Published in final edited form as:

J Pediatr Surg. 2013 January ; 48(1): 81–87. doi:10.1016/j.jpedsurg.2012.10.021.

Primary Payer Status is Significantly Associated with Postoperative Mortality, Morbidity, and Hospital Resource Utilization in Pediatric Surgical Patients within the United States

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Abstract

Purpose—Current healthcare reform efforts have highlighted the potential impact of insurance status on patient outcomes. The influence of primary payer status (PPS) within the pediatric surgical patient population remains unknown. The purpose of this study was to examine risk-adjusted associations between PPS and postoperative morbidity, mortality, and resource utilization in pediatric surgical patients within the United States.

Methods—A weighted total of 153,333 pediatric surgical patients were evaluated using the national Kids' Inpatient Database (2003 and 2006): appendectomy, intussusception, decortication, pyloroplasty, congenital diaphragmatic hernia repair, and colonic resection for Hirschsprung's disease. Patients were stratified according to PPS: Medicare (n=180), Medicaid (n=51, 862), uninsured (n=12,539), and private insurance (n=88,753). Multivariable hierarchical regression modeling was utilized to evaluate risk-adjusted associations between PPS and outcomes.

Results—Overall median patient age was 12 years, operations were primarily non-elective (92.4%), and appendectomies accounted for the highest proportion of cases (81.3%). After adjustment for patient, hospital, and operation-related factors, PPS was independently associated with in-hospital death ($p<0.0001$) and postoperative complications ($p<0.02$), with increased risk for Medicaid and uninsured populations. Moreover, Medicaid PPS was also associated with greater adjusted lengths of stay and total hospital charges ($p<0.001$). Importantly, these results were dependent on operation type.

Conclusions—Primary payer status is associated with risk-adjusted postoperative mortality, morbidity, and resource utilization among pediatric surgical patients. Uninsured patients are at increased risk for postoperative mortality while Medicaid patients accrue greater morbidity, hospital lengths of stay, and total charges. These results highlight a complex interaction between socioeconomic and patient-related factors, and primary payer status should be considered in the preoperative risk stratification of pediatric patients.

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Keywords

Payer status; Pediatric surgery outcomes; Healthcare reform

Introduction

A national emphasis on healthcare reform within the United States is aimed at extending both the availability and delivery of healthcare, with specific emphases on Medicaid and uninsured patient populations. The number and percentage of Americans receiving government-sponsored healthcare continues to increase, with 95 million Americans receiving government healthcare coverage in 2010¹. Medicaid and Medicare programs provide coverage for 15.9 and 14.5 percent of people respectively, while 64 percent of people are privately insured. Despite these opportunities for healthcare coverage, an estimated 49.9 million people remain uninsured¹. The effect of this disparity in healthcare coverage extends to pediatric populations, with 9.8 percent of children (7.3 million) and 15.4 percent of children in poverty living without health insurance¹. Thus, committed research efforts are warranted to determine the effect of payer status on childhood healthcare outcomes to support both patient risk stratification and effective health policy reform.

Uninsured and Medicaid payer statuses have been associated with increased risk-adjusted mortality and resource utilization for major surgical operations and poorer medical admission outcomes in adult patient populations^{2, 3}. Analyses of payer status in pediatric populations have identified critical disparities in the allocation of surgical treatment for children as a function of payer status yet the effect of payer status on pediatric surgical outcomes and resource utilization remains less well-defined^{4, 5}.

The purpose of this study was to examine the effect of primary payer status on morbidity, mortality, and resource utilization in children within the United States following pediatric surgical operations. An established national administrative database was used to achieve a comprehensive analysis for this potential association within a large, nationwide pediatric patient population.

Methods

Data Source

Patient data were obtained from the Kids' Inpatient Database 2003 and 2006 (KID) of the Healthcare Cost and Utilization Project (HCUP). KID represents the only current nationwide administrative dataset established for the analysis of healthcare systems for newborns, children, and adolescents. KID assimilates data from participating community hospitals every three years within the United States and encompassed 3,739 hospitals in 2006 and 3,438 hospitals in 2003⁶. Pediatric discharges, defined as patients with an age of 20 years or less at admission, are stratified as uncomplicated in-hospital birth, complicated in-hospital birth, and all other pediatric cases and further sorted by state, hospital, diagnosis related group, and a random number within each diagnosis related group⁷. Hospital weights are post-stratified in concordance with the National Inpatient Sample database based on ownership/control, bedsize, teaching status, rural/urban location, and U.S. region with the addition of a stratum for freestanding children's hospitals. National estimates are obtained according to the American Hospital Association standard and include patients with all sources of insurance. Systematic random sampling generates a broadly representative pediatric patient population undergoing surgical operations within the United States during the study period. The University of Virginia Institutional Review Board did not perform a

formal review for this study due to the absence of patient identifiers and the collection of these data for purposes other than research.

Patients

The International Classification of Diseases, Ninth Revision, Clinical Modifications (ICD-9-CM) procedure coding system was used to identify children within the KID dataset with one of the following diagnoses: intestinal intussusception (560.0), acute appendicitis (540.0, 540.1, 540.9), empyema (510.0, 510.9), pyloric stenosis (750.5), congenital diaphragmatic hernia (756.6), and Hirschsprung's disease (751.3)⁸. Patients were matched to corresponding procedure codes: small bowel resection, air contrast enema, appendectomy, decortication, pyloromyotomy, diaphragm repair, and colonic resection⁹. The selected operations were chosen to achieve a broad representation of both infant and childhood illness across a spectrum of risk for both postoperative morbidity and mortality. Patients were stratified according to primary payer status into four groups for comparison: Medicare, Medicaid, uninsured, and private insurance. Co-morbid measures and categories were assessed according to the Elixhauser method, a proven effective adjustment for mortality risk among surgical populations^{2, 10, 11}.

Risk-adjusted Outcomes

Adjusted in-hospital mortality, in-hospital complications, hospital length of stay, and total costs comprised the primary outcomes of interest in the analysis. In-hospital complications were classified according to the Guller et al. ICD-9-CM coding scheme as defined by the following categories: wound, infections, urinary, pulmonary, gastrointestinal, cardiovascular, systemic, and procedural^{2, 12}. Discharge records were reviewed to establish the unadjusted mean lengths of stay and total charges. Inpatient death was determined by the patient discharge status.

Statistical Analysis

Defined preoperative and hospital variables in addition to the unadjusted outcomes were compared using the analysis of variance for continuous variables and the Pearson χ^2 test analysis or Fisher exact test for categorical variables as appropriate. All group comparisons were unpaired.

Adjusted odds of in-hospital death and complication following the defined operations were calculated utilizing hierarchical multivariable logistic and linear regression modeling. Preoperative variables were determined *a priori* and selected based upon accepted clinical risk or potential confounding effect on the analysis of payer status among patient groups. Adjustments for each contributing covariate, defined as contributing cases to each outcome, were performed as a function of in-hospital death and in-hospital complication. Regression models included adjustments for variance estimated from the weighted study population^{2, 13}. The Wald χ^2 test was used during logistic regression to determine the statistical significance of the association between primary payer status and in-hospital death or in-hospital complication, while the β coefficient was compared for primary payer categories during linear regression for the outcomes of length of stay and total charges. Statistical model discrimination was evaluated using the area under the receiver operating characteristics curve (AUC), with values of 1.0 indicating perfect discrimination and values of 0.5 indicating results of equal to chance between groups. The Hosmer-Lemeshow test was used to assess the statistical significance of differences in each model's calibration across deciles for observed and predicted risk.

Sensitivity analyses were performed to validate the model discrimination and performance. Each model was then re-estimated following the removal of the most statistically significant

covariate as measured by the Wald statistic. The absence of attenuation in the observed effect with persistence of statistical significance following re-estimation reduces the potential for spurious results¹⁴. The sensitivity of each original model was validated after removal of this covariate, as the effect of primary payer status on the estimated odds of the outcomes was not substantially attenuated (<10%).

Categorical variables are presented as percentages of the group of origin and continuous variables are reported as means $\pm$ standard deviation. Logistic regression model results are represented by odds ratios (OR) with a 95% confidence interval. Representative *p* values are two-tailed and were considered statistically significant if $p < 0.05$. SPSS software version 17 (SPSS, Inc.) was utilized to perform data analyses.

Results

Patient and hospital characteristics

A weighted total of 153,333 children comprised pediatric surgical patients from 2003 and 2006 that underwent one of seven operations: appendectomy, intussusception reduction or resection, decortication, pyloromyotomy, congenital diaphragmatic hernia repair, or colonic resection for Hirschsprung's disease. Frequencies of all patient characteristics stratified by primary payer status are listed in Table 1. Patients with private insurance (57.9%) and Medicaid (33.8%) represented the largest payer groups. Patients were predominately male (62.8%) with a median age of 12.0 years [7.0, 16.0]. Appendectomy accounted for the majority of surgical operations (81.3%). Elective operations comprised 7.6% of all operations, with Medicare patients demonstrating the highest elective status percentage (16.8%).

Adjusted outcomes for the effect of primary payer status

In the setting of variable patient characteristics (age, sex, race, income, primary payer status, 29 co-morbid disease categories), operative characteristics (operation type, operative year, elective status), and hospital characteristics (size, region, teaching status, rural location), risk adjustment was performed to evaluate the independent effect of primary payer status on post-operative mortality and morbidity. Table 2 presents the adjusted odds ratios for the effect of primary payer status on mortality and post-operative morbidity for patients undergoing the select pediatric surgical operations.

Following risk factor adjustments for patient and hospital-related factors, primary payer status remained a highly significant predictor of mortality ($p < 0.0001$, Table 2). In comparison to children with private insurance, uninsured payer status conferred a greater than three-fold increased risk of mortality (OR: 3.72).

In the risk-adjusted model, multivariate analyses for postoperative complications also identified payer status to be an independent predictor of postoperative morbidity ($p = 0.02$, Table 2). In the composite morbidity model, Medicaid payer status conferred the highest adjusted odds ratio for post-operative complication (OR: 1.14) in comparison to private insurance. In addition, risk-adjusted hospital resource utilization was significantly associated with payer status, with Medicaid payer status conferring increased length of hospital stay and total charges in comparison to private insurance ($p < 0.0001$, Table 3). The presented findings were, importantly, dependent on the type of operation.

Discussion

This study identifies primary payer status as an independent predictor of post-operative mortality, morbidity, and resource utilization. The presented risk-adjusted outcomes indicate

that uninsured payer status is independently associated with increased in-hospital mortality following the selected pediatric surgical operations in comparison to that afforded by private insurance. In addition, Medicaid payer status is associated with increased composite post-operative morbidity, hospital length of stay, and resource utilization. Importantly, these findings are present following risk adjustment for patient demographic and co-morbid conditions in addition to hospital-related factors that are frequently encountered in low-income patient groups.

Prior to the present study, the effect of payer status on outcomes in pediatric surgery remained undefined. Uninsured and publically insured payer statuses have been identified as factors predisposing children to a higher rate of mortality following traumatic injury, introducing initial considerations for the effect of payer status on outcomes in pediatric healthcare¹⁵. Additional data in neonatal medicine in the analysis of 24,151 premature infants have further supported a correlation between Medicaid payer status and adverse outcomes and neonatal intensive care unit discharge processes¹⁶. The association of payer status on resource utilization has also been demonstrated in pediatric depression admissions, with private payer status conferring a shorter length of admission in comparison to public payer statuses¹⁷. These related studies support awareness for the complex socioeconomic factors that influence outcomes in the care of children. Parallel studies in adult surgical populations have established primary payer status as a principal and independent determinant of risk-adjusted morbidity, mortality, and resource utilization, imparting a foundation on which to evaluate this potential relationship in pediatric surgical patients^{2, 18, 19}.

Access limitations in the medical and surgical care of children have been identified in pediatric subspecialty care and are proposed correlates to primary payer status. Recent research efforts have established disparities in access to surgical treatment for children with public insurance in comparison to patients with private payer status. In the analysis of 2,995 children under the age of 24 months with cleft palate, public insurance status was associated with a delay in cleft palate repair in comparison to children privately insured²⁰. This finding was considered a significant predisposing risk factor for the future development of improper speech and hearing²⁰. A corresponding survey study in Southern California, a state with the highest rate of public healthcare coverage, revealed that 97% of otolaryngologists would provide consultation to a child with commercial insurance while only 27% would provide the same service for children with public coverage²¹. In addition to these findings, the type of care has been shown to differ as a function of primary payer status among children. In pediatric neurosurgical literature, private insurance status has been demonstrated to confer a greater rate of surgical treatment for children with intractable temporal lobe epilepsy⁴. Analysis of payer status in children with appendicitis demonstrated an increased application of laparoscopic appendectomy compared to open appendectomy for children with private insurance at non-children's hospitals⁵. Uninsured children living below the poverty line have also been shown to experience the lowest immunization coverage, highlighting significant access limitations within pediatric medicine²². These data demonstrate that primary payer status is a determinant of both access and allocation of care for children.

The finding that primary payer status is associated with postoperative outcomes has a presumptive multi-factorial origin. An initial consideration for this effect in the present study is demonstrated in the finding that uninsured children more commonly underwent non-elective operations. The higher incidence of urgent or emergent operations within the uninsured payer group parallels prior reports in adult literature, with operative status having a documented association with negative outcomes in both adult and pediatric surgical populations^{2, 23, 24}. In the present analysis, the applied risk-adjusted model accounted for operative status and payer status differences remained significant. Inherent to emergent

operative status is the potential confounding influence of inadequate resuscitation, which may also contribute to poorer outcomes. Second, bias among healthcare providers must be considered as a potential influence for the observed findings. Included in the present analysis are conditions managed exclusively by pediatric surgeons. For select operations, expert consultation at centers with higher operative volumes has been shown to both improve postoperative outcomes and decrease cost^{25, 26}. For many, private insurance affords referral to specialty centers while patients with Medicaid and uninsured payer statuses may have less latitude in the selection of a surgeon. In addition to these referral patterns, primary care diagnostic patterns may differ as a function of payer status. Demographic study of adult emergency department patients has demonstrated decreased radiographic studies for patients with uninsured payer status, which may predispose patients to a delay in the diagnosis of surgical conditions²⁷. These findings may translate to the pediatric emergency care setting, especially in non-specialized centers. Furthermore, immeasurable familial influences are integrated in the evaluation of childhood illness and may account for the effect of payer status on childhood operative outcome. In the study of children with inflammatory bowel disease, a significant increase in both health services utilization and operative risk have been demonstrated in children from lower income families²⁸. These findings suggest that lower socioeconomic status may be associated with decreased recognition of pediatric surgical illness in addition to limited access to care, which may also account for the increased emergent operations observed in the presented uninsured patient population. Within the pediatric population, the dependency of children on parental support and the effect of parental behaviors must be considered when evaluating the influence of poverty and limited resources on fundamental healthcare measures within the home. Proposed factors in adult healthcare for disparate healthcare outcomes among uninsured and publically insured patient populations have included language barriers, level of education, inadequate nutrition, and poor health maintenance^{3, 29}. Each of these factors is inherently linked to healthcare patterns in children and may account for the present findings. In addition to these considerations, the potential presence of unaccounted for variables in our analysis may have led to incomplete risk adjustment. However, after controlling for patient and hospital-related factors, payer status remained an independent predictor of mortality, morbidity, and resource utilization among pediatric surgical patients.

There are several limitations inherent to the presented findings. First, the retrospective study design introduces the potential for selection bias. The adoption of strict methodology and randomization of the KID database reduce the potential influence of this bias. In the review of national administrative databases, it is important to consider the potential for unrecognized miscoding within the presented diagnostic and procedure codes. The present analysis provides a statistical measure of association and does not allow a causal relationship to be established between payer status and risk-adjusted outcomes. Additionally, the use of discharge records does not include long-term outcomes and underestimates true incidences of perioperative mortality and morbidity following discharge. Use of discharge records does, however, limit the potential impact of dual insurance eligibility and cross-over between payer groups during an inpatient admission. Within the private insurance payer status group, a percentage of these children may have inadequate coverage and functionally represent the uninsured patient population. Finally, the constraints of the KID database do not allow comment regarding disease severity and introduce the potential presence of an unmeasured confounder. The absence of potential confounding influences is supported by our sensitivity analyses and it is unlikely that such a factor would alter our primary results.

Conclusions

Primary payer status is an independent predictor of postoperative morbidity, mortality, and resource utilization in pediatric surgical patients within the United States. Uninsured payer

status confers the highest risk-adjusted mortality for pediatric surgical patients in comparison to patients with private insurance. In addition, Medicaid patients accrue greater morbidity, hospital length of stay, and resource utilization. These results were dependent on the type of operation and identify a complex interaction of social, economic, and patient-related influences among pediatric surgical patients. Therefore, primary payer status should be considered for both preoperative risk stratification and healthcare reform within pediatric surgery.

Bibliography

1. DeNavas-Walt, CPB.; Smith, JC. U.S. Census Bureau. [Accessed February 28, 2011.] Income, poverty, and health insurance coverage in the United States. 2010. <http://www.census.gov/prod/2011pubs/p60-239.pdf>
2. LaPar DJ, Bhamidipati CM, Mery CM, et al. Primary payer status affects mortality for major surgical operations. *Ann Surg.* 2010; 252:544–550. [PubMed: 20647910]
3. Lantz PM, House JS, Lepkowski JM, et al. Socioeconomic factors, health behaviors, and mortality: Results from a nationally representative prospective study of us adults. *JAMA-J Am Med Assoc.* 1998; 279:1703–1708.
4. McClelland S 3rd, Curran CC, Davey CS, et al. Intractable pediatric temporal lobe epilepsy in the United States: Examination of race, age, sex, and insurance status as factors predicting receipt of resective treatment. *J Neurosurg.* 2007; 107:469–473. [PubMed: 18154015]
5. Hagendorf BA, Liao JG, Price MR, et al. Evaluation of race and insurance status as predictors of undergoing laparoscopic appendectomy in children. *Ann Surg.* 2007; 245:118–125. [PubMed: 17197974]
6. HCUP Databases. Healthcare Cost and Utilization Project (HCUP). Agency for Healthcare Research and Quality; Rockville, MD: Nov. 2011 <http://www.hcup-us.ahrq.gov/kidoverview.jsp> [Accessed February 29, 2012.]
7. Healthcare Cost and Utilization Project (HCUP). Agency for Healthcare Research and Quality; Rockville, MD: Jul. 2008 2006 Introduction to the KID. www.hcup-us.ahrq.gov/db/nation/kid/kid_2006_introduction.jsp [Accessed February 29, 2012.]
8. Public Health Service Health Care Financing Administration. International classification of diseases. 9th revision, clinical modification (ICD-9-CM). United States Department of Health and Human Services; Washington, D.C: 1991.
9. American Medical Association. CPT Code/Relative Value Search. 1995–2012. American Medical Association; Chicago, IL: <https://ocm.ama-assn.org/OCM/CPTRelativeValueSearch.do?submitButton=accept> [Accessed February 29, 2012.]
10. Elixhauser A, Steiner C, Harris DR, et al. Comorbidity measures for use with administrative data. *Med Care.* 1998; 36:8–27. [PubMed: 9431328]
11. Southern DA, Quan H, Ghali WA. Comparison of the Elixhauser and Charlson/Deyo methods of comorbidity measurement in administrative data. *Med Care.* 2004; 42:355–360. [PubMed: 15076812]
12. Guller U, Hervey S, Purves H, et al. Laparoscopic versus open appendectomy: Outcomes comparison based on a large administrative database. *Ann Surg.* 2004; 239:43–52. [PubMed: 14685099]
13. Rao J, Shao J. Modified balanced repeated replication for complex survey data. *Biometrika.* 1999; 86:403–415.
14. Lin DY, Psaty BM, Kronmal RA. Assessing the sensitivity of regression results to unmeasured confounders in observational studies. *Biometrics.* 1998; 54:948–963. [PubMed: 9750244]
15. Rosen H, Saleh F, Lipsitz SR, et al. Lack of insurance negatively affects trauma mortality in us children. *J Pediatr Surg.* 2009; 44:1952–1957. [PubMed: 19853754]
16. Brandon GD, Adeniyi-Jones S, Kirkby S, et al. Are outcomes and care processes for preterm neonates influenced by health insurance status? *Pediatrics.* 2009; 124:122–127. [PubMed: 19564291]

17. Sclar DA, Robison LM, Gavrun C, et al. Hospital length of stay for children and adolescents diagnosed with depression: Is primary payer an influencing factor? *Gen Hosp Psychiat*. 2008; 30:73–76.
18. Kelz RR, Gimotty PA, Polsky D, et al. Morbidity and mortality of colorectal carcinoma surgery differs by insurance status. *Cancer*. 2004; 101:2187–2194. [PubMed: 15382089]
19. Lapar DJ, Bhamidipati CM, Walters DM, et al. Primary payer status affects outcomes for cardiac valve operations. *J Am Coll Surgeons*. 2011; 212:759–767.
20. Abbott MM, Kokorowski PJ, Meara JG. Timeliness of surgical care in children with special health care needs: Delayed palate repair for publicly insured and minority children with cleft palate. *J Pediatr Surg*. 2011; 46:1319–1324. [PubMed: 21763828]
21. Wang EC, Choe MC, Meara JG, et al. Inequality of access to surgical specialty health care: Why children with government-funded insurance have less access than those with private insurance in southern california. *Pediatrics*. 2004; 114:e584–590. [PubMed: 15520090]
22. Molinari NA, Kolasa M, Messonnier ML, et al. Out-of-pocket costs of childhood immunizations: A comparison by type of insurance plan. *Pediatrics*. 2007; 120:e1148–1156. [PubMed: 17974710]
23. Hennein HA, Mendeloff EN, Cilley RE, et al. Predictors of postoperative outcome after general surgical procedures in patients with congenital heart disease. *J Pediatr Surg*. 1994; 29:866–870. [PubMed: 7931959]
24. Boxer LK, Dimick JB, Wainess RM, et al. Payer status is related to differences in access and outcomes of abdominal aortic aneurysm repair in the United States. *Surgery*. 2003; 134:142–145. [PubMed: 12947310]
25. Ly DP, Liao JG, Burd RS. Effect of surgeon and hospital characteristics on outcome after pyloromyotomy. *Arch Surg-Chicago*. 2005; 140:1191–1197. [PubMed: 16365241]
26. Safford SD, Pietrobon R, Safford KM, et al. A study of 11,003 patients with hypertrophic pyloric stenosis and the association between surgeon and hospital volume and outcomes. *J Pediatr Surg*. 2005; 40:967–972. [PubMed: 15991179]
27. White FA, French D, Zwemer FL Jr. Care without coverage: Is there a relationship between insurance and ed care? *J Emerg Med*. 2007; 32:159–165. [PubMed: 17307625]
28. Benchimol EI, To T, Griffiths AM, et al. Outcomes of pediatric inflammatory bowel disease: Socioeconomic status disparity in a universal-access healthcare system. *J Pediatr*. 2011; 158:960–967. [PubMed: 21227449]
29. Wallace LS, Cassada DC, Rogers ES, et al. Can screening items identify surgery patients at risk of limited health literacy? *J Surg Res*. 2007; 140:208–213. [PubMed: 17509266]

Table 1
Descriptive statistics for patient characteristics and operative features Median [25th, 75th quartile]

Variable	Overall	Medicare	Medicaid	Uninsured	Private Insurance
Weighted Frequency	153,333 (100.0%)	180 (0.1%)	51,862 (33.8%)	12,539 (8.2%)	88,753 (57.9%)
Patient age (years) ^a	12.0 [7.0, 16.0]	16.0 [10.5, 19.0]	9.0 [2.0, 14.0]	16.0 [11.0, 19.0]	12.0 [8.0, 16.0]
Female	37.2%	43.0%	36.0%	34.5%	38.0%
Elective Operations	7.6%	16.8%	7.5%	4.6%	8.1%
Operation Type					
Appendectomy	81.3%	81.7%	71.9%	91.3%	85.4%
Intussusception	6.3%	12.8%	8.5%	3.9%	5.3%
Decortication	1.9%	1.7%	2.1%	1.0%	1.9%
Pyloromyotomy	9.5%	3.9%	16.0%	3.7%	6.6%
CDH repair	0.8%	0.0%	1.1%	0.1%	0.7%
Hirschsprung's	0.2%	0.0%	0.3%	<0.01%	0.2%

Table 2

Hierarchical multivariable logistic regression results for risk-adjusted effect of primary payer status on inpatient mortality and morbidity

Primary Payer Type	Mortality Model ^a		Morbidity Model ^b	
	Odds Ratio (95% C.I.)	<i>p</i>	Odds Ratio (95% C.I.)	<i>p</i>
Medicare	4.68 (0.74–29.4)	<0.0001	1.08 (0.40–2.91)	0.02
Medicaid	1.24 (0.93–1.67)		1.14 (1.05–1.24)	
Uninsured	3.72 (2.21–6.27)		1.04 (0.91–1.18)	
Private Insurance	1.00		1.00	

C.I. = Confidence Interval;

^aModel Performance: Area Under Receiver Operating Characteristics Curve (AUC) = 0.98, Nagelkerke Pseudo R^2 = 0.50 with 52 degrees of freedom;

^bModel Performance: Area Under Receiver Operating Characteristics Curve (AUC) = 0.68, Nagelkerke Pseudo R^2 = 0.07 with 52 degrees of freedom. Model adjustment for patient characteristics (age, sex, race, income, primary payer status, 29 co-morbid disease categories) operative characteristics (operation type, operative year, elective vs. non-elective status) and hospital characteristics (size, region, teaching status, rural location).

Table 3

Hierarchical multivariable generalized linear regression results for risk-adjusted effect of primary payer status on inpatient length of stay and total charges

Primary Payer Type	LOS ^a		Total Charges ^b	
	β (95% C.I.)	<i>p</i>	β (95% C.I.)	<i>p</i>
Medicare	2.18 (−2.40, 6.77)	0.35	685.7 (−10999.2, 12370.6)	0.91
Medicaid	0.97 (0.67, 1.27)	<0.0001	2,678 (1138.4, 4019.1)	<0.0001
Uninsured	0.09 (−0.16, 0.35)	0.48	−457.7 (−1561.6, 646.1)	0.42
Private Insurance	1.00	-	1.00	-

C.I. = Confidence Interval;

^aModel Performance: R^2 0.31 with 52 degrees of freedom;

^bModel Performance: R^2 0.30 with 52 degrees of freedom. Model adjustment for patient characteristics (age, sex, race, income, primary payer status, 29 co-morbid disease categories) operative characteristics (operation type, operative year, elective vs. non-elective status) and hospital characteristics (size, region, teaching status, rural location).