Title

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Does Insurance Status Influence a Patient's Hospital Charge?

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Abstract

Background—There is obscurity regarding how U.S. hospitals determine patients' charges. Whether insurance status influences a patient's hospital charge has not been explored.

Objective—The objective of this study was to determine whether hospitals charge patients differently based on their insurance status.

Methods—This was an analysis of the FY 2011–2012 Florida Hospital Inpatient Data File (N=4.7 million). Multivariable regression analysis was used to adjust for patients' age, sex, length of stay, priority of admission, principal ICD-9-CM diagnosis, and All Payer Refined Diagnosis Related Group (APR DRG) subdivided by Severity of Illness subclass. Hospital fixed effects were included to account for differences in hospitals' markups.

Results—Compared to those with no insurance, patients with private insurance received hospital bills that were an average of 10.7% higher and patients with Medicare received bills that were an average of 8.9% higher. The impact of Medicaid coverage was imprecisely estimated, but the magnitude of the point-estimate was consistent with 3.5% higher charges to Medicaid patients, relative to the uninsured.

Conclusion—Conditional on patient characteristics, length of stay and expected intensity of resource utilization, patients with private insurance and patients with Medicare were charged more (before discounting) than their uninsured counterparts within the same hospital.

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Woodworth contributed to the conception and design of the study, and performed all statistical analyses. All authors contributed to the interpretation of the results and assisted in the preparation of the manuscript.

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1 Introduction

Total spending for hospital care in the U.S. increased by 4.1% to $971.8 billion in 2014, representing 32% of national health expenditures [1]. Only 3.2% of payments to hospitals come from patients directly. The remaining payments come from various government programs, employer-sponsored health insurance, and other indemnity schemes [1].

A unique attribute of the U.S. hospital market is that the amount that a hospital charges is unlikely to correspond to the amount that the hospital actually receives [2]. Moreover, the degree of separation between charges and payments varies from payer to payer [3,4]. To account for the expectation that 100% of charges will not be recovered, hospitals inflate the list prices of their services to ensure that aggregate payments will cover expenses.

Currently, the average U.S. hospital bill exceeds the cost of care by “many times over” [5]. However, while it is known that hospital charges are inflated, whether hospitals inflate charges equitably across patients with different sources of payment has not been explored. Given the complexity of services that hospitals provide and the private nature of medical bills, it is nearly impossible for an individual patient to assess whether his or her hospital bill is inflated to the same extent as those of other patients within the same hospital. Such a comparison would require finding another individual treated at the same hospital at a time when the same list prices were in effect, who had the same condition, the same length of stay, and who utilized identical services. Insurance companies have the ability to measure inter-patient variation in charges, but these comparisons are limited to patients with the same source of payment. As a result, nowhere in the healthcare system is it readily apparent whether hospitals apply list prices consistently from one payer type to the next. Furthermore, despite recent policy efforts focusing on the most commonly performed procedures [6,7], hospital pricing remains mysterious and opaque.

The objective of this study was to determine whether, given similar medical conditions and treatments, hospitals adjust their charges based on patients’ principal payer. This question is motivated by the observation that hospitals might have a financial incentive to charge particular patients more aggressively. The amount that a hospital receives for its services depends on the patient’s mechanism of payment, and different sources of payment involve different mechanisms.

For most patients with private insurance, the hospital receives a fixed percent of its total gross charge to the insurer [8]. These percentages are based on discount rates that are negotiated annually between individual insurers and hospitals. Because discount rates do not fluctuate with the base amount to which they are applied, hospitals can feasibly increase their revenue by increasing privately insured patients’ charges. For patients with public insurance, payments are generally regulated or negotiated based on diagnosis-related groups (DRGs) or number of inpatient days. Such DRG and per diem payment mechanisms render the hospital’s charges irrelevant. One exception, however, is Medicare’s outlier payments. For each DRG, Medicare establishes an upper threshold for costs. If the hospital’s “cost” of caring for the patient (i.e., the hospital’s total gross charge multiplied by the hospital’s cost-to-charge ratio) exceeds the Medicare threshold, then the hospital receives an outlier

payment equal to a fraction of the excess [9]. In this case, the hospital's total gross charge again becomes relevant–the higher the hospital's total gross charge, the higher the outlier payment. For patients without insurance, total gross charges are the opening bid in payment negotiations. However, in practice, there is usually little relationship between uninsured patients' charges and payments. Uninsured patients are able to afford full payment for only about 12% of their hospitalizations [10].

2 Background

Hospital charges are generated by tracking the number of units of each input product or service that is used in caring for a patient, multiplying each of these quantities by its corresponding unit list price in the hospital's chargemaster, and then adding the resulting products. Some "units" consist of a package (e.g., "room charge") that can be bundled or unbundled at the hospital's discretion.

Accordingly, differences in total gross charges across patients with different sources of payment could be explained by three mechanisms:

1. Some patients may receive more (or more expensive) products and services,
2. Conditional on utilization, some patients' products and services may be bundled or unbundled to increase their total charge, and/or
3. Conditional on utilization, some patients may be charged for a greater proportion of the products and services they consume.

Several prior studies identified surprising differences in how hospitalized patients are treated according to insurance status. For example, Haas and Goldman found that uninsured patients emergently hospitalized in Massachusetts in 1990 after acute trauma were less likely to undergo an operative procedure or physical therapy than privately insured patients, given the same injury severity and mechanism [11]. Among all critically ill adults under 65 years of age admitted to intensive care units in Pennsylvania in 2005–2006, uninsured patients had lower adjusted odds of receiving a central venous catheter, acute hemodialysis, and tracheostomy, relative to privately insured adults [12]. In a systematic review by the American Thoracic Society, patients who were uninsured and critically ill were more likely to have life support withdrawn, and less likely to have an invasive procedure or pulmonary artery catheterization, than similar patients with private insurance [13]. Because these disparities in treatment might reasonably lead to differences in charges, the challenge for this study is to compare patients who were similar in utilization but different in insurance status to determine whether mechanisms 2 or 3 were at play.

We know of no peer-reviewed evidence of the second mechanism. However, the Centers for Medicare & Medicaid Services (CMS) acknowledged that "a laboratory might receive an order for a panel of blood tests on a patient" and "instead of billing for the panel, the laboratory might attempt to increase its income by billing for each test separately." CMS denounced this practice, likening it to "ordering a value meal at a fast-food restaurant and then being charged the higher individual prices for each item." CMS further included unbundling on its list of common types of health care fraud [14]. If this billing maneuver

occurs more frequently among patients with a particular type of insurance, it could plausibly lead to differences in charges between patients who utilized similar services but had different sources of payment.

Regarding the third mechanism, we are unaware of any previously published evidence of under-charging, but it is also plausible that hospital staff may be more thorough in recording all consumed resources among patients with insurance. For example, if hospital staff know that a patient is uninsured and will therefore receive an itemized bill for each chargeable item, then they may be less likely to report all chargeable items, knowing that the (frequently low-income) patient will be liable for the entire charge.

3 Methods

3.1 Data

The data used in this study come from the Florida Hospital Inpatient File. This file contains encounter-level records on all hospital discharges in the state. We obtained records on discharges from October 1, 2010 through September 30, 2012. From this sample, we excluded discharges from non-general acute care hospitals and hospitalizations coded as "charity, professional courtesy, no charge, research/clinical trial, refusal to pay/bad debt, Hill Burton free care, research/donor that is known at the time of reporting". We further excluded all other hospitalizations in which the patient's recorded principal payer was not either private insurance, Medicare, Medicaid or self-pay. This procedure left us with a sample of inpatient encounters, all presumably deserving of a >$0 total gross charge.

For each record, we generated an All Patient Refined Diagnosis Related Group (APR DRG) and Severity of Illness (SOI) score using 3M software for FY2011 or FY2012, as appropriate. DRG systems are the primary tools used to classify hospitalizations according to intensity of resource use. Unlike the Medicare Severity (MS) DRGs used for paying hospitals in the Inpatient Prospective Payment System, 3M APR DRGs categorize all possible reasons for hospitalization into mutually exclusive groups, encompassing diagnoses and procedures across all patients (including children and women) enrolled in any type of health plan [15]. Additionally, each of the 315 base APR DRGs can be subdivided into four Severity of Illness (SOI) levels to further delineate expected resource use based on severity of illness.

The information we input to the software from the Florida data file was, for each hospitalization: the patient's age, sex, length of stay, source of admission, discharge status, admitting diagnosis, principal diagnosis, up to 30 secondary diagnoses, principal procedure, up to 30 secondary procedures, days to procedure(s), up to 3 external cause of injury codes, and present on admission indicator(s) for external cause of injury code(s). The APR DRG grouper was unable to return a SOI code for <0.01% of the encounters in our sample. These 1,059 observations were omitted as a final exclusion.

3.2 Main Analysis

We estimated the impact of insurance status on the amount a patient was charged using multivariable regression analysis. Because patients in different payer groups may differ in

resource utilization and randomization is not feasible in this setting, we adjusted for observed differences in patients' characteristics, conditions, duration of care, and expected intensity of resource utilization to construct an approximation for the counterfactual outcome.

Our estimating equation was as follows:

$$\ln(Total\ Charge_{\mathrm{i}})=\beta_0+\beta_1 Private_{\mathrm{i}}+\beta_2 Medicare_{\mathrm{i}}+\beta_3 Medicaid_{\mathrm{i}}+\zeta_{\mathrm{h}}+\delta_{\mathrm{i}}+\varepsilon_{\mathrm{ih}}$$

Subscript i denotes variation at the encounter level and subscript h denotes variation at the hospital level.

The dependent variable, *Total Charge*, was defined as "the total of undiscounted charges for services rendered by the hospital excluding professional fees". The dependent variable was log-transformed in order to measure the percent effect of the right-hand side variables on total charge. To prevent missing values in response to the log transformation, values of $0 were replaced by $0.01.

The independent variables, *Private*, *Medicare* and *Medicaid*, consisted of binary indicators for principal payer. *Self-Pay* was omitted for a reference. Private insurance was defined as including all forms of commercial health insurance, including health maintenance organizations (HMOs), preferred provider organizations (PPOs), and self-insured plans. Medicare and Medicaid each consisted of fee-for-service and managed care plans. Self-pay served as an indicator for no health insurance.

The control variables, denoted by vectors ζ_h and δ_i, included fixed effects for hospital of admission as well as fixed effects for distinct values within the categories of sex, age (years), length of stay (days), priority of admission, principal diagnosis and APR DRG/SOI. To account for SOI, each base APR DRG category was split four ways, leading to a total of 315*4=1,260 possible APR DRG/SOI values. In total, our model contained 2,852 fixed effect control variables (Table 1). These allowed us to capture the bounce that each characteristic independently contributed to total charge. Error term ε contained residual noise.

To account for the possibility of correlation in unobserved predictors of charges among people who visited the same hospital, we clustered standard errors by hospital of admission. Standard errors were also corrected for heteroskedasticity. The coefficients of interest were β_1, β_2 and β_3. These are respectively interpreted as the average percent effect of having private insurance, Medicare, and Medicaid, as opposed to no insurance, on total charge.

3.3 Supplementary Analysis

To further explore the relationship between insurance status and hospital charges, we conducted three sets of supplementary analyses. Each used the same regression as the main analysis, but either changed the dependent variable and/or omitted particular observations.

First, we re-estimated the original model but changed the dependent variable to an indicator for any (>$0) charge for inpatient care. A linear probability model was used. This analysis was to test for the presence of under-charging under-insured patients (i.e., mechanism 3). Because charity cases were excluded from the original sample, all observations in the original sample were presumably deserving of a >$0 total charge. Any residual cases with $0 in total charges would be clear cases of under-charging, and so the payer coefficients in this regression should not be statistically significant unless insurance status is correlated with being under-charged. We further tested for the presence of under-charging by re-estimating the original model but dropping encounters with $0 in total gross charges. The payer coefficients in this regression should mirror those in the original model if insurance status is uncorrelated with not being charged.

Second, we measured the relationship between insurance status and the likelihood of accruing any (>$0) charge within each of the 25 possible billing sub-domains using a linear probability model. We note that these estimates should be treated with a degree of caution. If utilization of a service line is influenced by insurance status, then we would expect positive coefficients on the payer variables in these regressions. Similarly, if accruing a charge for utilization of a service line is correlated with insurance status, conditional on utilization, then we would also expect positive coefficients on the payer variables. As such, this analysis is incapable of disentangling the presence of under-charging the under-insured (i.e., mechanism 3) from persistent disparities in care (i.e., mechanism 1). However, inspecting particular categories may be insightful for elucidating the mechanism. If we observe positive coefficients in categories where it is unlikely that a patient within a given ARP DRG would be withheld the service–for example, surgical patients not being charged for an operating room–then this would provide suggestive evidence of mechanism 3.

Third, among the patients who accrued a charge within a given billing sub-domain, we measured the relationship between insurance status and the amount that the patient was charged. If *being* charged for a particular service line accurately reflects utilization of that service line, then positive coefficients on the payer variables in these regressions will either suggest that well-insured patients received additional care within those service lines (i.e., mechanism 1) or that well-insured patients were charged more aggressively for similar care (i.e., mechanism 2). Again, this analysis is incapable of disentangling the mechanism. However, focusing on particular categories where there is little room for variation in the intensity of care within an APR DRG may shed light on the most probable mechanism. For example, because we would expect consistency in the “intensity” of anesthesia within most APR DRGs, disparities in anesthesia charges would be suggestive of mechanism 2.

4 Results

4.1 Patient Characteristics

Descriptive statistics are presented in Table 2. Of the 4,712,790 hospitalizations in our sample, 24% were covered by private insurance, 48% by Medicare, 21% by Medicaid, and 7% were reported as self-pay.

In the absence of controls, hospital charges noticeably varied across payer types. Persons covered by Medicare accrued the highest average charge at $52,110. Persons covered by Medicaid accrued the lowest average charge at $31,711. These differences in charges may, in part, be attributed to the differences in the care rendered to individuals who were admitted to the hospital within each payer category as there was substantial variation in severity of illness.

Over 70% of Medicare and uninsured hospital admissions were classified as being of emergency status, defined as requiring “immediate medical intervention as a result of a severe, life threatening or potentially disabling condition”. Emergency admissions accounted for fewer than half of the hospitalizations among patients with private insurance and Medicaid. Instead, one quarter of privately insured admissions were elective. One in five Medicaid admissions was for pregnancy or delivery.

4.2 Differences in Charges

The regression-adjusted coefficients for the impact of principal payer on total charge are presented in Table 3. Conditional on hospital of admission, patient characteristics and expected intensity of resource utilization, privately insured patients were charged 10.7% more, and Medicare-covered individuals were charged 8.9% more, than those who were uninsured. Although Medicaid coverage was associated with a 3.5% higher charge relative to the uninsured, the impact of Medicaid was not statistically significant.

The results from our first supplementary analysis are presented in Table 4. Patients with private insurance were 0.8 percentage-point more likely to generate non-zero charges for their inpatient care and patients with Medicare were 0.6 percentage-point more likely to generate non-zero charges, relative to uninsured patients who were *not* coded as charity cases, although only the former difference was statistically significant. When encounters with $0 in total gross charges are excluded from the original regression, the estimates for the impact of payer source on total charges decrease substantially, but remain statistically significant. This dilution of the effect is consistent with zero-charging being a major driver of the overall charge disparities.

The results from our second supplementary analysis are presented in Table 5. For some service lines, we observe differences in the incidence of a charge that might reasonably stem from differences in actual utilization. For instance, patients with insurance were more likely to be charged for laboratory tests and physical therapy. However, privately insured and Medicare patients were also more likely to be charged for an operating room, conditional on APR DRG. Given that it would be relatively difficult to withhold an operating room from patients within a given APR DRG, based on the source of payment, this finding suggests that some uninsured patients may not generate charges for some billable services at some hospitals, even when those services were actually provided.

The results from our third supplementary analysis are presented in Table 6. Conditional on being charged for laboratory testing, patients with insurance were charged lower amounts for laboratory tests, relative to uninsured patients with the same APR DRG. Conditional on being charged for radiology/imaging, patients with insurance were charged lower amounts

for radiology/imaging, relative to uninsured patients with the same APR DRG. Conditional on being charged for anesthesia, we observe no statistically significant difference between of insured and uninsured patients' anesthesia charge. One obvious explanation for this counterintuitive finding is zero-charging. In other words, hospitals may be more likely to write-off an uninsured patient's charge if they only utilized a small-ticket item; it is less likely the hospital would write off the charge if the uninsured patient utilized a large-ticket item. Therefore, conditional on accruing a charge, we might expect the average charge for an uninsured patient to be higher than the average charge for an insured patient. This is because the insured group's mean conditional charge will be spread over patients with both high and low charges in that service line, whereas the uninsured group's mean conditional charge will be spread predominantly over patients with high charges.

5 Discussion

This study provides evidence from Florida in FY 2011–2012 that individuals who were admitted to the same hospital with the same baseline characteristics, who stayed the same length of time and who were expected to utilize similar resources, were charged differently based on their insurance status. Specifically, patients with Medicare and patients with private insurance were found to generate higher charges than their uninsured counterparts. This study is unique in the literature in that prior studies have focused on hospital payments or prices as outcome variables, and have treated undiscounted charges as exogenous [16–22].

It is important to note that we do not observe actual service utilization in our data. As a result, it is possible that our results are somewhat driven by disparities in treatment between patients who appeared clinically identical and received the same duration of care within the same hospital. However, for our estimates to be completely explained by differences in utilization would require a 10.7% treatment disparity between the average privately insured patient and the average uninsured patient with the same APR DRG. Hence, the magnitudes of our estimates suggest something more going on, beyond just residual disparities in care. Our supplementary analyses also provides some additional evidence of systematic differences in the thoroughness of itemization across payers. This finding, together with recent research demonstrating that hospitals strategically inflate markups in particular patient care departments to maximize revenue [23], underscores the possibility that hospitals are also inflating markups (by coding more thoroughly) according to patients' insurance status.

The incidence of disparate hospital charging has significant implications for the debate over hospital cost-shifting. Prior work has recognized the difficulty of assigning costs to patients, concluding that "the only practical way to [measure cost-shifting] is to assume that the ratio of costs to billed charges (but not reimbursements) is uniform from one insurer to another." When this is the case, payment differentials can be measured by "comparing the ratio of reimbursements to billed charges from each insurer" [16].

The current literature takes this approach [17–20,22]. However, despite strong suspicions that cost-shifting occurs [21], recent studies have found limited evidence of its occurrence [24]. Our results suggest that the implicit assumption underlying these studies–that charges

are unaffected by payer type–is flawed. Hospitals need not negotiate a more favorable discount rate to squeeze a particular insurer harder. Instead, hospitals could inflate their undiscounted charges to that particular insurer and effectively achieve the same outcome. Future studies on price discrimination and cost-shifting should take into account the endogeneity of hospital charges.

Disparate hospital charging also has implications for policymakers. This study's data come from before the Affordable Care Act's individual mandate and Medicaid expansion. With full implementation of the Affordable Care Act, over 20 million Americans have gained health insurance coverage [25]. Our results suggest that these individuals' hospital charges may now rise in response to their insurance acquisition, creating an obvious source of economic inefficiency. To the extent that these individuals may not actually be receiving additional services during their hospital stays, per patient healthcare expenditures will increase with no additional investment in health.

The primary strength of our study is that we compared individuals within APR DRGs and Severity of Illness subclasses. This allowed us to assess whether charges varied across individuals who seemingly should have utilized identical services [26,27]. We also compared individuals who visited the same hospital. This adjustment accounted for differences in case mix and other hospital-specific factors that might reasonably result in differences in charges across facilities [28,29].

Our study does, however, have certain limitations. First, although our list of covariates is extensive, not all predictors of patients' undiscounted charges are included in the analysis. If any of these omitted variables is correlated with principal payer, then this would bias the estimates. Second, our model cannot fully explain the mechanisms by which charge discrimination occurs. We cannot disentangle whether well-insured individuals were charged beyond what was merited, uninsured individuals were charged below the appropriate level, or disparities in care persist. Finally, our findings reveal patterns within one state. Florida may represent a unique setting as some of its hospitals have particularly high charge-to-cost ratios [29]. Validating these results with data from other states would be useful for establishing generalizability.

In spite of these limitations, our study does unambiguously show that when two clinically similar individuals enter the same hospital in Florida and stay the same length of time, the patient with private insurance or Medicare systematically leaves out with a higher gross hospital charge than the patient without insurance. We find some evidence that this disparity exists because hospitals are more thorough in itemizing well-insured patients' utilization. Further investigation is needed to explore the causes and consequences of this unrecognized hospital behavior.

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Key Points for Decision Makers

There is a lack of transparency regarding how U.S. hospitals assess charges.

Evidence from Florida suggests that, on average, hospitals charge patients with private insurance and Medicare more than they charge uninsured patients for similar care.

The mechanism through which hospitals charge-discriminate appears to be more thorough itemization of insured patients' utilization.

Table 1

Fixed Effect Control Variables

Category	Dichotomized Values
Hospital of Admission:	Y/N indicator for each general acute care hospital in the state of Florida (one omitted for reference)
Sex:	Y/N for male
Age:	Y/N indicator for each year of age (one omitted for reference)
Priority of Admission:	Y/N for “Trauma”
	Y/N for “Newborn”
	Y/N for “Elective”
	Y/N for ‘Urgent” (“Emergency”” omitted for reference”)
Principal Diagnosis:	Y/N indicator for each three digit ICD-9 diagnosis category (one omitted for reference)
Length of Stay:	Y/N indicator for each duration, in days (one omitted for reference)
APR DRG/SOI Combination[a]:	Y/N indicator for each combination of APR DRG and Severity of Illness (one omitted for reference)

[a] All Patient Refined Diagnosis Related Group (APR DRG); Severity of Illness (SOI)

Table 2

Descriptive Statistics

	Private Insurance (n=1,130,911)	Medicare (n=2,249,945)	Medicaid (n=1,012,961)	Self-Pay (n=318,973)
Mean Total Charge	$39,255	$52,110	$31,711	$33,690
Male	40.5%	45.7%	36.4%	53.9%
Mean Age	39 years	73 years	26 years	39 years
Mean Length of Stay	4 days	5 days	4 days	4 days
Priority of Admission:				
Trauma	0.9%	0.3%	0.5%	1.6%
Newborn	13.0%	0.1%	22.0%	7.4%
Elective	25.8%	16.8%	15.2%	7.0%
Urgent	15.9%	11.6%	15.3%	8.2%
Emergency	44.5%	71.2%	47.1%	75.8%
Principal Diagnoses:				
1st most frequent	Single liveborn, born in hospital, delivered without mention of cesarean section	Pneumonia, organism unspecified	Single liveborn, born in hospital, delivered without mention of cesarean section	Single liveborn, born in hospital, delivered without mention of cesarean section
2nd most frequent	Single liveborn, born in hospital, delivered by cesarean section	Obstructive chronic bronchitis with (acute) exacerbation	Single liveborn, born in hospital, delivered by cesarean section	Other chest pain
3rd most frequent	Previous cesarean delivery, delivered, with or without mention of antepartum condition	Urinary tract infection, site not specified	Previous cesarean delivery, delivered, with or without mention of antepartum condition	Single liveborn, born in hospital, delivered by cesarean section
4th most frequent	Pneumonia, organism unspecified	Unspecified septicemia	Pneumonia, organism unspecified	Acute pancreatitis
5th most frequent	Coronary atherosclerosis of native coronary artery	Atrial fibrillation	Normal delivery	Pneumonia, organism unspecified
6th most frequent	Other chest pain	Coronary atherosclerosis of native coronary artery	First-degree perineal laceration, delivered, with or without mention of antepartum condition	Cellulitis and abscess of leg, except foot
7th most frequent	Osteoarthrosis, localized, not specified whether primary or secondary, lower leg	Acute kidney failure, unspecified	Other current conditions classifiable elsewhere of mother, delivered, with or without mention of antepartum condition	Acute appendicitis without mention of peritonitis
8th most frequent	Diverticulitis of colon, without mention of hemorrhage	Congestive heart failure, unspecified	Post term pregnancy, delivered, with or without mention of antepartum condition	Chest pain, unspecified
9th most frequent	Atrial fibrillation	Subendocardial infarction, initial episode of care	Other chest pain	Coronary atherosclerosis of native coronary artery
10th most frequent	Acute appendicitis without mention of peritonitis	Osteoarthrosis, localized, not specified whether primary or secondary, lower leg	Abnormality in fetal heart rate or rhythm, delivered, with or without mention of antepartum condition	Subendocardial infarction, initial episode of care

Table 3

Regression-Adjusted Differences in Total Charges

	Percent Effect on Individual's Undiscounted Hospital Charge (95% Confidence Interval)	
Individual's Principal Payer:		
Private Insurance	10.7% ↑ (1.0% to 20.4%)	P=0.03
Medicare	8.9% ↑ (0.1% to 17.6%)	P=0.05
Medicaid	3.5% ↑ (−6.0% to 12.9%)	P=0.47
Self-Pay (i.e., uninsured)	Reference Category	
Fixed Effect Controls:		
Sex	Included	
Age (in years)	Included	
Length of Stay (in days)	Included	
Priority of Admission	Included	
Principal Diagnosis	Included	
APR DRG/SOI Combination[a]	Included	
Hospital of Admission	Included	
R-Squared	0.685	
Observations	4,712,790	

[a]All Patient Refined Diagnosis Related Group (APR DRG); Severity of Illness (SOI)

Table 4

Supplementary Analysis I: Under-Charging for Inpatient Care

	Percentage-Point Effect on Individual's Likelihood of Being Charged ANYTHING for Their Inpatient Care[a] (95% Confidence Interval)		Percent Effect on Individual's Undiscounted Hospital Charge, Excluding Encounters with No Charge (95% Confidence Interval)	
Individual's Principal Payer:				
Private Insurance	0.8 ppt ↑ (0.0ppt to 1.5ppt)	P=0.05	1.0% ↑ (0.1% to 1.9%)	P=0.03
Medicare	0.6 ppt ↑ (−0.1ppt to 1.3ppt)	P=0.09	1.1% ↑ (0.2% to 2.0%)	P=0.02
Medicaid	0.3 ppt ↑ (−0.4ppt to 1.0ppt)	P=0.42	0.5% ↓ (−1.3% to 0.3%)	P=0.23
Self-Pay (i.e., uninsured)	Reference Category		Reference Category	
Fixed Effect Controls:				
Sex	Included		Included	
Age (in years)	Included		Included	
Length of Stay (in days)	Included		Included	
Priority of Admission	Included		Included	
Principal Diagnosis	Included		Included	
APR DRG/SOI Combination[b]	Included		Included	
Hospital of Admission	Included		Included	
R-Squared	0.024		0.818	
Observations	4,712,790		4,704,115	

[a] After initially excluding charity cases

[b] All Patient Refined Diagnosis Related Group (APR DRG); Severity of Illness (SOI)

Table 5

Supplementary Analysis II: Percentage-Point Effect on Individual's Likelihood of Being Charged for Particular Services

	Independent Variables:				No. Obs.
	Private Insurance	**Medicare**	**Medicaid**	**Self-Pay**	
Dependent Variable:					
Accrued Any Room & Board Charge	--	1.0 ppt ↓**	--	Reference	n=4,712,790
Accrued Any Nursery Level I Charge	--	--	1.2 ppt ↑*	Reference	n=4,712,790
Accrued Any Nursery Level II Charge	--	--	--	Reference	n=4,712,790
Accrued Any Nursery Level III Charge	--	--	--	Reference	n=4,712,790
Accrued Any Intensive Care Charge	--	--	--	Reference	n=4,712,790
Accrued Any Coronary Care Charge	--	--	--	Reference	n=4,712,790
Accrued Any Pharmacy Charge	--	0.7 ppt ↑*	--	Reference	n=4,712,790
Accrued Any Medical & Surgical Supply Charge	--	1.0 ppt ↑**	--	Reference	n=4,712,790
Accrued Any Oncology Charge	--	--	--	Reference	n=4,712,790
Accrued Any Laboratory Charge	0.8 ppt ↑ *	1.5 ppt ↑**	--	Reference	n=4,712,790
Accrued Any Radiology or Other Imaging Charge	1.9 ppt ↓ **	--	--	Reference	n=4,712,790
Accrued Any Operating Room Charge	1.7 ppt ↑ **	0.9 ppt ↑**	--	Reference	n=4,712,790
Accrued Any Anesthesia Charge	0.7 ppt ↑ **	--	--	Reference	n=4,712,790
Accrued Any Respiratory Services or Pulmonary Function Charge	--	2.5 ppt ↑**	1.7 ppt ↑**	Reference	n=4,712,790
Accrued Any Physical Therapy Charge	0.6 ppt ↑ **	2.7 ppt ↑**	0.8 ppt ↑**	Reference	n=4,712,790
Accrued Any Occupational Therapy Charge	--	--	--	Reference	n=4,712,790
Accrued Any Speech Therapy or Language Pathology Charge	--	--	--	Reference	n=4,712,790
Accrued Any Emergency Room Charge	2.3 ppt ↓ **	1.3 ppt ↓**	--	Reference	n=4,712,790
Accrued Any Cardiology Charge	0.6 ppt ↓ **	2.4 ppt ↓**	1.5 ppt ↓**	Reference	n=4,712,790
Accrued Any Trauma Response Charge	--	--	--	Reference	n=4,712,790
Accrued Any Recovery Room Charge	0.6 ppt ↑ *	--	--	Reference	n=4,712,790
Accrued Any Labor Room Charge	0.7 ppt ↑ **	0.3 ppt ↑*	--	Reference	n=4,712,790
Accrued Any Treatment or Observation Room Charge	--	1.6 ppt ↑**	0.8 ppt ↑**	Reference	n=4,712,790
Accrued Any Behavioral Health Charge	0.6 ppt ↑ **	--	0.4 ppt ↑*	Reference	n=4,712,790
Accrued Any Other Charge	--	0.8 ppt ↑*	--	Reference	n=4,712,790

Only statistically significant estimates presented, with * if $p \leq 0.05$ and ** if $p \leq 0.01$. All estimates adjusted for the full set of controls (i.e., sex, age, length of stay, priority of admission, principal diagnosis, APR DRG/SOI and hospital of admission).

Table 6

Supplementary Analysis III: Conditional on Being Charged, Percent Effect on Amount Individual Charged for Particular Services

	Independent Variables:				No. Obs.
	Private Insurance	**Medicare**	**Medicaid**	**Self-Pay**	
Dependent Variable:					
Amount of Room & Board Charge	--	--	--	Reference	n=3,097,113
Amount of Nursery Level I Charge	--	1.5% ↑**	--	Reference	n=369,776
Amount of Nursery Level II Charge	--	--	--	Reference	n=38,433
Amount of Nursery Level III Charge	--	--	--	Reference	n=21,707
Amount of Intensive Care Charge	1.7% ↑ **	0.9% ↑**	0.7% ↓ *	Reference	n=1,312,608
Amount of Coronary Care Charge	--	--	--	Reference	n=521,826
Amount of Pharmacy Charge	--	8.6% ↑**	4.7% ↑ **	Reference	n=4,651,518
Amount of Medical & Surgical Supply Charge	7.0% ↑ **	7.2% ↑**	2.7% ↑ *	Reference	n=3,630,729
Amount of Oncology Charge	--	--	--	Reference	n=301
Amount of Laboratory Charge	6.0% ↓ **	4.4% ↓**	1.8% ↓ *	Reference	n=4,630,815
Amount of Radiology or Other Imaging Charge	1.9% ↓ **	11.2% ↓**	6.5% ↓ **	Reference	n=3,502,860
Amount of Operating Room Charge	4.1% ↑ **	1.8% ↑*	--	Reference	n=1,477,438
Amount of Anesthesia Charge	--	--	--	Reference	n=1,374,698
Amount of Respiratory Services or Pulmonary Function Charge	--	7.7% ↑**	5.5% ↑ **	Reference	n=1,601,315
Amount of Physical Therapy Charge	1.2% ↑ *	--	--	Reference	n=1,342,812
Amount of Occupational Therapy Charge	1.3% ↓ *	2.9% ↓**	--	Reference	n=520,090
Amount of Speech Therapy or Language Pathology Charge	2.1% ↑ *	--	--	Reference	n=268,655
Amount of Emergency Room Charge	--	--	0.9% ↑ *	Reference	n=2,961,233
Amount of Cardiology Charge	--	2.4% ↓**	2.6% ↓ **	Reference	n=1,100,830
Amount of Trauma Response Charge	--	--	--	Reference	n=21,376
Amount of Recovery Room Charge	--	2.9% ↑**	--	Reference	n=1,269,569
Amount of Labor Room Charge	--	19.4% ↓**	--	Reference	n=367,304
Amount of Treatment or Observation Room Charge	--	--	--	Reference	n=541,741
Amount of Behavioral Health Charge	--	--	--	Reference	n=42,791
Amount of Other Charge	5.9% ↑ **	10.9% ↑**	3.9% ↑ **	Reference	n=3,455,162

Only statistically significant estimates presented, with * if p 0.05 and ** if p 0.01. All estimates adjusted for the full set of controls (i.e., sex, age, length of stay, priority of admission, principal diagnosis, APR DRG/SOI and hospital of admission).