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Hospitals with Higher Direct Cost Ratios Have Lower Readmission Rates

Ge Bai, PhD, CPA
Assistant Professor of Accounting
The Johns Hopkins Carey Business School

Tim Xu, MPP
The Johns Hopkins School of Medicine

Andrew T. Rogers, BS
The Johns Hopkins School of Medicine

Gerard F. Anderson, PhD
The Johns Hopkins Bloomberg School of Public Health

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ABSTRACT

Utilizing limited resources to generate the best quality of care for patients is one of the most pressing challenges faced by hospital executives. In this study, we examine how a hospital's direct cost ratio, defined as the cost directly related to patient care divided by the total cost of patient care, is associated with an important quality metric, the Medicare 30-day unplanned readmission rate. Using the 2014 Medicare Cost Report, Hospital Compare, and Final Rule Data from the Center for Medicare & Medicaid Services (CMS), we find that one standard deviation increase in the direct cost ratio is associated with fifteen fewer readmissions per 10,000 discharges, holding total patient care cost per adjusted discharge constant. Supplementary analyses show that the direct (indirect) cost per adjusted discharge is negatively (positively) associated with readmission rates. Our study recognizes the implication of cost structure on one important measure of hospital quality of care. The results provide hospital executives with useful guidance for making budgetary decisions.

I. Introduction

One of the goals of cost accounting research is to analyze how cost allocation affects organizational outcomes and to propose the most appropriate course of action based on cost efficiency and capability. For hospitals, perhaps no other organizational outcome is more critical than the quality of care (American Hospital Association 2016).[1] In this study, we examine whether hospital cost allocation, specifically the relation between the cost of direct patient care and the total cost of patient care, affects the quality of care.

The hospital industry is experiencing significant reforms in which new initiatives that link hospital payments with quality of care are being tested and can impact hospital profitability considerably (Bai and Anderson 2016). For example, in 2012, Medicare started the Hospital Readmissions Reduction Program (HRRP), which penalizes hospitals for up to 3% of their Medicare payments if the hospital's readmission rates for certain medical conditions are higher than expected based on its patient population characteristics.[2] HRRP and other payment initiatives provide financial incentives for hospitals to reduce readmission rates as well as to improve on other quality metrics, such as nosocomial infection rates and the level of care coordination.[3] Hospital executives, therefore, are under pressure to improve care quality in the face of budgetary constraints. It is necessary for them to make informed resource allocation decisions that lead to improved quality by knowing how cost allocation affects quality.

[1] In 2014, the United States spent $972 billion or 6 percent of its gross domestic product (GDP) on hospital care and the proportion of hospital spending relative to GDP is projected to keep increasing (CMS 2014; World Bank 2015; Keehan et al. 2016).

[2] For more information on HRRP, please refer to https://www.cms.gov/medicare/medicare-fee-for-service-payment/acuteinpatientpps/readmissions-reduction-program.html.

[3] For more information on CMS' hospital quality initiatives, please refer to ttps://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/index.html.

Most cost accounting studies regarding hospital cost behaviors examined hospitals' response to a changing regulatory environment (Eldenburg and Soderstrom 1996; Eldenburg and Kallapur 1997; Eldenburg and Kallapur 2000; Kallapur and Eldenburg 2005; Holzhacker, Krishnan, and Mahlendorf 2015) Our paper extends this literature by examining how the cost structure can influence hospital quality of care. Specifically, we focus on the relationship between direct patient care cost and total patient care cost, an aspect of cost structure that has received relatively little attention.

The clinical literature has suggested a positive link between the overall hospital spending and care quality. Joynt, Orav, and Jha (2011) showed that high-volume hospitals incurred higher costs, but had lower readmission rates for patients with congestive heart failure. Stukel et al. (2012) found that hospital spending is positively associated with care quality, as measured by mortality, readmissions, and cardiac event rates. Jha, Orav and Epstein (2011) documented that high-cost hospitals provided better care and generated greater patient satisfaction than low-cost hospitals. Romley, Jena, and Goldman (2011) concluded that higher spending was associated lower mortality for six common medical conditions. Silber et al. (2010) suggest that surgical patients in hospitals with higher costs had lower mortality. Romley et al. (2014) found that for children undergoing congenital heart disease surgery, hospital cost is negatively associated with mortality. While these clinical studies provide important insights into the positive link between hospital cost and quality, they all measure costs at the aggregate level and thus have limited ability to inform hospital executives of which specific types of spending are more effective for improving quality of care.

Hospital patient care cost (or operating cost) can be categorized into the direct cost and the indirect cost, based on whether a cost item is traceable to patient care services. Direct costs are traceable to patient care, such as operating room and radiology costs. Indirect costs are related to but not directly traceable to patient care, such as cafeteria and administrative costs. Since direct costs are more closely linked to patient care services than indirect costs, a greater percentage of spending on direct cost items might have a more beneficial effect on care quality than spending on indirect cost items. We hypothesize, therefore, that a higher direct cost ratio, defined as the direct cost divided by the total cost of patient care, will be positively associated with care quality.

We use the 2014 Medicare Cost Report, released in spring 2016 by the Center for Medicare & Medicaid Services (CMS), combined with data from the 2014 CMS Hospital Compare, the 2014 CMS Final Rule Data, and the 2014 U.S. Census Model-based Small Area Health Insurance Estimate (SAHIE) to create our sample for hypothesis testing. We measured hospital care quality using Medicare 30-day unplanned readmission rates, which are calculated by CMS after adjusting for patient case mix. Our findings are threefold. First, holding the total patient care cost per adjusted discharge constant, a one standard deviation increase in the direct cost ratio (0.08) is associated with a fifteen-basis-point decrease in the readmission rate; (ii) for most hospitals, holding the indirect cost per adjusted discharge constant, a $1,000 increase in the direct cost per adjusted discharge is associated with a three-basis-point decrease in readmission rates; (iii) for most hospitals, holding direct cost per adjusted discharge constant, a $1,000 increase in the indirect cost per adjusted discharge is associated with a four-basis-point increase in readmission rates. These findings are consistent with H1 that the direct cost ratio is positively associated with readmission rates.

Our study demonstrates that cost allocation has a tangible effect on hospital care quality. This study is also the first to focus on the direct cost ratio, an understudied aspect of hospital cost structure. By differentiating direct cost from indirect cost, our results can be of significant value to hospital executives attempting to improve outcomes under budgetary constraints.

The paper is organized as follows. The next section develops the hypothesis. We then discuss data and research methods. The following section presents study results. The final section concludes the paper and suggests directions for future research.

II. HYPOTHESIS DEVELOPMENT

Health care quality is affected by the clinical aspects of health care settings and processes (Donabedian 1988; Calvillo–King, et al. 2013; Rogers et al. 2016). Picone, Sloan, Chou, and Taylor (2003) documented that higher hospital input use and longer length of stay improve care outcomes. A number of studies have found that clinical interventions, such as medication reconciliation, nursing staffing, discharge planning, care transitions, patient education, and post-discharge care, can improve care quality (Bradley et al. 2013; McHugh and Ma 2013; Dharmarajan and Krumholz, 2014; Kripalani et al. 2014; Horwitz et al. 2015). Recently, Rogers et al. (2016) showed that hospital spending on occupational therapy is positively associated with the quality of care. These studies imply that improving clinical processes can benefit the quality of care.

The costs of hospital patient care can be categorized into two groups based on the traceability of the cost items —the direct patient care cost (hereafter, direct cost) and the indirect general service cost (hereafter, indirect cost).[4] Direct costs include those generated from inpatient services, outpatient services, and other clinical services. The indirect cost includes general services that are not directly traceable to patient care, such as cafeteria costs. The objective of this study is to understand how hospitals can allocate their budget efficiently in order to improve care quality. Based on the services provided for direct and indirect costs and using the clinical literature on care quality as a guide, we hypothesize that the association between costs and the quality of care will vary depending on whether the cost is direct or indirect. We hypothesize that greater allocation to direct cost will be associated with higher quality of care than allocation to indirect costs. In other words, holding the total patient care cost constant, a higher proportion of direct costs (i.e., a higher direct cost ratio) will lead to higher quality of care. We state our hypothesis formally as follows.

H1: Holding total patient care cost constant, hospitals with higher direct cost ratios have higher quality of care.

[4] Hospitals also incur costs unrelated to patient care, such as gift shops.

III. Data & Methods

Sample Selection

We obtain data from four sources. The 2014 Medicare cost reports were published by the Center for Medicare and Medicaid Services (CMS).[5] The cost reports contain financial and operational information for all Medicare-certified hospitals in the nation in their fiscal years beginning between October 1, 2013 and September 30, 2014. The 2014 CMS Hospital Compare database provides case-mix adjusted readmission rates for Medicare patients of all conditions as a part of its rating of hospitals. The 2014 CMS Final Rule Data provides a case mix index and wage index for all acute care hospitals that received Medicare inpatient reimbursement based on the Inpatient Prospective Payment System (IPPS). The 2014 U.S. Census Model-based Small Area Health Insurance Estimate (SAHIE) for counties includes annual estimated median household income for each county in the nation. The merged dataset from the four sources contains 3,004 acute care hospitals that do not have missing values on the variables required for our statistical analysis. We excluded one hospital that reported higher direct costs than the total cost, three hospitals that reported over $100,000 direct cost per adjusted discharge and one hospital that reported over $100,000 indirect cost per adjusted discharge. The final dataset had 2,999 acute care hospitals.

Readmission Rates

We use the thirty-day readmission rates from all medical conditions for Medicare patients published by CMS Hospital Compare program as a measure of quality of care. The Hospital Compare program provides data on the overall readmission rate for each hospital. It is calculated as unplanned admissions to hospitals within 30 days of discharge from the initial hospitalization, regardless of the readmission reason.[6] Readmission rates have widely been used in the clinical literature as a quality care indicator (e.g., Taylor, Whellan, and Sloan 1999; Patrick and Conway 2014). Readmission rates are also used by Medicare's Hospital Readmissions Reduction Program (HRRP), which is a quality-improvement initiative that penalizes hospitals when their 30-day readmission rates for common medical conditions (i.e., heart attack, heart failure, pneumonia, hip/knee replacement, and chronic obstructive pulmonary disease) are higher than what would be expected based on their patient population characteristics (Gilman et al., 2015).

Direct Cost Ratio

The CMS cost reports have detailed category information for each Medicare-certified hospital's cost. The direct cost ratio is measured as direct costs divided by the total cost of patient care. The total cost of patient care refers to the cost determined by the CMS to be associated with care for patient care and includes both direct patient care cost and indirect general service cost and excludes items unrelated to the patient care provided by the hospital, such as services of the gift shop and private physicians' offices. The direct cost include cost items generated from inpatient services (e.g., intensive care units and nursery), ancillary services (e.g., operating room and anesthesiology), outpatient services costs (e.g., clinic and emergency), and other clinical services (e.g., ambulance services and organ acquisition). The indirect cost includes cost items incurred for general services, which are indirectly linked with patient care: building and equipment,

[5] CMS is operated by the U.S. Department of Health and Human Services.

[6] For more information about the measure, please visit https://www.medicare.gov/hospitalcompare/Data/30-day-measures.html and http://kff.org/medicare/issue-brief/aiming-for-fewer-hospital-u-turns-the-medicare-hospital-readmission-reduction-program/.

employee benefits, administrative and general, maintenance and repairs, plant operations, laundry and linen services, housekeeping, dietary, cafeteria, personnel maintenance, nursing administration, central services and supply, pharmacy, medical records, social service, and other general services.

While the direct cost ratio captures the proportion of resources invested in clinical services, it might be argued that since our quality of care measure—the readmission rate—pertains to inpatient care only, the inpatient cost ratio (i.e., the inpatient care cost divided by the total cost of patient care) instead of the direct cost ratio should be used in the analyses. The process of inpatient care, however, is directly linked to ancillary services, such as anesthesiology and radiology, and outpatient services, such as emergency and observation beds. It is difficult, if not impossible, to quantify the proportion of inpatient usage of ancillary and outpatient services from the data provided in CMS cost reports, a feature that prevents us from generating an accurate proxy to measure the cost incurred only for inpatient services in relation to the total cost of patient care.

Empirical Analysis

We use the model specified in Equation (1) to test H1. A positive coefficient λ_1 on *Direct cost ratio* would provide evidence consistent with H1. Given that this study's focus is on how quality of care varies in relation to the direct cost ratio when the total cost is held constant, we include the total patient care cost per adjusted discharge as a control variable in the model. We use the number of adjusted discharges as the scaling variable for cost because hospitals differ widely in their inpatient visits and outpatient discharges. The number of adjusted discharge is calculated as the number of inpatient discharges multiplied by the ratio of total gross revenue to inpatient gross revenue, based on the assumption that outpatient output can be converted to "equivalent inpatient discharges" according to the gross revenue (White and Wu 2014; Bai and Anderson 2016). Besides output volume, clinical complexity and labor wage level also vary significantly across hospitals. As a result, we include each hospital's case mix index and wage index in the denominator to make cost per adjusted discharge more comparable across hospitals, consistent with previous literature (Bai and Anderson 2016; Bai 2016). Case mix index measures the relative clinical complexity of the mix of Medicare patients treated at a given hospital, with a higher value indicating a more seriously ill patient population.[7] Wage index measures the geographic differences in the price of labor that each hospital faces within its labor market.[8]

$$\begin{aligned} Readmission\ rate_i &= \lambda_0 + \lambda_1 Direct\ cost\ ratio_i + \lambda_2 Cost\ per\ adjusted\ discharge_i \\ &+ \lambda_3 Nonprofit + \lambda_4 Forprofit_i + \lambda_5 System_i + \lambda_6 Rural_i + \lambda_7 Teaching_i \\ &+ \lambda_8 Beds_i + \lambda_9 Average\ length\ of\ stay_i + \lambda_{10} Medicare\%_i \\ &+ \lambda_{11} Medicaid\%_i + \lambda_{12} Median\ household\ income + \varepsilon_i \end{aligned} \quad (1)$$

We include a set of hospital characteristics as control variables, which have been identified as factors influencing hospital behaviors and outcomes by the accounting and health economics

[7] For more information on Medicare case mix index, please refer to https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/Acute-Inpatient-Files-for-Download-Items/CMS022630.html

[8] For more information on Medicare case mix index, please refer to https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/wageindex.html

literature (Eldenburg and Kallapur 2000; Bai et al. 2010; Holzhacker et al. 2015; Bai and Anderson 2016). *Nonprofit* (*For-profit*) is a dummy variables that takes the value of 1 if a hospital's ownership type is nonprofit (for-profit) and 0 otherwise, respectively. *System* is a dummy variable that takes the value of 1 if a hospital is affiliated with a health system and 0 otherwise. *Rural* is a dummy variable that takes the value of 1 if a hospital is located in a rural area and 0 if otherwise. *Teaching* is a dummy variable that takes the value of 1 if a hospital is involved in approved graduate medical education programs and 0 if otherwise. *Beds* measures the number of beds in a hospital. *Average length of stay* is calculated as the total inpatient days of all patients divided by the number of discharges. *Medicare%* and *Medicaid%* measure the percentages of discharges covered by Medicare or Medicaid, respectively. Besides these hospital characteristics, we control for the median household income for the county where a hospital is located in the model, because it has been shown that the socioeconomic status of patients is associated with care quality (Fiscella et al. 2000). Variable definitions are listed in Table 1. [Insert Table 1 Here]

IV. Results

Descriptive Statistics

In Table 2, we present descriptive statistics of the variables used in the empirical analyses. On average, 16% of Medicare inpatient discharges lead to readmission, with a standard deviation of 1.06%. Hospitals on average have 52% of total patient care cost incurred for direct patient care services, with a standard deviation of 8%. The average cost per adjusted discharge is $7,931. In the sample, 60% are nonprofit, 24% are for-profit, and the remaining 16% are government hospitals. 61% of hospitals are affiliated with a health system, 28% of hospitals are located in rural areas, and 34% are teaching hospitals. Hospitals on average had 203 beds, with a mean length of stay of 4.4 days. On average, Medicare insures 36% of all discharges and Medicaid 12% The average median household income across the counties where hospitals located is $52,097. [Insert Table 2 Here]

Regression Analysis

In Table 3 Column (1), we report the estimation result for Equation (1). The coefficient of *Direct cost ratio* is -1.814 ($p<0.001$), suggesting that, ceteris paribus, a one standard deviation increase in direct cost ratio (0.08) is associated with fifteen fewer readmission per 10,000 discharges, consistent with H1 that hospital direct cost ratio is associated with lower readmission rates.[9] To examine the possible nonlinear relationship between the direct cost ratio and readmission rates, we include the square of the direct cost ratio in the model and report the estimation result in Table 3 Column (2). Neither the coefficient of the direct cost ratio nor the coefficient of its square is statistically significant.[10]

[9] The coefficient on *Direct cost ratio*, -1.814, multiplied by 0.08.

[10] These results, however, do not necessarily suggest that readmission rates are always positively associated with the direct cost ratio regardless of how large the ratio is. The median ratio in the sample is 0.52 and 95% of hospitals have their ratios below 64%. The negative association between direct cost ratios and readmission rates is unlikely to exist beyond a certain relative range.

In column (1), a higher total patient care cost per adjusted discharge is associated with lower readmission rates, consistent with previous findings that higher spending is linked to higher quality (Joynt, Orav, and Jha 2011; Stukel et al. 2012). In both columns, for-profit and teaching hospitals have higher readmission rates than government and non-teaching hospitals, respectively. System-affiliated hospitals have lower readmission rates than independent hospitals. Larger hospitals and hospitals with patients having longer periods of stay have higher readmission rates. Finally, hospitals having more Medicaid patients are associated with higher readmission rates. These findings are consistent with previous health service literature on hospital care quality (Keeler et al. 1992; Sloan 2000; Tsai et al. 2013; Gohil et al. 2015; Kim et al. 2016). [Insert Table 3 Here]

Supplementary Analysis

The negative association between direct cost ratios and readmission rates suggests that holding total cost per adjusted discharge constant, a larger proportion of direct costs incurred is associated with fewer readmissions. In other words, every dollar spent directly on patient care is more effective on lowering readmission rates than one dollar spent indirectly on patient care. To further illustrate this relationship, we regress readmission rates on the direct cost per adjusted discharge (i.e., direct cost divided by adjusted discharge, case mix index, and wage index) and the indirect cost per adjusted discharge (i.e., indirect cost divided by adjusted discharge, case mix index, and wage index), while including all control variables listed in Equation (1). This model tests how the spending on direct (indirect) cost affects readmission rates when the spending on indirect (direct) remains constant. The estimation results are reported in Table (4). [Insert Table 4 Here]

As shown in Column (1), the coefficient of direct cost per adjusted discharge is -0.275 (p=0.03) while the coefficient of indirect cost per adjusted discharge is 0.414 (p=0.03), suggesting that the cost-quality association has opposite directions for the direct cost versus the indirect cost. A $1,000 increase in the direct cost per adjusted discharge is associated with three fewer readmissions per 10,000 discharges, while a $1,000 increase in the indirect cost per adjusted discharge is associated with a four more readmissions per 10,000 discharges. These findings are consistent with the results in Table (3) that higher direct cost ratios are negatively associated with readmission rates, because an increase in the direct cost when holding the indirect cost constant or a decrease in the indirect cost when holding the direct cost constant has the effect of raising the direct cost ratio.[11]

When the squares of the direct and indirect cost per adjusted discharge are included in the model (Column 2), a significant nonlinear relationship is observed for both the direct and the indirect cost. However, the results have little practical application. First, holding the indirect cost per adjusted discharge constant, an increase in the direct cost per adjusted discharge is negatively associated with readmission rates until the direct cost reaches above $40,000, an amount that is higher than almost all observations in our sample.[12] Second, holding the direct cost per adjusted

[11] If we increase a and keep b constant, then the value of a/(a+b) will increase; similarly, if we keep a constant and decrease b, then the ratio a/(a+b) will increase as well.

[12] [0.723/(2*0.081)]*10,000 = $44,630. Only four observations have direct cost per adjusted discharge higher than this value.

discharge constant, an increase in the indirect cost per adjusted discharge is positively associated with readmission rates until the indirect cost reaches above $25,000, an amount that is higher than almost all observations in our sample.[13] These findings imply that the direct (indirect) costs have a concave (convex) association with readmissions when holding the other cost category constant. It is only within a relative range that an increase in the direct costs or a decrease in the indirect cost can have a positive association with readmissions.

V. CONCLUSION

In this study, we found that higher direct cost ratios are associated with lower readmission rates, holding the total patient care cost per adjusted discharge constant. Additional analyses show that the direct cost per adjusted discharge is associated with lower readmission rates. There are at least three possible reasons why hospitals with relatively low direct cost ratios had high readmission rates. First, these hospitals might have an insufficient focus on clinical aspects. Second, they might have cost inefficiency for non-clinical aspects caused by poor cost control. Third, indirect costs might have been incurred due to the agency problem. For example, executives in these hospitals might receive relatively high compensation.

Our study recognizes the important implications of cost structure on hospital care quality and extending the scope of cost structure to the relationship between the direct and the total cost. In addition, our results have the potential to facilitate hospital executives in making informed resource allocation decisions to improve care quality—an upward adjustment of the direct cost ratio might lead to reductions in readmission rates. Such adjustments might require an increase of resources committed to clinical aspects, more efficient cost control on indirect costs, more effective governance to reduce the agency problem, or a combination of these actions.

Several limitations of this study need to be considered. First, the data from CMS are based on administrative records submitted by hospitals, so the data may contain inaccuracies. Second, although 30-day unplanned readmission rate is a commonly used quality metric, there are many other measures that evaluate different aspects of hospital quality. Future research is needed to examine whether the results of this study can be generalized to other quality metrics. In addition, in this paper we did not examine spending at individual departments, but it is important for future research to examine whether specific components of direct patient care are primarily responsible for the lower readmission rates. Finally, our analyses cannot establish a causal link between the direct cost ratio and the quality of care. Future studies may explore potential events or discontinuity to identify causality and examine other aspects of cost structure and behavior, such as cost stickiness and the relationship between variable and fixed costs, to further our understanding on the mechanism of how hospital costs affect the quality of care.

[13] [1.320/(2*0.247)]*10,000 = $26,721. Only two observations have direct cost per adjusted discharge higher than this value.

Authors' Contact Information

Ge Bai, PhD, CPA*
Assistant Professor of Accounting
The Johns Hopkins Carey Business School
Bernstein-Offit Building 353
1717 Massachusetts Ave NW
Washington, DC 20036
Phone: (202) 580-7573
Email: gbai@jhu.edu

Tim Xu, MPP
The Johns Hopkins School of Medicine
tim.xu@jhmi.edu

Andrew T. Rogers, BS
The Johns Hopkins School of Medicine
aroger32@jhmi.edu

Gerard F. Anderson, PhD
The Johns Hopkins Bloomberg School of Public Health
ganderson@jhu.edu

*: Corresponding author

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Table 1: Variable Definitions

Variable	Definition
Readmission rate	Thirty-day readmission rate from all medical conditions for Medicare patients
Direct cost ratio	Direct cost of patient care / Total cost of patient care
Cost per adjusted discharge	Total cost of patient care/ (adjusted discharge * case mix index * wage index)
Direct Cost per adjusted discharge	Direct cost of patient care/ (adjusted discharge * case mix index * wage index)
Indirect Cost per adjusted discharge	Indirect cost of patient care/ (adjusted discharge * case mix index * wage index)
Nonprofit	Dummy variable that takes the value of 1 if a hospital is nonprofit
For-profit	Dummy variable that takes the value of 1 if a hospital is for-profit
System	Dummy variable that takes the value of 1 if a hospital is affiliated with a health system
Rural	Dummy variable that takes the value of 1 if a hospital is located in a rural area
Teaching	Dummy variable that takes the value of 1 if a hospital is a teaching hospital
Beds (X100)	Number of hospital beds
Average length of stay	Total inpatient stay / total discharges
Medicare%	Number of Medicare discharges / Number of total discharges
Medicaid%	Number of Medicaid discharges / Number of total discharges
Median household income	Estimated median household income for the county where a hospital is located

Table 2: Descriptive Statistics

Variable	Mean	Median	Std	1Q	3Q
Readmission rate	15.63	15.50	1.06	15.00	16.20
direct cost ratio	0.52	0.52	0.08	0.47	0.57
Cost per adjusted discharge (X10,000)	0.79	0.71	0.50	0.60	0.87
Direct Cost per adjusted discharge (X10,000)	0.48	0.43	0.34	0.35	0.53
Indirect Cost per adjusted discharge (X10,000)	0.31	0.28	0.20	0.23	0.34
Nonprofit	0.60	1	0.49	0	1
For-profit	0.24	0	0.43	0	0
System	0.61	1	0.49	0	1
Rural	0.28	0	0.45	0	1
Teaching	0.34	0	0.47	0	1
Beds (X100)	2.03	1.46	1.93	0.72	2.68
Average length of stay	4.37	4.29	1.27	3.74	4.85
Medicare%	0.36	0.36	0.12	0.29	0.44
Medicaid%	0.12	0.09	0.10	0.04	0.18
Median household income (X10,000)	5.21	5.00	1.40	4.27	5.74

Table 3: Regression Estimation Results—Direct Cost Ratio and Readmission Rates

Variable	Coefficient	
	(1)	(2)
Direct cost ratio (H1)	-1.814***	0.790
	(<0.01)	(0.76)
Direct ratio squared		-2.596
		(0.30)
Cost per adjusted discharge (X10,000)	-0.056*	-0.053
	(0.09)	(0.11)
Nonprofit	-0.068	-0.071
	(0.21)	(0.19)
For-profit	0.212***	0.211***
	(<0.01)	(<0.01)
System	-0.206***	-0.208***
	(<0.01)	(<0.01)
Rural	0.016	0.014
	(0.74)	(0.76)
Teaching	0.170***	0.172***
	(<0.01)	(<0.01)
Beds (X100)	0.058***	0.058***
	(<0.01)	(<0.01)
Average length of stay	0.085***	0.085***
	(<0.01)	(<0.01)
Medicare %	-0.059	-0.064
	(0.73)	(0.71)
Medicaid %	0.900***	0.900***
	(<0.01)	(<0.01)
Median household income (X10,000)	-0.026*	-0.026*
	(0.09)	(0.09)
N	2,999	2,999
R^2	0.08	0.08

Notes: P values, based on two-tailed test, are in parentheses. *, **, *** indicates significance 10%, 5%, and 1% level, respectively. All standard errors are robust to hetersoskedity. The coefficients on constants are not reported.

Table 4: Supplementary Analysis—Direct and Indirect Cost and Readmission Rates

Variable	Coefficient	
	(1)	(2)
Direct cost per adjusted discharge (X10,000)	-0.275** (0.03)	-0.723*** (<0.01)
Direct cost per adj. disc. squared (X100,000,000)		0.081*** (<0.01)
Indirect cost adjusted discharge (X10,000)	0.414** (0.03)	1.320*** (<0.01)
Indirect cost per adj. disc. squared (X100,000,000)		-0.247*** (<0.01)
Nonprofit	-0.050 (0.36)	-0.041 (0.45)
For-profit	0.209*** (<0.01)	0.239*** (<0.01)
System	-0.205*** (<0.01)	-0.218*** (<0.01)
Rural	0.048 (0.32)	0.044 (0.36)
Teaching	0.185*** (<0.01)	0.185*** (<0.01)
Beds (X100)	0.053*** (<0.01)	0.059*** (<0.01)
Average length of stay	0.077*** (<0.01)	0.071*** (<0.01)
Medicare %	0.001 (1.00)	-0.064 (0.71)
Medicaid %	1.077*** (<0.01)	1.074*** (<0.01)
Median household income (X10,000)	-0.020 (0.20)	-0.026* (0.09)
N	2,999	2,999
R^2	0.06	0.07

Notes: P values, based on two-tailed test, are in parentheses. *, **, *** indicates significance 10%, 5%, and 1% level, respectively. All standard errors are robust to hetersoskedity. The coefficients on constants are not reported.