) to calculate means, standard deviations, confidence intervals, and frequencies for patient demographics, hospital characteristics, and PSI incidence. We assessed balance between the Medicaid/self-pay and privately insured cohorts using odds ratios (OR) for each of the Elixhauser comorbidities recorded in the NIS. Continuous variables were compared using the independent t-test assuming unequal variance and categorical data were compared using the chi-squared test.

Results

539,172 adult lumbar fusion procedures were recorded in the NIS from 1998–2011. Patient demographics and hospital characteristics are presented in Figure 1 and Table 1. Overall, the mean age was 54.8 ± 15.1 years and 55.0% of patients were female. In our sample, there were 1,362 patients that were missing primary insurance status data. These patients were significantly younger, less likely to be female, more likely to be seen in large, southern hospitals, and had a lower mean number of comorbidities relative to patients with complete primary insurance status data (all $p < 0.001$). Medicaid/self-pay patients had a significantly higher mean number of Elixhauser comorbidities relative to privately insured patients ($p < 0.001$). More than 40% of Medicaid/self-pay and privately insured patients were treated in southern hospitals, while privately insured patients were significantly more likely to be electively admitted relative to Medicaid/self-pay patients ($p < 0.001$).

A total of 12,681 PSI were recorded among lumbar fusion patients from 1998–2011. The estimated national incidence of experiencing one or more PSI during an inpatient episode for lumbar fusion was 2,447 per 100,000 patient years (approximately 2.4%). The most common PSI was perioperative pulmonary embolism or deep vein thrombosis, with an estimated national incidence of 839 per 100,000 person years (or about 0.8%).

Prior to adjustment in our secondary analysis, Medicaid/self-pay patients faced significantly greater odds of experiencing one or more PSI during an inpatient episode for lumbar fusion compared to privately insured patients (OR 1.43, 95% CI 1.31 – 1.55, $p < 0.001$). Following adjustment for observed differences in comorbidities and patient demographics, the odds of experiencing one or more PSI were greater for the Medicaid/self-pay cohort relative to the privately insured cohort (OR 1.20, 95% CI 1.10–1.30, $p < 0.001$). Finally, when the multivariable model was adjusted to include hospital characteristics as well as patient demographics and comorbidities, Medicaid/self-pay patients continued to have significantly greater odds of experiencing one or more PSI compared to privately insured patients (OR 1.16, 95% CI 1.07 – 1.27, $p < 0.001$). The results of these three models are shown in Table 2. In a follow-up analysis, the odds of experiencing one or more PSI during an inpatient episode for lumbar fusion were significantly lower for patients from elective admission sources relative to emergent and urgent admission sources after controlling for hospital

characteristics, patient demographics, and comorbidities (OR 0.77, 95% CI 0.69 – 0.84, $p < 0.001$).

Discussion

The present study found that the incidence of PSI among lumbar fusion patients was approximately 2.4%. In a secondary analysis, after adjusting for comorbidities, patient demographics, and hospital characteristics as potential confounders, patients with Medicaid/self-pay primary payer status had significantly greater odds of experiencing one or more PSI during an inpatient episode for lumbar fusion relative to privately insured patients. The current iteration of AHRQ quality indicators includes four components: preventative, pediatric, inpatient, and patient safety indicators (PSI).^[17] Examples of PSI include postoperative respiratory failure, postoperative hemorrhage, and postoperative thromboembolic events.^[17] Prior studies have demonstrated that experiencing a PSI is significantly associated with adverse patient outcomes.^[16, 33, 36] The association between inpatient healthcare quality and patient outcomes led to the development of physician and hospital reimbursement systems that are tied to quality of care.^[15] Despite these efforts, Rajaram et al. showed that substandard quality of care led CMS to financially penalize over 22% of all hospitals that participated in the first year of the Hospital Acquired Condition (HAC) reduction program.^[36] CMS defines quality of care in part using PSI incidence.^[15, 36] Stakeholders across the healthcare system stand poised to benefit from identifying predictors of adverse quality outcomes following common surgical procedures such as lumbar fusion surgery. Ultimately, identifying at-risk populations enables the creation and implementation of targeted initiatives that can reduce disparities in quality of care.

Incidence of PSI

Although several prior studies address patient safety following lumbar fusion,^[5, 8, 14, 18, 26, 29, 30, 38, 40] no study has described the incidence of adverse safety events using the CMS and AHRQ definition of patient safety. Compared to other patient populations, we observed lower incidences of PSI in lumbar fusion patients. After analyzing 548,727 patients in the NIS that were admitted with a brain tumor from 2002–2011, Hooten et al. estimated that 16.3% of brain tumor patients experience one or more PSI.^[24] In a similar study using NIS data, Fargen et al. identified 54,589 patients admitted with unruptured cerebral aneurysms and found that 14.6% (95% CI 13.9%–15.4%) of patients that underwent surgical clipping experienced one or more PSI during the inpatient episode while only 10.5% (95% CI 9.9%–11.1%) of patients that underwent endovascular coiling experienced one or more PSI. Relative to pathologies requiring lumbar spine fusion, brain tumors and cerebral aneurysms are more acute conditions necessitating urgent and emergent care. This difference in acuity may explain differences in the incidence of adverse quality outcomes among these populations.

Association of Insurance Status with PSI Incidence

The association between insurance status and patient outcomes has been established for several patient populations. Using single-institution data from 3,988 patients, Calfee et al.

found that relative to privately insured patients, Medicaid and uninsured patients face significantly greater barriers in access to surgical care.^[9] Specific to the orthopaedic surgery population, Browne et al. analyzed NIS data from 6,844,705 total joint arthroplasty patients and found that relative to other insurance cohorts, Medicaid patients had significantly greater resource utilization and poorer outcomes.^[7] Lad et al. reported similar findings among 28,462 patients that underwent surgery for lumbar spinal stenosis. The authors found that relative to commercially insured patients, Medicaid patients had significantly longer LOS and greater utilization of outpatient services.^[27] Using data on 1,591 spine surgery patients from a large academic medical center, Hacquebord et al. found that Medicaid or uninsured patients had significantly greater odds of experiencing a postoperative complication relative to other insurance cohorts after adjusting for patient level confounders.^[21] Alosch et al. analyzed 965,000 cases of anterior cervical fusion in the NIS and found that privately insured patients had significantly lower odds of experiencing a postoperative complication compared to other insurance cohorts after adjusting for comorbidity burden, race, ethnicity, and geography.^[3]

In keeping with the findings outlined above in other surgical cohorts, we observed significant disparities in odds of experiencing a PSI across primary payer status for patients undergoing lumbar fusion. Hooten et al. failed to identify a statistically significant association between insurance status and PSI among brain tumor patients after adjusting for patient demographics, comorbidities, and hospital characteristics.^[24] However, in the present study, we controlled for the same confounders as Hooten and colleagues and found that insurance status was significantly associated with odds of experiencing a PSI during an inpatient episode for lumbar fusion. Derakhshan et al. performed a similar study and analyzed the imaging history of 24,105 patients diagnosed with lumbar radiculopathy and/or myelopathy from a single institution. The authors found that socioeconomic status and extent of insurance coverage were highly significant predictors of imaging utilization.^[13] Importantly, the disparities observed by Derakhshan et al. may be due to difficulty in obtaining consent from public insurers for more advanced imaging modalities rather than systematic differences in care quality delivered to patients. However, as the authors conclude, it is also possible that physicians are less likely to seek advanced imaging from patients with less robust insurance if the physician is aware of the patient's insurance status.

In a follow-up analysis, we also found that the odds of experiencing one or more PSI following lumbar fusion were significantly lower for elective admissions relative to emergent and urgent admissions. Medicaid and self-pay patients have been shown to have lower odds of being electively admitted compared to privately insured patients.^[6] The results of the present study support these prior findings, as Medicaid/self-pay patients faced significantly lower odds of being from an elective admission relative to privately insured patients (OR 0.50 95% CI 0.49 – 0.51). However, even when adjusting for this potential confounder, Medicaid and self-pay patients were found to have significantly higher odds of PSI relative to privately insured patients.

After controlling for the patient demographics, comorbidities, and hospital characteristics that may influence the rate of adverse quality events, we found that insurance status is associated with increased odds of experiencing an adverse healthcare quality or safety event

following lumbar fusion surgery. Further studies that seek to address these disparities and to identify the latent variables across the healthcare system that drive these disparities are warranted.

Limitations

There are several limitations within the current study that should be considered. Importantly, procedures and diagnoses are recorded in the NIS using ICD-9-CM codes and are therefore subject to misclassification.^[19] Specifically, ICD-9-CM codes are assigned based on a clinician's note. Data omitted from the note are therefore not included in the NIS. Second, population-level trends should not be attributed to the individual according to the ecological fallacy.^[37] Third, the generalizability of our study is somewhat limited in part because we omitted Medicare patients from our analyses. However, omitting Medicare patients from our analyses enabled us to more accurately estimate the association between insurance status and PSI incidence. Furthermore, although the relative number of patients with missing primary insurance data was low among lumbar fusion patients, there were significant differences between patients with complete primary insurance data and those with missing primary insurance data. These differences introduce the possibility of selection bias to our findings. Lastly, the NIS only includes data obtained during the inpatient episode of care. Therefore, conditions and outcomes that may only become apparent with extended follow-up remain outside the scope of investigation of studies that utilize NIS data. Despite the limitations inherent to large, administrative databases, such data sources provide unique opportunities to study ecological and population-based trends. These limitations notwithstanding, the present study found significant disparities in the quality of patient care across health insurance groups. Further study is needed to better understand the causes of these disparities.

Conclusion

This study highlights disparities in patient safety and care quality across insurance groups among patients undergoing lumbar fusion. As the U.S. healthcare system continues to transition to a value-based reimbursement model, measures such as PSI will be increasingly used to determine care quality and value. As a result, reducing PSI across all patient populations can benefit patients, physicians, and hospital systems from both a clinical and financial perspective. The results of the present study can be used to support initiatives designed to eliminate disparities by improving the quality of care delivered to vulnerable patient populations.

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Figure 1. Odds Ratio of Patient Demographics and Comorbidities for Private vs Medicaid/Self-Pay

Odds ratio with 95% CI are shown comparing private insurance to Medicaid/self-pay cohorts for patient demographics, comorbidities, and admission source. “*” denotes significance at $p < 0.001$. CHF is congestive heart failure. DM is diabetes mellitus. All comorbidities are defined by the NIS according to ICD-9-CM diagnosis codes as defined by Elixhauser.

Table 1**Patient Demographics and Hospital Characteristics**

	Overall n=539,172	Medicare n = 174,910	Private Insurance n = 256,030	Medicaid/Self-Pay n = 32,645	P – value
Age (years) ± SD	54.8 ± 15.1	68.8 ± 10.4	49.5 ± 11.9	43.4 ± 12.6	<0.001
Female (%)	296,585 (55.0)	109,802 (62.8)	141,807 (55.4)	18,279 (55.9)	<0.001
Comorbidities ± SD	1.41 ± 1.38	1.99 ± 1.47	1.17 ± 1.07	1.34 ± 1.26	<0.001
Elective Admission (%)	424,708 (78.9)	139,140 (79.6)	207,584 (81.2)	22,228 (68.2)	<0.001
Academic Hospital (%)	286,938 (54.0)	90,022 (52.2)	140,693 (55.6)	20,521 (64.0)	<0.001
Hospital Size					
Small (%)	69,779 (12.2)	21,278 (11.5)	33,942 (12.5)	3,097 (8.9)	<0.001
Medium (%)	119,361 (22.1)	37,101 (21.3)	56,665 (22.1)	6,898 (21.1)	<0.001
Large (%)	346,971 (65.1)	115,499 (66.6)	164,152 (64.9)	22,311 (69.0)	<0.001
Hospital Location					
Northeast (%)	78,219 (15.0)	22,784 (13.5)	35,920 (14.5)	5,913 (18.8)	<0.001
Midwest (%)	127,727 (24.4)	41,261 (24.2)	67,155 (27.0)	7,686 (24.0)	<0.001
South (%)	226,516 (41.1)	76,191 (42.8)	106,005 (40.5)	13,190 (39.3)	<0.001
West (%)	106,710 (19.5)	34,674 (19.6)	46,950 (18.0)	5,856 (17.8)	0.035

All results are listed as N (%) except that age and number of Elixhauser comorbidities are reported as mean ± standard deviation (SD). P-values refer to comparison of Medicaid/Self-Pay and Private Insurance.

Table 2

Effect of Insurance Status on Odds of PSI

	Odds of PSI (Insurance Status Only)	95% CI	Odds of PSI (Insurance Status + Patient Characteristics)	95% CI	Odds of PSI (Insurance Status + Patient and Hospital Characteristics)	95% CI
Medicaid/self-pay	1.43 *	1.31 – 1.55	1.20 *	1.10 – 1.30	1.16 *	1.07 – 1.27
Elective Admission			0.76 *	0.69 – 0.84	0.77 *	0.69 – 0.84
Age			1.01 *	1.0 – 1.02	1.01 *	1.0 – 1.02
Female			0.79 *	0.74 – 0.83	0.79 *	0.75 – 0.84
Race						
Black			1.18	1.05 – 1.32	1.14	1.02 – 1.27
Hispanic			0.94	0.80 – 1.1	0.92	0.79 – 1.07
Asian			0.98	0.73 – 1.33	0.97	0.72 – 1.30
AIDS			1.53	0.56 – 4.2	1.43	0.54 – 3.75
Alcohol Abuse			1.29	1.09 – 1.52	1.25	1.06 – 1.48
Arthritis			1.21	1.02 – 1.42	1.2	1.03 – 1.41
Blood loss anemia			1.89 *	1.56 – 2.28	1.94 *	1.61 – 2.34
CHF			2.63 *	2.21 – 3.12	2.62 *	2.21 – 3.11
Chronic lung disease			1.33 *	1.23 – 1.44	1.33 *	1.23 – 1.44
Coagulopathy			3.28 *	2.9 – 3.7	3.23 *	2.87 – 3.64
Deficiency Anemia			1.20 *	1.08 – 1.33	1.22 *	1.10 – 1.35
Depression			0.96	0.88 – 1.05	0.96	0.88 – 1.04
Diabetes Mellitus			0.91	0.83 – 1.0	0.92	0.84 – 1.0
Diabetes with Chron. Cx.			1.11	0.89 – 1.39	1.1	0.89 – 1.37
Drug abuse			1.49 *	1.23 – 1.80	1.46 *	1.22 – 1.75
Electrolyte imbalance			3.82 *	3.52 – 4.15	3.78 *	3.48 – 4.10
Hypertension			0.84 *	0.79 – 0.90	0.85 *	0.80 – 0.90
Hypothyroidism			0.92	0.83 – 1.02	0.92	0.83 – 1.02
Liver disease			1.04	0.82 – 1.33	1.05	0.83 – 1.32
Lymphoma			2.18 *	1.55 – 3.07	2.08 *	1.49 – 2.90

	Odds of PSI (Insurance Status Only)	95% CI	Odds of PSI (Insurance Status + Patient Characteristics)	95% CI	Odds of PSI (Insurance Status + Patient and Hospital Characteristics)	95% CI
Metastatic cancer			2.51 *	2.09 – 3.03	2.34 *	1.96 – 2.80
Neurological disorder			1.54 *	1.34 – 1.77	1.54 *	1.34 – 1.76
Obesity			1.17 *	1.07 – 1.29	1.19 *	1.08 – 1.30
Paralysis			1.85 *	1.59 – 2.17	1.81 *	1.56 – 2.11
Peripheral vascular disease			1.52 *	1.24 – 1.89	1.52 *	1.25 – 1.86
Psychosis			1.17	0.99 – 1.39	1.19	1.0 – 1.4
Renal failure			1.31	1.03 – 1.66	1.33	1.05 – 1.68
Hospital Size						
Medium					1.22	1.03 – 1.47
Large					1.36 *	1.15 – 1.61
Academic Hospital					1.45 *	1.33 – 1.59
Hospital Location						
Midwest					0.72 *	0.62 – 0.83
South					0.77 *	0.67 – 0.88
West					0.75 *	0.64 – 0.87
Number of Observations	288,675		287,368		285,758	

All results are odds ratios. The results of three models are displayed: a univariable logistic regression analysis with insurance status as the sole explanatory variable, a multivariable logistic regression analysis with insurance status and patient characteristics (gender, age, race [Black, Hispanic, Asian, or other, all relative to White], admission source [elective relative to emergent or urgent], and Elixhauser comorbidities) as explanatory variables, and finally a multivariable logistic regression analysis with insurance status, patient characteristics (defined above) and hospital characteristics (hospital teaching status, hospital bed size [medium and large relative to small], and hospital region [South, West, and Midwest relative to Northeast]) as explanatory variables. The number of observations is also given for each model. Diabetes with chronic cx is diabetes with chronic complications.

* denotes statistical significance at $p < 0.001$.