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Abstract

In this paper we analyze the cross-sectional relationship between hospital quality scores calculated by the Joint Commission on the Accreditation of Healthcare Organizations (JCAHO) and risk-adjusted indicators of outcomes and quality—mortality, rates of surgical/medical misadventures, adverse drug reactions, and length of stay—calculated from Nationwide Inpatient Sample discharge records. The results suggest that greater adherence to JCAHO accreditation standards is not associated with reduced mortality or lower probability of avoidable hospital or physician-caused adverse outcomes. Other hospital characteristics, such as teaching/non-teaching and urban/rural status, also exhibit little or no correlation with risk-adjusted survival and adverse-event probabilities.

Introduction

The interest among purchasers in managed care enrollment in the United States over the last decade has brought with it both excitement and debate. Earlier in the decade, purchasers were enthusiastic about the ability of managed care to contain costs and arrest the rate of growth in spending. Indeed between 1990 and 1997, the rate of health expenditures declined from 12.2 percent to 4.8 percent and the rate of growth in private insurance premiums declined from 4.0 percent to 3.2 percent (Levit et al. 1998). Most analysts attribute the decline to managed care. However, in recent years the enthusiasm over managed care has waned and has been replaced partially by the concern that enrollment in managed care plans will lead to a decrease in the quality of care. A concern over the quality of care that managed care plans deliver was one of the motivations that led to the development of the National Committee on Quality Assurance (NCQA) and in turn to HEDIS. Worries over managed care, the heavy participation of Medicare and Medicaid in managed care and continuous cuts in both programs have fueled a heated and more generalized concern that belt tightening and cost cutting in health care will lead to poorer quality. Several recent studies provide illustrations of the seriousness of the quality concerns. First, an Institute of Medicine Committee reported that thousands of deaths were linked to medical errors, more deaths than are attributable to breast cancer, traffic accidents and AIDS (*Washington Post* November 30, 1999). The IOM report, among other things, called for mandatory disclosure of adverse events by hospitals. In that spirit, a Veteran's Administration report just revealed that almost 3000 medical mistakes occurred during the period June 1997 to December 1998 with 700 of them resulting in deaths (*New York Times*, December 20, 1999, front page). Recently, United Health Care a large and one of the most respected managed care companies in the United States announced that it would no longer require gatekeepers to approve referrals to specialists because of widespread concerns that financial incentives impede referrals that are beneficial to patient health. Also, in response to a July 1999 study, *The External Review of Hospital Quality*, conducted by the Inspector General of the Department of Health and Human Services, Health Care Financing Administration Administrator Nancy Ann Min-DeParle states:

> We will hold the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) and the state survey agencies more fully accountable for their performance. For example, in our revised Conditions of Participation regulations, we will more clearly define our priorities for hospital surveys of basic health and safety issues such as medication errors and surgery mix-ups. We will also clarify JCAHO's responsibility in monitoring the performance of accredited hospitals and work with them to conduct more unannounced surveys and perform more rigorous assessments of each hospital's internal quality assurance process.

Though HEDIS and other report card approaches to monitoring and insuring quality have been developed only recently, voluntary accreditation of hospitals and other healthcare organizations as a way of assuring a minimal quality standard has been around since 1951. The Joint Commission on the Accreditation of Healthcare Organization is arguably the best known accrediting body in health care today. Hospitals who wish to be reimbursed by Medicare must stand for JCAHO accreditation or certification by their own state; 20 percent of all hospitals fail accreditation by either organization (Inspector General 1999). Yet, though JCAHO accreditation is widely accepted, it has never been subjected to empirical scrutiny. In particular, though JCAHO accreditation is supposed to lead to either a minimum level of or an improvement in quality in comparison to what might have existed without accreditation, there are no studies that investigate the relationship between accreditation and quality in order to determine how it is working. This paper has as its goal trying to understand the determinants of several measures of quality of care focussing particularly on whether JCAHO accreditation has a positive impact on the quality/outcomes we can measure. In particular, we estimate the statistical relationships across hospitals among measures of compliance with JCAHO accreditation standards (the overall JCAHO score and performance on the 45 subcategories), patient and hospital characteristics, and several hospital-specific measures of outcome which are thought to be correlated with quality: death, the probability of accidental poisonings, surgical/medical misadventures, adverse drug reactions and length of stay. In the following sections we discuss our data sources, hypotheses, estimation strategy, findings and conclusions. The reader should keep in mind that our results are **very** preliminary and that, as we explain below, much work remains to be done both in the measurement of several variables and in our econometric specification.

Previous Literature

Through the years there have been many studies of three determinants of hospital based outcomes death, cost and length of stay; they are too numerous to summarize in this paper. More recently there has emerged a small and growing literature on the determinants of hospital quality. While many of the newer articles on hospital quality still use measures of death as the dependent variable, they address two important problems that earlier articles on hospital outcome determinants did not.

First economists focused first on whether hospital characteristics such as teaching status and volume are associated with death rates and outcomes for specific diseases such as acute myocardial infarction. The authors of these newer studies correctly point out the need to model patient severity very carefully (see for example, McClellan et al. 1994; Vaccarino et al. 1999; Thiemann et al. 1999). Without appropriate clinical variables as controls, there is omitted variable bias that leads to inaccurate conclusions about the relationship between hospital characteristics and dependent measures of quality. Even newer research concentrates principally on how selection issues at the hospital level may introduce biases that may lead to inappropriate conclusions about the measured impact of hospitals on the probability of death. In particular, the focus of the econometrics is on the hypothesis that sicker patients may select hospitals that either offer more specialized procedures or provide higher volumes of certain types of more specialized care that is relevant to a patient's condition. Failure to control for this type of selection bias may lead to under or overestimates of the impact of relevant hospital characteristics such as volume or teaching status on measures of hospital quality. For example, in an important new paper entitled "Measuring Hospital Quality," Tay (1999) uses data on deaths from acute myocardial infarction as a proxy for quality in her exploration of quality differences across hospitals. She points out that patients may choose hospitals based on their health status, so that certain hospitals have sicker patients. Neglecting to control for such unobserved heterogeneity results in unmeasured selection bias with the result that measures of quality do not accurately capture the true effect of a given hospital on the probability of survival. Tay's patient data are reimbursed claims on all non-HMO Medicare beneficiaries from the states of California, Oregon and Washington. She finds that " selection does lead to a correlation between the patient's initial health status and hospital inputs, as measured by the characteristics of the hospital."

In similar research to Tay's, Gowrisankaran and Town (1999) [hereafter G-T], discuss the fact that discharge databases do not include rich enough data on severity to make appropriate severity adjustments. Since they recognize that it is often too expensive to collect additional information on clinical patient characteristics that could be merged into discharge data, they suggest an instrumental variables method to correct for selection bias in hospital mortality figures. Like Tay, their concern is that "hospitals may differ in the severity of illness of the patients that they treat, as higher quality hospitals may attract a sicker patient population. Thus mortality rates for a hospital will have at least two components: one component that reflects the severity of illness of the patients they treat and the other component that reflects the quality of care they provide. In econometric terms, if a patient's choice of hospital is correlated with his/her (unobserved) severity, then patient choice will be endogenous and any analysis will give inconsistent estimates of the hospital specific contribution to mortality." To address the problem of unobserved heterogeneity, G-T implement instrumental variables estimation using distance of the patient from the hospital as the instrument. They implement their IV model using discharge abstract data provided by the State of California, Office of Statewide Health Planning and Development (OSHPD) on all patients with pneumonia hospitalized between 1989-1994. The OSHPD data include constructed disease-staging which are used as controls. G-T, instrumental estimates provide support for the notion that that failing to correct for unobserved severity leads to bias in measuring hospital mortality.

Even with these recent econometric improvements in the hospital quality literature, there are few if any articles that address more specific quality-related hospital measures such as adverse drug reactions, and medical/surgical misadventures. Lack of attention to other measures of hospital quality is unfortunate. Most patients do not die as a result of hospital care but they are injured in hospitals in ways that often are irreparable. Yet, these types of bad outcomes are almost entirely preventable, making them excellent proxies for hospital quality. Whether the dependent measure in studies of hospital quality has been more widely analyzed (such as is the case with death, cost and length of stay), or rarely investigated (adverse drug reactions and medical misadventures), economists and other researchers apparently have never specifically addressed the impact of hospital accreditation on these variables. The existing studies which attempt to address the relationship between accreditation and measures of adverse outcomes have been more qualitative in nature and have not included empirical analyses; see for example, Gaynes and Solomon (1996), Young, Charnes, Desai et. al. (1997) and Wolfe (1999). Indeed an extensive medline search revealed only one empirical article focusing on the relationship between accreditation and any measure of adverse outcome. In addition, there are no more general empirical studies of the determinants of adverse hospital outcomes that we could find. In the one existing study of adverse events (medical misadventures, complications, adverse drug reactions) we could find, Hunter and Bains (1999) used administrative data on hospital admissions and day surgeries in Ontario, Canada, to investigate the correlation with these measures of hospital quality. Hunter and Bains made no attempt to control for patient (including severity) or hospital characteristics and did not investigate the interrelationships among adverse events and time, age and gender. They found increasing rates in all measures of adverse events over time.

In our very preliminary study, we attempt to address two important holes in the literature. First, in addition to death and length of stay, we look at several other quality-related measures of hospital outcomes. This is important since more individuals who are hospitalized do not die but can experience unexpected consequences as a result of their hospital stay. Second, we analyze what role, if any, JCAHO accreditation plays in reducing poor outcomes. We start by simply using common and older econometric techniques. It is our plan to introduce measures of volume and to better control for selection bias and patient severity in later enhancements.

Data, Hypotheses and Estimation Procedures

Our data set represents the merger of information included on the Hospital Performance Reports produced as a result of JCAHO accreditation site visits and The Hospital Cost and Utilization Project (HCUP-3) Nationwide Inpatient Sample data sponsored by The Agency for Health Care Policy and Research (AHCPR now AHRQ). The Joint Commission evaluates and accredits more than 18,000 health care organizations and programs. The JCAHO approach has led to the development of professionally based standards. JCAHO accreditation is a process that leads to the evaluation of the compliance of hospitals (and other health care organizations) with these standards. For each of the hospitals that undergo accreditation, Quality Check TM, located on the JCAHO website, provides the organization's name, address, telephone number, accreditation decision, accreditation date, current accreditation status and the effective date of the most recent accreditation. Hospitals must be visited every three years by a team of approximately three visitors comprised of a physician, nurse and hospital administrator. Prior to accreditation, the hospital's staff prepares self-studies of their operations. Site visitors read the self-study, visit the institution for about three days to observe activities, review documents, and interview patients and staff. The team spends a large period of time on patient units observing care as it is carried out. Surveyors do not judge quality of care directly. Rather, they focus on what activities are carried out, how well they are performed and the resulting effects/outcomes. Specific standards that are related are grouped into performance areas each element of which is scored from 1-5. Though the method for combining the performance area scores into an overall score is not explicit, there is almost a perfect correlation between the overall score assigned and the sum of the performance area scores (data not shown). An overall score of 0-100 is assigned by combining in some way the scores from each of the performance areas. Hospitals that receive a score of 1 on a standard are in substantial compliance, meaning the organization consistently meets all major provisions of the standards in the performance. A category 2 hospital means that the organization meets most provisions of the standard in the performance area (significant compliance). Partial compliance is signified by a score of 3. It means the hospital has met some of the standards. A score of 4 indicates minimal compliance; few of the provisions of the standard have been met. Noncompliance is a score of 5 and indicates that the organization fails to meet the provisions of the standards. The overall score determines the category of accreditation.

The JCAHO standards themselves address the hospital's level of performance in specific areas in terms of what actually is done. Standards are supposed to set forth performance expectations for activities that affect the quality of care by addressing two kinds of questions, "Is the hospital doing the right things?" and "is it doing it well?" The standards are updated periodically to reflect new developments in delivery and in methods of evaluating quality. The final accreditation score is not scaled. That is to say that scoring does not indicate a hospital's ranking in relation to others; rather, it indicates how well a hospital meets an absolute standard.

The Nationwide Inpatient Sample from HCUP-3 database is "designed to approximate a 20 percent sample of U. S. Community hospitals, including about 6.5 million discharges selected from a representative sample of 938 hospitals in 19 states (Department of Health and Human Services, Hospital Inpatient Statistics 1999). By linking the JCAHO and HCUP files, we are able to assess, at the hospital level, the relationship between several outcome measures and accreditation, as measured by the overall JCAHO score, holding constant a number of hospital and patient characteristics. JCAHO Hospital Performance Reports were available for only 204 of the 938 HCUP-3 hospitals, but we have no reason to suspect that the merged sample is unrepresentative (we address this issue below in our discussion of Table 2).

We hypothesize that the higher the overall accreditation summary score, the less likely is death, the shorter is the length of stay, and the lower the probability of a patient experiencing any of the adverse outcomes we measure. [In our analyses, in addition to testing the overall score variable, we also look at the impact of the score in each of the performance areas on death, cost and adverse outcomes. The performance areas included are: Patient Rights and Organizational Ethics, Assessment of Patients, Care of Patients, Education, Continuum of Care, Improving Organizational Performance, Leadership, Management of the Environment of Care, Management of Human Resources, Management of Information, Infection Control, Medical Staff, Nursing and Management. The complete list of the dimension sub-components and our variable names is appended. The complete list of these findings which are too lengthy to present are available from the authors but do not reveal any consistent findings.]

In addition to the accreditation score, we include a number of other independent variables in order to attempt to understand the determinants of outcomes. The other independent variables include vectors of variables representing individual patient characteristics, the characteristics of the hospital, and location and region of the country in which the hospital is located. The patient specific variables include: age (single year-of-age dummies), race (white, black, Hispanic, Asian/Pacific Islander, Native-American, other), gender (male 0 and female 1), the number of diagnoses, the principal diagnosis, the number of procedures performed on the patient, and the payer (Medicare, Medicaid, Blue Cross Blue Shield or BC/BS PPO, Commercial Insurance or Commercial PPO, an HMO or other type of managed care organization or self pay). Measures of diagnoses and procedures are our controls for severity. The hospital specific variables include: bedsize (small, medium, large), hospital control (government, private-non profit, investor-owned), and an indicator for whether the hospital had a teaching program (1) or not (0). Finally, we included regressors for region of the country (Northeast, Midwest, South, West), an indicator for rural (0) or urban (1) location, and the average income of the zipcode in which the hospital was located, meant as a proxy for patient income. *Ceteris paribus*, we would expect that greater severity is positively associated with a higher probability of death or any measure of adverse outcome. We hypothesize patients hospitalized in teaching hospitals would have fewer adverse events and a lower probability of death unless there are unmeasured severity factors, and that non-profit hospitals would outperform the others. We had no specific hypotheses about the other independent variables.

Our dependent variables, all taken from H-CUP3, are all binary except for length of stay. They are: ANY (measures the probability that ANY of the complications was found on the discharge abstract:), accidental poisoning by a drug, an adverse drug reaction, the probability of a medical/surgical misadventure, and inpatient death. Length of stay is continuous and transformed into natural logarithms. All regressions were estimated in SAS using the General Linear Models procedure.

Results

Table 1 includes a list of definitions of the dependent and independent variables; in Table 2 we present minima, maxima and mean. Table 3 presents the regressions for each of the dependent variables. Note that the regressor of most interest is SCORE, whose coefficient indicates the estimated relationship between the overall JCAHO score and the dependent variable. In the interest of focus and space we present in Table 3 only our estimates of the most interesting relationships. The full regressions are available from the authors.

Table 2 indicates that there are few differences between our merged sample that includes 204 hospitals and the 938 in the full HCUP-3 database. There is a slightly larger fraction of patients in the HCUP-3/JCAHO sample who are in the self-pay category and a slightly smaller percentage in the commercial category. Also, there is about a one percentage point difference in that the merged sample has a higher proportion of blacks than the full HCUP sample. Most importantly, there are no large differences in the dependent variables. Since both samples include millions of discharges, all differences are statistically significant.

We find that our regressions fit reasonably well, especially for cross sectional data (R-squared in the range 0.13 to 0.27—see Table 3). However, our hypothesis that a higher JCAHO score will lead to a high probability of survival or lower probability of poor outcomes is not confirmed in any of our regressions. Recall that a higher number indicates a better overall score so that a positive coefficient indicates the greater likelihood of an adverse outcome. In fact, the coefficients were all positive and significant indicating that the probability of an accidental poisoning, surgical/medical misadventure, an adverse drug reaction or death all *increased* as the SCORE increased. However, the coefficient on score in the LOS equation did support our hypothesis that greater compliance with accreditation standards lowers length of stay.

Our proxies for severity performed as expected. We included fixed diagnosis effects (for the patient's first-listed diagnosis), as well as the total number of diagnoses recorded and procedures performed. For this reason we report the significance of the group of variables (see F test and p-values in Table 3). More diagnoses are associated with a greater probability of experiencing any of the complications and of the adverse outcomes. More diagnoses also are associated with an increased length of stay and each construct of variables is highly significant. Similarly, more procedures and increasing age are associated with a greater probability of occurrence of any of the outcomes and increasing length of stay.

Turning to the hospital-level variables of interest, we note that for all the dependent variables except for accidental poisonings and death, non-teaching hospitals are associated with lower probabilities of adverse outcomes. As we suggest above, this result would not be expected unless there are unobserved severity factors that are endogenous to hospital choice not accounted for in our regressions—a problem we suspect. The coefficients on region of the country indicate that hospitals located in the west have statistically significant shorter lengths of stay than any of the other regions of the country. This result provides face validity to our other findings in that it corroborates virtually all other studies that control for region in length of stay regressions. However, none of the regions consistently outperform others for the other dependent variables. Similarly, the coefficients on ownership do not indicate a consistent picture. Neither for-profit, non-profit nor governmental hospitals are consistently associated with reductions in adverse outcomes. And contrary to several other studies, individuals who are black do not have a consistently higher probability of death or any of the other outcome measures. Also, none of the payment variables are associated all the time with better outcomes.

Conclusions

This is a first attempt to do two important things: assess the impact of compliance with JCAHO accreditation on two standard measures of hospital quality and performance, death and length of stay, and explore the determinants of three other hospital-related measures of quality not yet analyzed in the literature: the probability of accidental poisonings, surgical/medical misadventures, and adverse affects of drugs. Our results are highly preliminary and should be viewed with appropriate caution. However, the results suggest that whatever adherence to JCAHO accreditation does, it does not lead to greater survival or a lower probability of avoidable hospital or physician-caused adverse outcomes. Similarly, we could not identify any other hospital characteristics that are consistently associated with the likelihood of increased survival, lessened occurrence of adverse outcomes or shorter lengths of stay.

These preliminary findings are highly policy relevant. With much fanfare and press coverage, the IOM released its findings that an unacceptably large number of medical errors are taking place in hospitals, and that national reporting standards and active clinical interventions were needed to address the issue. Also, the Inspector General of DHHS is concerned that not enough attention is being paid to poor quality in unaccredited hospitals in State and JCAHO review processes. Assuming our results hold, the HCFA administrator appears correct in calling for greater accountability by JCAHO. If our results are corroborated after introducing improved measures of severity and after controlling for unobserved heterogeneity, we will have to devise new and better ways to improve the quality of hospital care.

Table 1
Variable Definitions

Variable Name	Variable Definition	Levels
AGE	Age	Continous Variable
NDX	Number of Diagnosis	1-30
NPR	Procedures	0-25
PAY1	Insurance Type	(1) Medicare (2) Medicaid (3) BC/BC PPO (4) Commerical/PPO (5) HMO/PHP/etc. (6) Self Pay
RACE	Race	(1) White (2) Black (3) Hispanic (4) Asian/Pacific Islander (5) Native American (6) Other
SEX	Sex	(1) Male (2) Female
ZIPINC	Income and zipcode in which hospital is located	(1) 0-25,000 (2) 25,001-30,000 (3) 30,001-25,000 (4) 35,001+
H_BEDSZ	Bedsize	(1) Small (2) Medium (3) Large
H_CONTRL	Control	(1) Govt, nonfederal (2) Private, not-for-profit (3) Private, investment-ow
H_LOC	Location	(0) Rural (1) Urban
H_REGION	Region	(1) Northeast (2) Midwest (3) South (4) West
H_TCH	Teaching	(0) Nonteaching (1) Teaching
SCORE	Accreditation score	

Table 2
Minima, Maxima, and Means for Dependent and Independent Variables

HCUP - n = 938 hospitals with approximately 6 million discharges
HCUP/JCAHO - n = 204 hospitals with approximately 1.8 million discharges

Variables		Mean		Minima		Maxima	
Dependent Variables		**HCUP**	**HCUP/JCAHO**	**HCUP**	**HCUP/JCAHO**	**HCUP**	**HCUP/JCAHO**
Accidental Poisonings		0.2	0.3	0	0	1	1
Surgical/Medical		1.5	1.7	0	0	1	1
Adverse Effects		2.5	2.3	0	0	1	1
ANY		4.2	4.2	0	0	1	1
AGE at Admission		46.05	47.16	0	0	123	118
DIED during Hospitalization		2.6	2.7	0	0	1	1
LOS		5.27	5.35	0	0	55130	3100
Independent Variables							
NDX		4.46	4.52	0	0	30	30
NPR		1.44	1.42	0	0	99	25
PAY 1							
	Medicare	35.70	36.80				
	Medicaid	18.50	18.00				
	BC/BC PPO	37.00	37.60				
	Commercial/PPO	5.10	4.90				
	HMO/PHP/etc.	0.20	0.20				
	Self-pay	3.50	2.50				
	Title V	0.00	-				
	CHAMPUS/VA	0.00	-				
RACE							
	White	73.80	73.80				
	Black	14.20	15.10				
	Hispanic	8.70	8.20				
	Asian/Pacific Islander	1.40	1.10				
	Native American	0.40	0.40				
	Other	1.60	1.30				
SEX							
	Male	41.5	41.6				
	Female	58.5	58.4				

Note: Sample sizes are so large that all differences are statistically significant

Table 2
Minima, Maxima, and Means for Dependent and Independent Variables

Variables		Mean		Minima		Maxima	
Dependent Variables		**HCUP**	**HCUP/JCAHO**	**HCUP**	**HCUP/JCAHO**	**HCUP**	**HCUP/JCAHO**
ZIPINC							
	$0-25,000	33.90	27.10				
	$25,001-30,000	20.80	20.50				
	$30,001-$35,000	15.60	18.50				
	$35,000+	29.70	33.90				
BEDSIZE							
	Small	15.4	14.8				
	Medium	32	34				
	Large	52.6	51.1				
CONTROL/OWN							
	Govt, nonfed	14.1	12				
	Pvt, not-profit	75.5	76.9				
	Pvt, invest-own	10.4	11.1				
URBAN/RURAL				0	0	1	1
	Rural	13.6	8.7				
	Urban	86.4	91.3				
LOCATION/TEACH STATUS							
	Rural	13.6	8.7				
	Urban Non-teaching	51.1	51.4				
	Urban Teaching	35.3	39.8				
REGION							
	Northeast	22	30.2				
	Midwest	25.2	18.6				
	South	34.2	40				
	West	18.6	11.3				
TEACH/NON-TEACHING				0	0	1	1
	Teaching	35.6	39.8				
	Non-Teaching	64.4	60.2				

Note: Sample sizes are so large that all differences are statistically significant

Table 3
OLS Regression Results for Binary Dependent Variables on Matched HCUP-3/JCAHO Sample

Variable Name	Accidental Poisonings	t score	p score	Surgical/ Medical	t score	p score	Adverse Effects of Drugs	t score	p score
Score	0.0000	0.4300	0.6698	0.0002	7.6700	0.0001	0.0002	7.3700	0.0001
Pay									
Medicare	0.0000	0.0600	0.9536	-0.0043	-5.3700	0.0001	-0.0041	-4.4900	0.0001
Medicaid	0.0000	-0.1500	0.8821	0.0000	0.0600	0.9519	-0.0030	-3.3800	0.0007
BC/BC PPO	0.0002	1.0300	0.3025	0.0022	3.0700	0.0022	0.0013	1.6100	0.1064
Commercial PPO	-0.0003	-1.0500	0.2951	-0.0001	-0.1200	0.9019	-0.0021	-2.1100	0.0351
HMO/PHP/etc.	-0.0022	-2.8300	0.0046	0.0102	4.1100	0.0001	-0.0039	-1.3600	0.1727
Self-pay (Omitted Category)	0.0000			0.0000			0.0000		
Race									
White	-0.0001	-0.3700	0.7090	0.0040	4.3200	0.0001	0.0048	4.4400	0.0001
Black	0.0006	1.9800	0.0476	0.0062	6.5300	0.0001	-0.0005	-0.4800	0.6309
Hispanic	-0.0002	-0.7300	0.4663	0.0049	5.0000	0.0001	0.0018	1.5600	0.1190
Asian/Pacific Islander	0.0001	0.1700	0.8652	0.0030	2.2100	0.0272	0.0031	1.9600	0.0500
Native American	0.0005	0.8300	0.4090	0.0000	-0.0100	0.9938	0.0002	0.0900	0.9248
Other (Omitted Category)	0.0000			0.0000			0.0000		
Sex									
Male	0.0002	3.3900	0.0007	0.0000	0.0000	0.9985	-0.0052	-18.8900	0.0001
Female (Omitted Category)	0.0000			0.0000			0.0000		
Zip Inc									
$0-25,000	0.0000	-0.0700	0.9406	-0.0029	-9.5500	0.0001	-0.0013	-3.5300	0.0004
$25,001-$30,000	0.0000	-0.0200	0.9870	-0.0031	-10.2900	0.0001	-0.0018	-5.1400	0.0001
$30,001-$35,000	0.0000	-0.2200	0.8286	-0.0025	-8.1200	0.0001	-0.0016	-4.5500	0.0001
$35,001+ (Omitted Category)	0.0000			0.0000			0.0000		
Bed Size									
Small	-0.0005	-4.3600	0.0001	-0.0020	-5.6400	0.0001	0.0013	3.2400	0.0012
Medium	0.0000	-0.0600	0.9494	0.0012	5.0500	0.0001	0.0023	8.3700	0.0001
Large (Omitted Category)	0.0000			0.0000			0.0000		
Control									
Govt, nonfed	-0.0001	-0.6000	0.5496	0.0045	10.1500	0.0001	-0.0019	-3.6200	0.0003
Pvt, not-profit	-0.0005	-4.1700	0.0001	0.0021	5.8800	0.0001	-0.0048	-11.4000	0.0001
Pvt, intest-own (Omitted Cat	0.0000			0.0000			0.0000		

Table 3
OLS Regression Results for Binary Dependent Variables on Matched HCUP-3/JCAHO Sample

Variable Name	Accidental Poisonings	t score	p score	Surgical/ Medical	t score	p score	Adverse Effects of Drugs	t score	p score
Location									
Rural	-0.0008	-5.9100	0.0001	-0.0073	-16.3800	0.0001	-0.0006	-1.2500	0.2119
Urban (Omitted Category)	0.0000			0.0000			0.0000		
Region									
Northeast	-0.0003	-2.4700	0.0136	0.0142	32.2900	0.0001	-0.0034	-6.6400	0.0001
Midwest	-0.0003	-1.4800	0.1390	0.0599	101.9500	0.0001	0.0086	12.6200	0.0001
South	-0.0009	-6.6700	0.0001	0.0049	11.3600	0.0001	-0.0083	-16.6800	0.0001
West (Omitted Category)	0.0000			0.0000					
Teaching									
Nonteaching	-0.0001	-0.9900	0.3242	-0.0094	-35.3300	0.0001	-0.0030	-9.7000	0.0001
Teaching (Omitted Category	0.0000			0.0000			0.0000		
Variable Name	**score**	**f score**	**p score**	**score**	**f score**	**p score**	**score**	**f score**	**p score**
NDX	0.7905	18.1800	0.0001	291.8852	638.8900	0.0001	785.1278	1270.8400	0.0001
NPR	0.0693	1.8500	0.0060	112.5067	285.6600	0.0001	49.5997	93.1300	0.0001
Age	2.3492	14.1100	0.0001	8.9404	5.1100	0.0001	24.5262	10.3700	0.0001
R^2	0.2785			0.1828			0.1215		

Table 3
OLS Regression Results for Binary Dependent Variables on Matched HCUP-3/JCAHO Sample

Variable Name	ANY	t score	p score	Died During Hospitalization	t score	p score	Length of Stay	t score	p score
Score	0.0004	10.0700	0.0001	0.0000	0.2100	0.8362	-0.0210	-10.4700	0.0001
Pay									
Medicare	-0.0079	-6.6200	0.0001	-0.0082	-8.5100	0.0001	-0.1237	-2.2100	0.0271
Medicaid	-0.0030	-2.6400	0.0082	-0.0059	-6.4800	0.0001	0.0049	0.0900	0.9268
BC/BC PPO	0.0036	3.3000	0.0010	-0.0059	-6.7900	0.0001	-0.5858	-11.5600	0.0001
Commercial PPO	-0.0027	-2.0700	0.0385	-0.0031	-2.9500	0.0032	-0.3842	-6.3800	0.0001
HMO/PHP/etc.	0.0030	0.7900	0.4282	-0.0091	-2.9700	0.0030	0.7378	4.2000	0.0001
Self-pay (Omitted Category)	0.0000			0.0000			0.0000		
Race									
White	0.0076	5.4400	0.0001	-0.0091	-8.1300	0.0001	-0.6826	-10.4800	0.0001
Black	0.0054	3.7700	0.0002	-0.0081	-7.0300	0.0001	-0.3235	-4.8100	0.0001
Hispanic	0.0054	3.6200	0.0003	-0.0057	-4.7900	0.0001	-0.1284	-1.8400	0.0660
Asian/Pacific Islander	0.0051	2.4900	0.0128	-0.0096	-5.8500	0.0001	-0.4743	-4.9800	0.0001
Native American	0.0000	0.0000	0.9974	-0.0089	-3.8500	0.0001	-1.0155	-7.5000	0.0001
Other (Omitted Category)	0.0000			0.0000			0.0000		
Sex									
Male	-0.0048	-13.4700	0.0001	0.0030	10.2900	0.0001	-0.2544	-15.1500	0.0001
Female (Omitted Category)	0.0000			0.0000			0.0000		
Zip Inc									
$0-25,000	-0.0042	-9.0300	0.0001	-0.0007	-1.9200	0.0551	0.2068	9.5100	0.0001
$25,001-$30,000	-0.0048	-10.4700	0.0001	-0.0006	-1.6500	0.0991	0.1343	6.2500	0.0001
$30,001-$35,000	-0.0040	-8.6700	0.0001	0.0011	3.0900	0.0020	0.2245	10.4200	0.0001
$35,001+ (Omitted Category)	0.0000			0.0000			0.0000		
Bed Size									
Small	-0.0006	-1.2100	0.2253	-0.0044	-10.4300	0.0001	-0.5207	-21.1400	0.0001
Medium	0.0038	10.4100	0.0001	-0.0001	-0.2700	0.7887	-0.1230	-7.2500	0.0001
Large (Omitted Category)	0.0000			0.0000			0.0000		
Control									
Govt, nonfed	0.0027	4.0200	0.0001	-0.0005	-0.8600	0.3876	-0.1394	-4.4500	0.0001
Pvt, not-profit	-0.0030	-5.4900	0.0001	0.0010	2.3200	0.0204	0.0356	1.4000	0.1602
Pvt, intest-own (Omitted Cat	0.0000			0.0000		0.0000			

Table 3
OLS Regression Results for Binary Dependent Variables on Matched HCUP-3/JCAHO Sample

Variable Name	ANY	t score	p score	Died During Hospitalization	t score	p score	Length of Stay	t score	p score
Location									
Rural	-0.0081	-12.0300	0.0001	0.0047	8.7200	0.0001	0.2882	9.1000	0.0001
Urban (Omitted Category)	0.0000			0.0000			0.0000		
Region									
Northeast	0.0107	16.0700	0.0001	0.0089	16.6600	0.0001	1.8468	59.4900	0.0001
Midwest	0.0645	72.4900	0.0001	0.0017	2.4200	0.0155	0.4662	11.2200	0.0001
South	-0.0041	-6.2900	0.0001	0.0031	5.9900	0.0001	0.6110	20.0800	0.0001
West (Omitted Category)	0.0000			0.0000			0.0000		
Teaching									
Nonteaching	-0.0119	-29.5900	0.0001	0.0004	1.2900	0.1955	0.1799	9.5800	0.0001
Teaching (Omitted Category	0.0000			0.0000			0.0000		
Variable Name	**score**	**f score**	**p score**	**score**	**f score**	**p score**	**score**	**f score**	**p score**
NDX	1979.9433	1889.0000	0.0001	226.1899	336.0000	0.0001	2377681.6013	1042.2200	0.0001
NPR	44.6429	49.4100	0.0001	233.0699	401.6200	0.0001	6261810.6387	3183.9200	0.0001
Age	43.8452	10.8300	0.0001	180.3315	69.9900	0.0001	84248.4432	9.6500	0.0001
R^2	0.1744			0.1331			0.2184		

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