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INTER-HOSPITAL VARIABILITY IN TIME TO DISCHARGE TO REHABILITATION AMONG INSURED TRAUMA PATIENTS

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Abstract

Background: Hospital costs are partly a function of length of stay (LOS), which can be impacted by the local availability of post-acute care (PAC) resources (inpatient rehabilitation and skilled nursing facilities), particularly for injured patients. We hypothesized that LOS for trauma patients destined for PAC would be variable based on insurance type and hospitals from which they are discharged.

Methods: We used the 2014-2015 National Inpatient Sample from the Healthcare Cost and Utilization Project (HCUP). We included all adult admissions with a primary diagnosis of trauma (ICD-9CM codes), who were insured and discharged to PAC. We then ranked hospitals based upon mean LOS and divided them into quartiles to determine differences. The primary outcome was inpatient LOS; secondary outcome was cost.

Results: 958,005 trauma patients met inclusion criteria. Mean LOS varied based upon insurance type (Medicaid vs. Private vs. Medicare: 12.7 days vs. 8.8 and 5.7; $p < 0.001$). Shortest LOS hospitals had a marginal variation in LOS (Medicaid vs. Private vs. Medicare: 5.5 days vs. 4.8 vs. 4.2, $p < 0.001$). Longest LOS hospitals had mean LOS that varied substantially (16.4 vs. 11.0 vs. 6.7 days, $p < 0.001$). Multivariate regression controlling for patient and hospital characteristics revealed that Medicaid patients spent an additional 0.4 days in shortest LOS hospitals and an additional 2.6 days in longest LOS hospitals ($p < 0.001$). The average daily

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cost of inpatient care was \$3,500 (SD \$132). Even with conservative estimates, Medicaid patients at hospitals without easy access to rehabilitation incur significant additional inpatient costs over \$10,000 in some hospitals.

Conclusion: Prolonged LOS is likely a function of access to post-acute facilities, which is largely out of the hands of trauma centers. Efficiencies in care are magnified by access to post-acute beds, suggesting that increased availability of rehabilitation facilities, particularly for Medicaid patients, might help to reduce length of stay.

Level of evidence: Epidemiologic, level III

Keywords

Rehabilitation; post-acute services; insurance status; trauma systems; healthcare utilization

Introduction:

Hospital costs are partly a function of length of stay (LOS), which has been previously associated with patient and hospital process-related factors.¹ However, LOS may also be impacted by the local availability of post-acute care (PAC) resources such as inpatient rehabilitation facilities or skilled nursing facilities. Furthermore, even when facilities are available, access to those resources may depend on the type of insurance a patient possesses. The Institute of Medicine (IOM) has documented substantial variation in spending for post-acute care spending, as well as variability in the number of rehabilitation and skilled nursing facilities by State. In fact, the IOM found that post-acute care spending accounted for 73% of the geographic variation in Medicare spending per beneficiary.² This suggests that variability in access exists. If so, this may directly impact a hospital's ability to discharge patients, resulting in unnecessarily longer lengths of stay, higher inpatient hospitalization costs, and impacting hospital benchmarking.³

Access to rehabilitation is particularly important for trauma patients, who frequently require discharge to rehabilitation and skilled nursing facilities post-injury in order to regain function and restore their quality of life. A recent study in Washington State found a 40% lower odds of mortality 1 year after injury for injured patients discharged to rehabilitation compared to similar patients who were not provided rehabilitation.⁴ PAC is also becoming increasingly important given that elderly patients are the fastest growing trauma population, many of whom require rehabilitation post-injury due to falls.^{5,6}

Even after controlling for socio-demographics and injury severity, uninsured hospitalized young adult trauma patients are less likely to receive rehabilitative care after serious injury and spend much longer recovering in hospital compared to those with insurance.^{7,8} However, differences in time spent awaiting rehabilitation for trauma patients with different types and quality of insurance are less well-documented. We hypothesized that for all trauma patients destined for PAC, LOS would vary based on insurance type. We further postulated that this would vary based on hospital, as different hospitals likely have different access to post-acute care beds. If true, this would suggest that a focus on improving access to post-

acute care destinations might help to improve patient outcomes as well as costs associated with excessive inpatient acute care hospital days.

Methods:

We queried the National Inpatient Sample (NIS) from the Healthcare Cost and Utilization Project (HCUP), a nationally representative all-payer database for inpatient hospitalizations that provides data for approximately 35 million weighted discharges from U.S. hospitals annually. We used the 2014 database and the first nine months of 2015 (January-September) that were consistent with International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9CM) coding, as the last three months of the 2015 database contained ICD-10CM coding. We included all admissions with a primary diagnosis of trauma based upon ICD-9CM codes (ICD-9-CM 800.0 to 959.0, excluding 905 to 924), who were age 18 and older, insured, and whose discharge disposition was post-acute care. We defined PAC using the HCUP standard, which included discharge to inpatient rehabilitation facilities, skilled nursing facilities, or long-term care hospitals. We excluded patients with missing cost data.

Patient demographic and healthcare utilization characteristics were compared across three primary insurance groups; Medicare, Medicaid and Private (including commercial and employer-based plans). Injury Severity Score (ISS) was calculated for each patient using the ICDPIC version 3.0 within Stata/SE version 14.2 (StataCorp, College Station, Texas).⁹ Major procedures were defined by the NIS as any procedure with an ICD-9-CM procedure indicator that is performed in the operating room, whether for diagnostic or therapeutic reasons.

To test the hypothesis that LOS prior to discharge to PAC varies by insurance type, we conducted a mixed-effects negative binominal regression with LOS as the outcome, insurance type (Medicare, Medicaid, Private) as the primary independent variable, and a random effect to account for clustering of patients in hospital. Patient-level control variables included in the model were age, sex, race/ethnicity, Injury Severity Score (ISS) calculated for using the ICDPIC version 3.0, income quartile for zip code of residence, and whether the admission included a major surgery/procedure. Hospital-level control variable included in the model were bed-size (small, medium, large), region, ownership (government, private non-profit, private investor-owned), and hospital teaching location (rural, urban non-teaching, urban teaching). The secondary outcome of cost was determined by converting charges to cost using conversion ratios provided by HCUP.

Sub-analysis was then performed based upon patient age, due to differences in insurance type in patients under and over the age of 65. Patients aged 65 and older, for example, would be far more likely to qualify for and be insured by Medicare. We therefore analyzed patients aged 18-64 analyzed separately from patients aged 65 and above.

In order to examine whether the effects of insurance status varied depending on hospital average LOS, we also repeated the analyses in patients treated in hospitals in the longest and, separately, the shortest quartiles of average LOS. Centers were rank ordered based upon

shortest to longest LOS to rehabilitation, and subsequently divided into quartiles by mean LOS. Hospital region, ownership, teaching status and bed-size were compared between groups.

The NIS is a nationally representative, all-payer database that provides data for approximately 35 million weighted discharges from U.S. hospitals annually. Survey weights were used to provide national estimates. As recommended, weights were not used in conducting regression analyses in this trauma-focused subsample of discharges.¹⁰ All analyses were conducted using Stata SE v14.2 and R. The study was exempted for review by the Stanford IRB as data were provided by HCUP in a de-identified format. Use of the NIS follows regulations within the data use agreement as defined by AHRQ.

Results:

A total of 464,119 patients had a primary diagnosis of trauma. When weighted, this represented approximately 2.4 million patients nationwide. The percent of patients discharged to PAC varied with insurance type. Of all adult trauma patients, 34.5% Medicare patients (n=160,128), 5.5% Private patients (n=25,357), and only 1.9% (n=8,915) Medicaid and 0.4% (n=2,016) self-pay patients were discharged to PAC. We then restricted our study sample to our defined conditions of being insured and discharged to PAC. Thus, 190,352 patients (weighted: 958,005) or 41% met inclusion criteria. Approximately 82% (n=156,793) were insured by Medicare, 5% (n=8,756) by Medicaid and 13% (n=24,803) by Private insurance. The additional 2,016 self-pay patients who were discharged to PAC (1.0% of all patients discharged to PAC) were excluded from analysis.

Patient demographic and utilization characteristics differed significantly across insurance types (Table 1). Medicaid patients were younger (50.5 years vs. 61.8 and 80.4 years for Private and Medicare, respectively; $p<0.001$) and more often male (55.7% vs. 45.2% and 29.6% for Private and Medicare, respectively; $p<0.001$). Injury severity score (ISS) was greatest among Medicaid patients discharged to rehabilitation (ISS greater than 15 in 27.6% vs. 24.8% and 9.0% for Private and Medicare, respectively; $p<0.001$). Operative intervention for trauma was also highest among Medicaid patients (72.0% vs. 70.8% and 65.0% for Private vs. Medicare, respectively, $p<0.001$).

The distribution of LOS across the overall sample is presented in Table 2. Overall, mean LOS for trauma patients discharged to rehabilitation was 6.4 days (SD: 0.1). Medicaid trauma patients discharged to rehabilitation had the longest length of stay (12.7 days vs. 8.8 and 5.7 for Private and Medicare, respectively; $p<0.001$). Mean costs were also highest for Medicaid patients (\$40,528 vs. \$30,087 and \$15,558 for Private and Medicare, respectively; $p<0.001$). The differences in costs between Medicaid and Private insurance were explained by the LOS, as the average daily costs for Medicaid and Private patients awaiting rehabilitation were the same (\$3,201 and \$3,407 per day, respectively; p value 0.23). In contrast, the lower mean costs for Medicare patients destined for rehab were due to both lower costs per day as well as shorter lengths of stay (Medicare \$2,739 per day, $p<0.001$).

Sub-analysis was then performed analyzing separately patient groups ages 18 to 64 years, and 65 and older. Among 196,616 trauma patients ages 18 to 64, 16% (n=31,246 patients) were discharged to rehabilitation. For this younger cohort discharged to rehabilitation, 30% (n=9,464) were insured by Medicare, 25% (n=7,787) by Medicaid and 45% (n=13,995) by Private insurance. When comparing clinical characteristics, younger patients being discharged to PAC had higher injury severity ((ISS>15: 25% vs. 9% in patients ages 65 and older, $p<0.001$) and more frequently underwent major procedures (73% vs. 64%, in patients 65 and older, $p<0.001$). Medicaid trauma patients under age 65 discharged to rehabilitation therefore had longer lengths of stay (13.3 days vs. 10.4 and 7.4 for Private and Medicare, respectively, $p<0.001$). Mean overall and average daily costs for patients showed similar patterns. The total costs for Medicaid vs. Private vs. Medicare were \$43,207 vs. \$37,936 vs. \$21,938 ($p<0.001$). Average costs for Medicaid vs. Private vs. Medicare were \$3,241 vs. \$3,659 vs. \$2,960 ($p=0.004$).

There were 243,766 trauma patients aged 65 or older (representing 1.23 million patients nationally). A majority of these were discharged to rehabilitation (65%, n=159,473). Of older adult trauma patients discharged to rehabilitation, 93% (n=147,560) were insured by Medicare, 1% (n=1,021) by Medicaid and 7% (n=10,908) by Private insurance. Older Medicaid trauma patients discharged to rehabilitation still had longer lengths of stay (7.5 days vs. 6.9 and 5.6 for Private and Medicare, respectively; $p<0.001$), but the total costs for costs for Medicaid vs. Private vs. Medicare were smaller in magnitude than the younger rehabilitation cohort at \$20,139 vs. \$20,059 vs. \$15,150, ($p<0.001$).

Hospital level analysis was then performed in order to analyze differences in time to discharge to rehabilitation. Among the 4,700 hospitals in the NIS sample, 4,456 met the two inclusion criteria of (1) treating adult trauma patients of one of three insurance types, and (2) having evidence that they discharged patients to rehabilitation (to ensure hospitals in areas without ready access to rehabilitation were not included in the analysis). Hospitals were rank ordered based upon mean LOS for their trauma patients and divided into quartiles based upon the mean LOS. Mean LOS differed between shortest LOS hospitals and longest LOS hospitals (4.3 vs. 8.0 days, $p<0.001$). When comparing LOS by insurance type within each hospital group, there were significant differences (Figure 1). The shortest LOS hospitals had a marginal variation in LOS based on insurance types (Medicaid vs. Private vs. Medicare: 5.5 vs. 4.8 vs. 4.2 days, $p<0.001$). In contrast, the longest LOS hospitals varied by as much as one week (Medicaid vs. Private vs. Medicare: 16.4 vs. 11.0 vs. 6.7 days, $p<0.001$). Mean costs of care were also lower across insurance types in the shortest LOS hospitals (Medicaid vs. Private vs. Medicare: \$19,055 vs. \$16,617 vs. \$13,762, $p<0.001$), as compared to the longest LOS hospitals (daily costs of Medicaid patients vs. Private vs. Medicare: \$51,582 vs. \$37,923 vs. \$17,525, $p<0.001$).

Patients within the hospitals with shortest LOS differed significantly from those with the longest LOS. Patients in the shortest LOS hospitals were overall older (79.3 vs. 74.0 years, $p<0.001$), more often female (72.1% vs. 63.2%, $p<0.001$), and of a higher income (zip income quartile 50-100%: 50.1% vs. 42.8%, $p<0.001$). Hospitals with the shortest LOS also had fewer Medicaid patients (3.1% vs. 6.3%), and more Medicare patients (88.2% vs. 77.2%, $p<0.001$).

Access to rehabilitation differed across the United States. Hospital level analysis revealed that the shortest LOS hospitals were more commonly found in the Midwest (41.6% of the top 25%). This included hospitals in the West North Central states including Missouri, the Dakotas, and Nebraska (n=267, 24.2%), and East North Central states such as Ohio, Illinois, Wisconsin, and Michigan (n=192, 17.4%). Hospitals in the longest LOS quartile were more often in the Southern part of the United States (47.1% of the bottom 25%). This included the South Atlantic states such as the Carolinas, Georgia and Florida (n=236, 21.1%), the West South Central states such as Oklahoma and Arkansas (n=221, 19.7%) and the East South central states including Kentucky, Tennessee and Alabama (n=71, 6.3%) (Figure 2). A full list of States by hospital division are available through HCUP.(HCUP)

Finally, in order to satisfy the statistical assumptions of our linear regression model, we performed a multivariate mixed effects negative binomial regression controlling for hospital, patient characteristics and injury factors (Table 3). Compared to patients with Medicare, patients with Medicaid had an additional 1.6 days longer LOS ($p<0.001$). In contrast, patients with private insurance had 0.5 more days compared to Medicare ($p<0.001$). The difference between insurance type became more pronounced when evaluating hospitals by LOS quartile. In hospitals with the longest LOS, patients with Medicaid or private insurance had an additional 2.6 days or 0.8 days longer LOS respectively ($p<0.001$). In hospitals in the shortest LOS quartile, patients with Medicaid or private insurance had an additional 0.4 days and additional 0.2 days longer LOS, respectively ($p<0.001$).

Discussion

Our study revealed that over 40% of trauma patients are discharged to rehabilitation post-injury, reflecting the urgent and increasing need for access to post-acute services, regardless of insurance status.^{11–13} This is an underestimate of true need, as this does not include those patients who require post-acute care, but do not have access due to lack of insurance. As expected, patients with Medicare and private plans were more often discharged to rehabilitation, but this could not fully be explained by patient characteristics. Medicaid patients in fact had a higher injury severity score and more often underwent operative intervention, indicating a greater burden of injury that would suggest need for rehabilitation. This also meant that they had the longest LOS, with patients under the age of 65 spending nearly an additional week in hospital awaiting discharge to PAC. While trauma care often focuses on the acute period, rehabilitation has been shown to have a significant impact on outcomes.^{14–16} The findings of this work suggest a lack of alignment between patient need and resources available based on insurance status.

Furthermore, length of stay for those patients with insurance who were ultimately discharged to rehabilitation varied substantially by insurance type. Overall, mean LOS for trauma patients discharged to PAC was 6.4 days (SD: 0.1), with LOS by insurance type varying by as much as 1 week. Medicaid trauma patients discharged to rehabilitation stayed approximately 13 days, compared to only 6 days for Medicare patients. This effect is seen across age groups, but particularly among patients under the age of 65. Within this younger group, the LOS stay difference is preserved, but young Medicare patients spend an average of 1 day longer in hospital than their elderly Medicare counterparts. This is likely due to the

fact that Medicare patients under 65 are a special cohort of patients with complex needs who qualify for coverage either through disability, end-stage renal disease or other select criteria.¹⁷ These patients under 65 meeting such criteria comprise 16% of the current U.S. Medicare population.¹⁷ They likely represent 30% of our under 65 cohort given that we limited our study sample to injured patients with a discharge destination of PAC, thereby potentially selecting for a group of patients with poorer baseline functional status.

Variability in LOS based upon type of insurance is likely a direct result of policy differences between Medicare and state-by-state Medicaid programs. For example, Medicare will pay for inpatient rehabilitation for up to 100 days in a benefit period after a hospitalization lasting 3 or more days.¹⁸ In contrast, Medicaid plans vary widely in their coverage for rehabilitation. Furthermore, variability exists in state-by-state Medicaid policies on approval for rehabilitation, exacerbating these differences.¹⁹ Therefore, Medicaid patients who require rehabilitation may spend longer in hospital while awaiting administrative approval for rehabilitation or end up doing most of their rehab during their acute hospitalization. Sensitivity of access to rehabilitation and public policy has been documented in the past. Immediately following implementation of the Inpatient Rehabilitation Facility (IPF) Prospective Payment System (PPS) Final Rule of May 2004, access to rehabilitation steadily declined.^{20,21}

As there is much focus on reducing healthcare costs and improving outcomes, it is important to recognize that limitations in access to PAC – particularly for Medicaid patients – contribute significantly to inpatient costs. The mean daily inpatient cost of Medicaid patients \$3,201 and they are admitted 6.5 days longer than the mean LOS of patients being discharged to PAC. This represents \$20,807 in excess inpatient costs per Medicaid patient, and approximately \$915 billion dollars when extrapolated to our weighted national Medicaid sample. It is worthwhile considering how redirecting these funds toward improved availability of PAC sites could result in both significant improvement in patient outcomes and improved inpatient resource utilization.

In addition to patient and policy differences, geographic location of a hospital may determine the number of beds locally available for rehabilitation. We discovered regional discrepancies in time to rehabilitation, as well as differences based upon rural vs. urban setting, and teaching status. Interestingly, hospitals with presumed good access to rehabilitation beds (as determined by shortest LOS for patients destined to rehabilitation) were most often located in the Midwest, and there was little difference between payer types in LOS. While this again may be a result of state Medicaid policy, the noticeable difference between LOS in each quartile suggests that some hospitals and regions have better access to post-acute care than others.

Our findings are consistent with the national distribution of PACs by region, as described in a study by the Office of the Assistant Secretary for Planning and Evaluation (ASPE).²² The highest volumes of PAC facilities were concentrated in the Midwest and Pacific regions, as well as in Texas. Furthermore, a Kaiser Family Foundation report on the national distribution of PAC similarly mapped the highest number of skilled nursing facility to the Midwestern states of Illinois and Ohio.²³ Previous studies have also highlighted issues

surrounding supply and demand of post-acute services in large urban settings where patients likely spend additional days in hospital waiting for rehab beds to become available, as the ratio of hospitals to post-acute care facilities is high.²⁴ Ultimately, further study is required to understand the regional and state-level factors by specific insurance beneficiary in order ensure that trauma patients in all areas of the country receive the best possible care.

There are several limitations to this study. This is a retrospective study, with inherent limitations determining causation based upon our findings. The NIS is a nationally representative administrative databases which provides valuable demographic, cost and healthcare utilization data. However, it does not include granular clinical data, nor trauma-specific information such as trauma center status or mechanism of injury. All trauma-related information (injuries and injury severity) was derived from ICD-9-CM codes, converted using the ICDPIC tool. Furthermore, the NIS does not differentiate between discharge to inpatient rehabilitation or SNF, therefore we were not able to determine which proportion of patients were discharged to either type of post-acute care. As well, the NIS uniquely captures data associated with inpatient hospitalizations. Consequently, we were not able to extrapolate upon outpatient outcomes of trauma patients discharged to rehabilitation, the burden of long-term disability, nor the out-of-hospital mortality rate (i.e. for patients who never survived to be admitted to hospital, or those who later died after discharge to rehabilitation). Finally, we did not have detailed geographic data regarding hospital location, therefore we were not able to confirm at the state or county level whether hospitals with the shortest mean lengths of stay were situated in areas with greater density of post-acute services. We hope that the findings from this study will lead to follow-up analyses with more robust clinical data from trauma registries and possibly linking to additional data regarding distribution of post-acute services throughout the country.

In order to build truly inclusive trauma systems within the U.S., ensuring appropriate access to post-acute facilities is an integral part of strengthening trauma care, as well as supporting the best possible functional and long-term outcomes for injured patients.

Conclusion:

Differences in time to discharge to rehabilitation and costs of hospitalization are based only upon patient demographics and insurance status. Our findings highlight that efficiencies in discharge are magnified at the facility level within certain trauma hospitals regardless of patient factors. This suggests these centers likely had improved access to post-acute care which helped to reduce length of stay. In order for trauma systems to be able to better integrate with post-acute care, a more comprehensive approach to resource planning is needed. Future studies should evaluate how to better inform policy aimed at incorporating access to rehabilitation for all insurance types in order to streamline inpatient healthcare utilization and reduce healthcare costs.

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Figure 1.
Differences in LOS by insurance type among hospital quartiles

**Shortest Mean LOS Quartile Hospitals
By Region**

**Longest Mean LOS Quartile Hospitals
By Region**

Figure 2.
Regional Distribution of Hospitals Discharging Patients to Rehabilitation, Based upon
Hospital Quartiles

Table 1.

Patient and Healthcare Utilization Characteristics for All Insured Trauma Patients Discharged to Post Acute Care, 2014-2015, Unweighted

Number (%) of all insured patients discharged to post-acute care	Medicare 156,793 (82.0%)	Medicaid 8,756 (5.0%)	Private 24,803 (13.0%)	P value
Patient Characteristics				
Age in 2014, mean (SE), years	80.4 (0.1)	50.5 (0.3)	61.8 (0.3)	<0.001
Age by Category, number (%)				
18-29 years	72 (0.1)	1,256 (14.3)	2,189 (8.8)	<0.001
30-44 years	666 (0.4)	1,580 (18.0)	2,151 (8.7)	
45-54 years	1,884 (1.2)	1,751 (20.0)	2,817 (11.4)	<0.001
55-64 years	6,072 (3.9)	2,931 (33.5)	6,225 (25.1)	
65-74 years	26,630 (17.0)	362 (4.1)	3,693 (14.9)	
75-84 years	50,025 (31.9)	362 (4.1)	3,788 (15.3)	
85 years and older	72,029 (45.9)	305 (3.5)	3,560 (14.4)	
Gender, number (%)				<0.001
Male	46,427 (29.6)	4,873 (55.7)	11,212 (45.2)	
Female	110,385 (70.4)	3,883 (44.3)	13,591 (54.8)	
Race, number (%)				<0.001
White	136,616 (87.1)	5,140 (58.7)	19,644 (79.2)	
Black	6,929 (4.4)	1,675 (19.1)	1,961 (7.9)	
Hispanic	7,652 (3.9)	1,218 (13.9)	1,523 (6.1)	
Other	6,015 (1.8)	735 (8.4)	1,287 (5.2)	
Zip Income Quartile, number (%)				<0.001
0-25 th Percentile	38,299 (24.4)	3,350 (38.3)	6,377 (25.7)	
25-50 th Percentile	42,886 (27.4)	2,189 (25.0)	6,282 (25.3)	
50-75 th Percentile	38,299 (24.4)	1,751 (20.0)	6,015 (24.3)	
75-100 th Percentile	34,834 (22.2)	1,104 (12.6)	495 (2.0)	
Injury Severity Score, number (%)				<0.001
Minor (ISS 0-8)	49,872 (31.8)	2,665 (30.4)	7,500 (30.2)	
Moderate (ISS 9-15)	92,663 (59.1)	3,655 (41.7)	11,117 (44.8)	
Major (ISS 16-25)	13,401 (8.5)	1,713 (19.6)	4,511 (18.2)	
Severe (ISS >25)	819 (0.5)	704 (8.0)	1,637 (6.8)	
Number Chronic Conditions, mean (SE)	2.8 (0.1)	2.6 (0.1)	2.5 (0.1)	<0.001
Healthcare Utilization				
Major Procedure, number (%)	101,933 (65.0)	6,282 (71.7)	17,569 (70.8)	<0.001
Length of Stay (LOS), mean (SE), days	5.68 (0.03)	12.66 (0.28)	8.83 (0.11)	<0.001
Mean Costs of Hospitalization (SE), \$				<0.001

Number (%) of all insured patients discharged to post-acute care	Medicare 156,793 (82.0%)	Medicaid 8,756 (5.0%)	Private 24,803 (13.0%)	P value
	\$15,558 (\$108)	\$40,527 (\$937)	\$30,089 (\$501)	

LOS: length of stay, ISS: Injury Severity Score SE: standard error

Table 2.

Distribution of LOS (in days) By Insurance Type

Insurance Type	Mean LOS (SD)	Median (IQR)	Maximum Number of Days	Total Number of Patients
Medicare	5.65 (4.8)	4.0 (3.0 – 6.0)	283	157,578
Medicaid	12.33 (16.6)	7.0 (4.0 - 14.0)	230	8,501
Private	8.78 (9.6)	6.0 (4.0 – 10.0)	298	24,815

LOS: length of stay; SD: standard deviation; IQR: interquartile range

Table 3.

Negative Binomial Mixed Effects Regression to Predict LOS, Based on Insurance Type

<u>Variable</u>	<u>Exp(Coefficient)</u>	<u>Additional Days</u>	<u>P-Value</u>
Intercept	4.71	--	<0.001
Payer Status			
Medicare		reference	
Medicaid	1.33	1.55	<0.001
Private insurance	1.10	0.47	<0.001
Race			
White		reference	
Black	1.08	0.37	<0.001
Hispanic	1.03	0.14	<0.001
Zip Income Quartile			
0-25 th percentile		reference	
25-50 th percentile	0.99	-0.04	<0.001
50-75 th percentile	0.98	-0.09	<0.001
75-100 th percentile	0.97	-0.14	<0.001
Injury Severity Score (ISS)			
0-8 (Minor)		reference	
9-15 (Moderate)	1.07	0.33	<0.001
16-25 (Major)	1.54	2.54	<0.001
>25 (Severe)	2.22	5.75	<0.001
Had Major OR procedure	1.27	1.37	<0.001
Hospital Region			
Northeast		reference	
Midwest	0.92	-0.38	<0.001
South	0.99	-0.01	<0.001
West	0.89	-0.52	<0.001
Hospital Teaching Location			
Rural		reference	
Urban Non-Teaching	1.06	0.28	<0.001
Urban Teaching	1.17	0.80	<0.001
Hospital Control			
Government		reference	
Private, Non-Profit	0.90	-0.47	<0.001
Private, For-Profit	0.92	-0.38	<0.001