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The Readmission Difference: Examining the Negative Impact of Hospital Readmissions on Financial Performance

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Abstract

This study assesses the impact of hospital readmissions on the financial performance of hospitals. Understanding the determinants of hospital performance is one of the most important issues for managers of hospitals and policy makers. The study assesses the impact of readmissions due to infections and complications on financial performance. Financial and hospital readmission variables are captured with data from the Pennsylvania Health Care Cost Containment Council for years 2003 through 2009. Market and organizational variables are from the American Hospital Association Annual Survey Database. Hospital case-mix data is from Center for Medicare and Medicaid Services. This study combines exploratory factor analysis and multiple regression with random effects and clustering. A risk adjusted composite score of hospital readmissions in a multiple regression model is used as the independent variable. Hospital readmissions were found to have a negative impact on operating margin in both the random effects model (β = -0.788, $p < 0.01$) and in the fixed effects model (β = -0.576, $p < 0.10$). The results of this study suggest unplanned readmissions from complications and infection have a strong negative impact on the financial performance of hospitals. Implications for management and policy are outlined.

Keywords: Hospital readmissions, financial performance, clinical outcomes, health care management, infections, and complications.

1. Introduction

Understanding the determinants of hospital performance is one of the most important issues for managers of hospitals and policy makers. One important measure of hospital performance is its quality of care as measured by thirty-day unplanned readmission rates (Jencks, Williams, & Coleman, 2009). Recent estimates suggest that almost 20 percent of Medicare beneficiaries discharged from a hospital are readmitted within 30 days resulting in an estimated cost of $17.4 billion from unplanned readmissions (Jencks et al., 2009). A high proportion of readmissions have been found to occur relatively soon after discharge (Dharmarajan, et al., 2013).

The federal government has pegged the cost of readmissions for Medicare patients alone at $26 billion annually, and says more than $17 billion of it pays for return trips that need not happen if patients get the right care. The Centers for Medicare & Medicaid Services (CMS) has identified unplanned readmissions as one of the leading problems facing the U.S. health care system and now penalizes hospitals with high rates of readmissions for their heart failure, heart attack, and pneumonia patients (Jencks et al., 2009). Unplanned readmissions have an important relationship with performance, management, and reimbursement and are the focus of this study. Discharge from the hospital is a critical and risky juncture in the care continuum for patients as many suddenly face the responsibility of their own recovery with limited or misunderstood information. This information gap has the propensity to contribute to hospital readmissions.

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According to a Dartmouth Atlas Report, almost 1 in 5 discharged Medicare patients are readmitted within 30 days and those with congestive heart failure are readmitted approximately 21 percent of the time, according to data from 2004 through 2009 (Goodman, Fisher, & Chang, 2011). Medicare Payment Advisory Commission (MedPAC) (2007) identified readmissions as a key driver of Medicare spending; 17.6% of hospital admissions resulted in readmissions within 30days of discharge, and 11.3% within 15 days. While many treatments require continued readmission, only 10 percent of the Medicare hospital readmissions in 2009 were planned (Jencks et al., 2009).

It is perhaps not surprising that hospitals might be reluctant to adopt interventions to reduce readmissions when they are paid on a fee-for-service (FFS) basis, even when the intervention is proven to be effective (Chollet, Barrett, & Lake, 2011). However, further changes in hospital reimbursement structure places increased importance on addressing clinical care quality. With the onset of value-based purchasing (VBP), hospitals now have with financial incentives to reduce readmissions and improve quality standards. VBP Medicare incentive payments are based, in part, on improvement in patient satisfaction and clinical outcomes. One of the measures in the in the patient satisfaction score is the quality of discharge instructions (Center for Medicare and Medicaid Services, 2011).

There is a paucity of empirical research assessing the relationship between hospital readmission and financial performance. In this study, we examine that relationship to determine the degree to which unplanned 30-day readmission rates, due to complications or infection after discharge, are related to financial performance (PHC4, 2011). This study contributes to the literature by being one of the first to empirically examine the impact of readmissions on hospital financial performance.

2. Hospital Readmissions

From a management perspective, unplanned hospital readmissions are costly and reflect suboptimal quality of inpatient care (Epstein, Jha, & Orav, 2011). For the purposes of this study, readmissions are defined as unplanned readmissions due to complications or infection within 30 days of discharge (Jenks, et al 2009). Common reasons for unplanned hospital readmissions include unclear communication between doctors, staff, patients, caregivers, and families at discharge; inappropriate instructions from hospital discharge staff regarding diet, mobility, medication and general care; lack of family support to provide informal home care; missing key symptoms that signal a need for readmission; limited resources for home care; lack of transportation and patient advocacy; and, lack of professional care supervision at home and resulting noncompliance (Chollet, Barrett, & Lake, 2011; Stone & Hoffman, 2010). High rates of hospital readmissions may also indicate unacceptable levels of hospital-acquired infections, premature discharge, failure to reconcile medications, inadequate communication with patients and community providers responsible for post-discharge care, or poor transitional care (Chollet, Barrett, & Lake, 2011).

2.1 Factors That Influence Hospital Readmissions.

Epstein and colleagues (2011) found a significant relationship between hospital referral regions' (HRR) rates for initial admission and the rates of readmissions for congestive heart failure and pneumonia. Recent findings indicate that there is not a significant relationship between the profitability of various service lines and the risk of readmission for patients receiving care from those service lines (Navathe, Volpp, Konetzka, et al, 2012). However, higher overall patient satisfaction and satisfaction with discharge planning are associated with lower 30-day risk-standardized readmission rates (Boulding, et al, 2011). Readmitted diabetic patients represent significant costs for hospitals and among diabetic patients lower socioeconomic status, comorbidities, public insurance, urgent admissions, and a history of prior recent prior hospitalization represent risk factors for readmissions (Rubin, 2015).

Readmission rates may be influenced by intrinsic organizational mechanisms that contribute to poor quality of care and weak financial performance. High readmission rates may thus be a sign of poor care and weak business processes that are intrinsic to the organization, which produce sub-optimal financial performance and poor quality of care (Jencks, et al., 2009). For example, there may be link between unplanned hospital readmissions for patients with diabetes, heart failure, and lung disease and poor quality of inpatient care (Ashton, Kuykendall, Johnson, Wray, & Wu, 1995).

2.2 The Costs of Unplanned Readmissions.

Unplanned readmissions are costly for hospitals. MedPAC reports that 13.3% of 30-day hospital readmissions are potentially preventable and cost an additional $12 billion, based on 2005 Medicare data (MedPAC, June 2007). Jencks et al (2009) found that 19.6% of Medicare fee-for-service beneficiaries who had been discharged from a hospital were readmitted to the hospital within 30 days, 34.0% within 90 days, and more than half (56.1%) within one year of discharge. Such readmissions could potentially be prevented as approximately half of readmitted patients do not received follow-up care from a physician after discharge (Jencks et al., 2009). The overall cost of these unplanned readmissions within 30 days was estimated to be $17.4 billion (Jenks et al., 2009).

A further link to cost reduction derives from the intersection of care quality and patient outcomes. High-quality care is purported to be less costly as quality and costs improve simultaneously when implementing best practices such as: process protocols, technologies, drugs, and other state of the art initiatives (Porter & Teisberg, 2006). Simultaneous improvement in financial performance and quality may be possible when medical mistakes are eliminated and care is provided correctly the first time (Porter & Teisberg, 2006). Conversely, lack of hospital quality of care efforts may simultaneously increase hospital readmissions and weaken hospital financial performance. Therefore, the following hypothesis is proposed:
Hypothesis: Hospitals with higher rates of unplanned readmissions have weaker financial performance.

3. Data Sources

General acute care hospital data in Pennsylvania for the years 2003 through 2009 were examined. Data for this study were drawn from four primary sources: The Pennsylvania Health Care Cost Containment Council (PHC4) provided the readmission and hospital financial data; the American Hospital Association (AHA) Annual Survey Database provided the market and organizational data; the hospital case mix was drawn from the Centers for Medicare and Medicaid Studies (CMS) Inpatient Prospective Patients System, and county level market data from the Area Resource File (ARF). The study is limited to hospitals in Pennsylvania to capture uniformly the impact of regulation, reimbursement, and unique market and demographic characteristics.

For the purposes of this study, readmissions are unplanned readmissions within 30 days of discharge due to a complication or infection in Pennsylvania acute care hospitals and reported to PHC4 (PHC4, 2011). These are distinct from medically appropriate readmissions for patients with chronic conditions associated with multiple readmissions along the disease trajectory.

4. Dependent variables

The dependent financial performance variables in this study are based on extant literature and measure performance with operating margin and total margin (Gapenski, 2003). Operating margin (Range -37.60 - 24.23; Mean = 1.59, Std. Dev. = 6.51) is defined as operating income over operating revenues and reflects core business operations by removing the transitory influence of non-operating sources of revenue and cost (Gapenski, 2003). Total margin (Range -35.45 - 25.61; Mean = 2.26, Std. Dev. = 6.07) is defined as net income divided by total revenues and measures the ability of the hospital to control expenses which reflects the return on operating and non-operating sources of revenues (Gapenski, 2003).

5. Independent Variable

The independent variable is a composite score of nine severity risk adjusted 30-day readmissions due to complication or infection for Pennsylvania hospitals from 2003 through 2009. Unplanned readmissions were after an initial diagnosis of congestive heart failure (CHF) (8.38 - 38.09), kidney and urinary tract infection (0 - 59.70), chronic obstructive pulmonary disease (COPD) (0 - 35.01), diabetes with medical management (0 - 45.58), infections pneumonia (0 - 34.70), stomach and intestinal bleeding (0 - 47.12), abnormal heartbeat (0 - 46.00), hip fracture with surgical repair (0 - 63.52), and stroke non-hemorrhagic (0 - 43.59). We chose these nine conditions given their high volume and risk of readmission. Readmission rates were risk adjusted to account for the fact that hospitals within the sample had varying levels of patient acuities. We used risk adjusted hospital readmission rates in exploratory factor analysis with varimax rotation to identify loading factors (Kremelberg, 2011). We identified one factor with an eigenvalue greater than 1 (2.99253), with variables loading a score of at least 0.5 (Kremelberg, 2011). Principal factor analysis supported the construction of a single composite score, which showed reasonably good reliability (χ^2 = 1353.43) (Kremelberg, 2011).

6. Control Variables

Control variables capture organizational and market factors that may influence the readmission rates of hospitals (Jenks, 2009). Data from the American Hospital Association (AHA) Annual Survey Database capture organizational characteristics including ownership, teaching status, Council of Teaching Hospitals (COTH) membership, system centralization, and complexity of healthcare information technology.

7. Descriptive Analyses

Table 1 provides descriptive statistics for the independent and dependent variables, including means and standard deviations for the independent and dependent variables of the study. The study population consists of all hospitals in Pennsylvania between 2003 through 2009. This time frame was selected to capture the strongest impact of readmissions from high volume conditions on hospital financial performance. The descriptive analyses for financial performance measures and risk adjusted readmission scores are in Table 1.

Table 1: Descriptive Statistics Dependent and Independent Variables, 2003 – 2009

Variable	Mean	Std. Dev.	Minimum	Maximum
Total Margin, N = 980	2.26	6.07	-35.45	25.61
Operating Margin, N = 980	1.59	6.51	-37.60	24.23
Hospital Readmission Composite Score Index, N = 980	-0.04	0.97	-2.58	4.40
Risk Adjusted CHF Readmission Score, N = 1062	24.84	4.86	8.38	38.09
Risk Adjusted Kidney Readmission Score, N = 1008	23.02	7.4	0	59.70
Risk Adjusted COPD Readmission Score, N = 1067	21.07	5.14	0	35.01
Risk Adjusted Diabetes with Medical Management Score, N = 1053	16.83	6.43	0	45.58
Risk Adjusted Pneumonia Readmission Score, N = 1069	16.65	4.11	0	34.70
Risk Adjusted Stomach and Intestinal Bleeding, N = 1069	15.9	5.76	0	47.12
Risk Adjusted Abnormal Heartbeat, N = 1061	15.62	4.78	0	46.00
Risk Adjusted Hip Fracture with Surgical Repair, N = 1002	15.02	6.42	0	63.52
Risk Adjusted Stroke Readmission Score, N = 1047	14.43	5.51	0	43.59

* The readmission Score Index is negative due to the it being a composite index of all the readmission means derived from factor analysis.

Hospital Readmission Composite Score Index mean is (-0.04), this is due to the principal factor analysis generation of a single composite score through exploratory factor analysis. Risk adjusted readmission scores for congestive heart failure (CHF) was the highest (Mean = 24.84) and the mean for the stroke (Mean = 14.43) readmission score was the lowest among the nine assessed diagnoses.

8. Methods

Multiple regression analyses were used to examine the effects of hospital readmissions on hospital performance measures. In the multiple regression equation, the independent variable is the hospital readmission composite score. We compared models with fixed effects and random effects and used the Hausman Test ($\chi^2 = 14.32$, $p < 0.2158$) to determine that random effects were appropriate to use in the multiple regression model. Based on the Hausman Test results ($\chi^2 = 14.32$, $p < 0.2158$), we were not able to reject the null hypothesis that both random and fixed effects were consistent methods to estimate the coefficients Invalid source specified.. The random effects model allowed us to control for hospital organizational factors, such as teaching status, ownership, technical complexity, and centralization (Littell, Stroup, & Freund, 2002). The multiple regression equation used random effects, clustering by AHAID, with a composite risk-adjusted hospital readmission score as the independent variable. The readmission score is regressed directly on the outcome performance variable and not time lagged because reimbursement for each readmission would most impact operating margin and total margin during the current quarter or year.

9. Results

Results indicate a statistically significant negative impact of readmissions on performance for both fixed effects and random effects models. The random effects model allowed us to control for hospital organizational factors and the fixed effects model confirmed our findings and allowed us to capture within hospital time invariant factors from 2003 through 2009 (Littell, Stroup, & Freund, 2002).

Table 2, columns 1 and 2 indicate that unplanned hospital readmissions had a negative impact on operating margin (β = -0.788, $p < 0.01$) and total margin (β = -0.839, $p < 0.01$) in the random effects model. The results of these findings support our hypothesis that hospitals with higher levels of readmissions have weaker financial performance. To examine the robustness of using random effects, we additionally report the results of the fixed effects model in columns 3 and 4. Columns 3 and 4 indicate that hospital readmissions also had a negative impact on operating margin (β = -0.576, $p < 0.10$) and total margin (β = -0.610, $p < 0.05$).

Table 2: Impact of Risk-adjusted Hospital Readmission Rates on Operating Margin and Total Margin

Column Number Model Type N = Sample Size Financial Performance Variable		(1) Random Effects N = 980 Operating Margin	(2) Random Effects N = 980 Total Margin	(3) Fixed Effects N = 980 Operating Margin	(4) Fixed Effects N = 980 Total Margin
Readmissions		-0.788*** (0.301)	-0.839*** (0.273)	-0.576* (0.319)	-0.610** (0.285)
Hospital Ownership Type		1.263 (2.909)	1.517 (1.853)	0.307 (4.238)	-0.545 (2.738)
Teaching Status		-0.0978 (0.833)	-0.242 (0.757)	-0.130 (1.130)	-0.236 (1.148)
COTH Membership		0.965 (0.864)	0.896 (0.880)	-0.290 (1.320)	0.194 (1.209)
Centralization: (Category 1 is omitted)	Category 2	-2.018 (1.856)	-0.804 (1.549)	-1.549 (1.861)	-0.446 (1.598)
	Category 3	-1.479 (1.666)	-1.239 (1.415)	-0.512 (1.691)	-0.406 (1.496)
	Category 4	-0.160 (2.273)	-0.164 (1.733)	1.139 (2.324)	0.950 (1.801)
	Category 5	-4.893* (2.532)	-4.109* (2.446)	-2.871 (2.832)	-1.919 (2.719)
	Category 6	-1.698 (1.778)	-1.060 (1.428)	-0.356 (1.848)	-0.0166 (1.499)
Technical Complexity Index		0.754* (0.418)	0.844*** (0.325)	-0.0453 (0.565)	-0.0224 (0.504)
Uncompensated Care as a Percentage of NPR		-0.726* (0.401)	-0.642** (0.315)	-0.721 (0.488)	-0.677* (0.359)
Total Ambulatory Surgery Centers		0.145 (0.135)	0.0783 (0.117)	0.152 (0.161)	0.133 (0.155)
Total Hospitals		-0.153 (0.166)	-0.110 (0.153)	-0.115 (0.403)	-0.0821 (0.370)
Population Over 65 Years Of Age		0.00000235 (0.0000259)	0.00000459 (0.0000243)	0.000122 (0.000107)	0.0000710 (0.0000964)
Per Capita Income		0.0000924 (0.0000780)	0.0000662 (0.0000669)	0.000183 (0.000238)	0.0000767 (0.000194)

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

The results in columns 1, 2, and 4 indicate that Uncompensated Care as a Percentage of net patient revenue (NPR) is a statistically significant control variable worth noting given its negative impact on financial performance. Uncompensated care percentage of NPR differs from performance indicators as it captures hospital payer mix characteristics verses marginal profitability. The variable was significant in both the random effects models in column 1 and 2 and in the fixed effects models in column 4. Its impact on operating margin was (β = -0.726, $p < 0.10$) and on total margin (β = 0.642, $p < 0.05$) in the random effects model. However, we tested and found that Uncompensated care percentage of NPR did not moderate the negative affect that readmissions had on operating or total margin ($p < 0.05$).

In addition, in columns 1 and 2 the hospital Technical Complexity Index has a positive impact on Operating Margin (β = 0.754, $p < 0.10$) and on Total Margin (β = 0.844, $p < 0.01$) in the random effects model.

There were, however, some inconsistencies in our results relative to the influence of individual readmission diagnoses. We found that readmission from complications or infection for patients initially diagnosed with cardiopulmonary obstructive disease (COPD) had the strongest (β =-0.106, $p < 0.05$) negative impact on operating margin while kidney and urinary track disease had a weak positive (β =0.0359, $p < 0.05$) impact in operating margin. Overall, the results for three of the nine-readmission diagnoses were consistent with the negative influence of the composite score.

Table 3: Impact of Individual Risk-adjusted Hospital Readmission Rates on Operating Margin in Random Effects Model

Conditions	All N = 980	1 N = 1061	2 N = 1067	3 N = 1062	4 N = 1053	5 N = 1008	6 N = 1069	7 N = 1059	8 N = 1047	9 N = 1002
Readmissions	-0.788*** (0.301)	-0.0282 (0.0362)	-0.106** (0.0464)	-0.0833* (0.0492)	-0.0797** (0.0357)	0.0359** (0.0183)	-0.0548 (0.0438)	-0.0423 (0.0581)	0.00130 (0.0393)	-0.0497 (0.0359)
Hospital Ownership Type	1.283 (2.909)	1.415 (2.934)	1.321 (2.909)	1.360 (2.882)	1.259 (2.901)	1.255 (2.981)	1.377 (2.926)	1.366 (2.949)	1.388 (2.914)	1.410 (2.921)
Medical School Affiliation	-0.0978 (0.833)	-0.187 (0.816)	-0.0972 (0.819)	-0.210 (0.828)	-0.170 (0.827)	-0.0328 (0.819)	-0.222 (0.816)	-0.200 (0.825)	-0.182 (0.829)	-0.170 (0.807)
COTH Membership	0.965 (0.864)	1.211 (0.864)	1.148 (0.886)	0.962 (0.820)	0.874 (0.817)	1.218 (0.865)	1.224 (0.854)	1.215 (0.856)	0.922 (0.818)	0.804 (0.818)
Centralization:										
Ichuster_2	-2.018 (1.856)	-1.511 (1.792)	-1.279 (1.661)	-1.373 (1.726)	-1.393 (1.790)	-1.971 (1.863)	-1.457 (1.748)	-1.388 (1.719)	-1.982 (1.866)	-2.125 (1.853)
Ichuster_3	-1.479 (1.666)	-1.304 (1.625)	-1.042 (1.491)	-1.166 (1.571)	-1.258 (1.608)	-1.533 (1.704)	-1.227 (1.582)	-1.212 (1.559)	-1.594 (1.706)	-1.668 (1.678)
Ichuster_4	-0.160 (2.273)	0.190 (2.182)	0.434 (2.070)	0.401 (2.129)	0.216 (2.170)	0.151 (2.299)	0.262 (2.145)	0.265 (2.145)	-0.301 (2.235)	-0.481 (2.198)
Ichuster_5	-4.893* (2.532)	-4.164 (2.565)	-4.048* (2.373)	-4.222* (2.382)	-4.207 (2.570)	-4.731* (2.674)	-4.147* (2.508)	-4.118* (2.452)	-4.813* (2.605)	-4.757* (2.565)
Ichuster_6	-1.698 (1.778)	-1.295 (1.722)	-1.083 (1.575)	-1.173 (1.651)	-1.272 (1.718)	-1.760 (1.793)	-1.248 (1.670)	-1.185 (1.646)	-1.875 (1.794)	-1.814 (1.783)
Technical Complexity Index	0.754* (0.418)	0.710* (0.400)	0.726* (0.386)	0.802** (0.388)	0.787** (0.401)	0.679* (0.411)	0.753* (0.390)	0.730* (0.399)	0.748* (0.397)	0.830** (0.415)
Uncompensated Care as a Percentage of NPR	-0.726* (0.401)	-0.522 (0.383)	-0.597 (0.369)	-0.571 (0.374)	-0.453 (0.378)	-0.731* (0.408)	-0.620* (0.372)	-0.514 (0.382)	-0.509 (0.391)	-0.815** (0.396)
Total Ambulatory Surgery Centers	0.145 (0.135)	0.0977 (0.137)	0.0986 (0.133)	0.109 (0.134)	0.0980 (0.137)	0.172 (0.137)	0.0983 (0.135)	0.104 (0.134)	0.144 (0.137)	0.136 (0.133)
Total Hospitals	-0.153 (0.166)	-0.193 (0.175)	-0.203 (0.172)	-0.187 (0.172)	-0.199 (0.174)	-0.153 (0.170)	-0.195 (0.173)	-0.195 (0.173)	-0.161 (0.177)	-0.219 (0.175)
Population Over 65 Years Of Age	0.00000235 (0.0000259)	0.00000918 (0.0000274)	0.0000122 (0.0000273)	0.00000787 (0.0000272)	0.00000975 (0.0000275)	-0.00000336 (0.0000270)	0.00000979 (0.0000272)	0.00000949 (0.0000276)	-0.00000122 (0.0000283)	0.0000106 (0.0000274)
Per Capita Income	0.0000924 (0.0000780)	0.0000820 (0.0000791)	0.0000824 (0.0000776)	0.0000852 (0.0000777)	0.0000942 (0.0000778)	0.0000662 (0.0000786)	0.0000804 (0.0000780)	0.0000803 (0.0000787)	0.0000861 (0.0000784)	0.0000834 (0.0000787)
Condition(s)	All	1 = Abnormal Heartbeat	2 = COPD	3 = CHF	4 = Diabetes With Medical Management	5 = Kidney and Urinary Tract Infection	6 = Infections Pneumonia	7 = Stomach And Intestinal Bleeding	8 = Stroke Non-Hemorrhagic	9 = Hip Fracture With Surgical Repair

* p < 0.10; ** p < 0.05; *** p < 0.

Table 3 allows us to determine if the overall impact of hospital readmissions is driven by individual diagnoses. Three of the nine individual readmission scores had a statistically significant negative influence on hospital financial performance as measured by operating margin. Specifically, strong negative influences include readmissions due to complications or infection from COPD (β = -0.106, $p < 0.05$), congestive heart failure (β =-0.0833, $p < 0.10$), and diabetes with medical management (β =-0.0797, $p < 0.05$). Four additional readmission conditions (abnormal heartbeat, infectious pneumonia, stomach and intestinal bleeding, hip fracture with surgical repair) also had negative influences on financial performance; however, they were not statistically significant.

10. Discussion

Almost 20 percent of Medicare beneficiaries experience an unplanned hospital readmission within 30 days of discharge (Jenks, et al., (2009). In this study, we found that unplanned readmissions have a negative influence on hospital financial performance. Our results were consistent across two statistical models which controlled for hospital organizational factors from 2003 through 2009. We used risk adjusted unplanned readmission data for which there was a readmission due to complications and infections. Understanding the factors influencing unplanned hospital readmission may represent areas for managers to decrease their negative impact on their hospital's performance.

The results support past findings and shed new light on the relationship between readmissions and hospital financial performance. Our results are consistent with arguments made by Porter and Teisberg (2006), who urged that eliminating mistakes and providing care correctly the first time reduces costs and improves quality simultaneously. The benefit from reducing readmissions due to complications and infections are significant due to the high costs of care, slower recovery, and the need for readmission for repeated treatments (Porter & Teisberg, 2006). They are also consistent with the findings of Alexander et al., (2006) who found who found that hospitals that invested in quality improvements improved their quality and cost performance. Based on the findings of these past studies, hospitals that invest in care quality that lead to reduced readmissions may experience improved financial performance.

The findings support the research findings of Jenks et al., (2009) who found that readmissions were costly for hospitals and not linked to bed supply. We also found negative influences on financial performance among conditions are that are typically chronic. The findings also indicate no relationship between bed supply as measured by number of hospitals and the readmission rates.

The findings support the results reported by Press Ganey (2012), which found that hospital readmission scores are associated with the patient experience with communication with their care provider, as measured by HCAHPS. Interactions with the clinician involve providing education and discharge planning for patients in efforts to reduce readmission (Press Ganey, 2012). The organizational culture, management, and systems that enable a hospital reduce readmissions and receive high HCAHPS scores, may also be associated with strong financial performance.

The negative financial effect of readmissions due to complications or infection may be significant for hospitals operating at high capacity levels (Jencks et al., 2009). When patients are readmitted within 30 days due to complications and infection, they may be assigned the same diagnostic related group (DRG) as patients who have lower cost of care and with shorter LOS. In this case, hospitals without excess capacity suffer financially when they are reimbursed at the same level for patient care that has higher costs due to complications and infection (Jencks, Williams, & Coleman, 2009).

Our results shed new light on the relationship between readmissions and financial performance. The following example, using the same medical and surgical conditions examined in our study illustrates this relationship. In Figure 1, Scenario 1 presents Average Revenue and Average Costs for a patient admitted for a stomach procedure involving bleeding or MS-DRG 328 and then readmitted for a post-operative infection without an operating room procedure and assigned MS-DRG 856. Scenario 1 illustrates the net loss (3030) a hospital experiences from filling a bed with the same patient through readmission due to a surgical site infection.

Figure 1, Scenario 2 presents an alternative in which the patient in Scenario 1 does not need readmission and the bed can thus be filled with an additional patient requiring stomach services. Scenario 2 illustrates the net profit (4,488) earned by a hospital through providing care to multiple patients admitted for stomach treatment without readmission. As Figure 1 suggests, the difference in net profits between Scenario 1 and 2 is $7,518.

Figure 1. Stomach Procedure (bleeding) Bed Productivity Example, 2009

Stomach Procedure (bleeding) MS-DRG 328

Scenario 1	Average Revenue	Average Cost	Net Reimbursement
Patient 1, Episode 1 Stomach Procedure	$9,361	$7,117	$2,244
Patient 1, Episode 2 Readmission due to surgical site infection	$31,852	$37,126	$(5,274)
Total Hospital Profit			$(3,030)

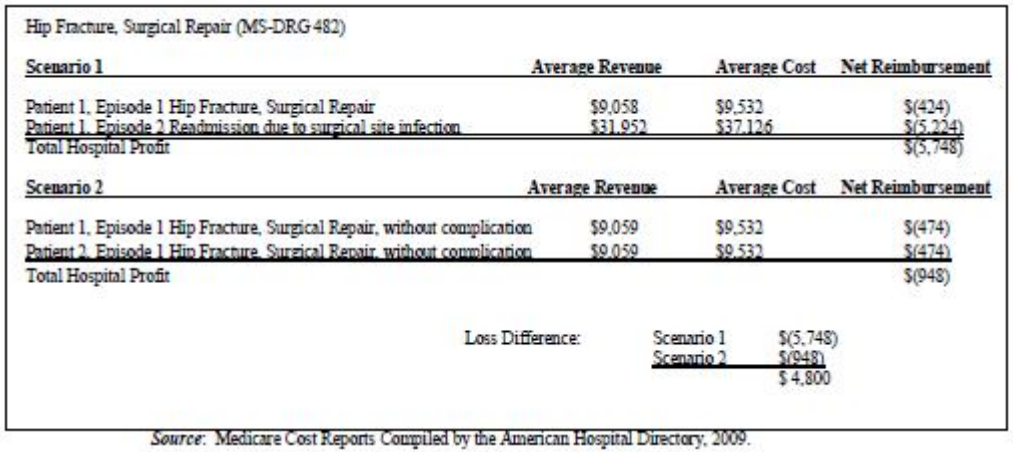
Scenario 2	Average Revenue	Average Cost	Net Reimbursement
Patient 1, Episode 1 Stomach Procedure without complication	$9301	$7,117	$2,244
Patient 2, Episode 1 Stomach Procedure without complication	$9301	$7,117	$2,244
Total Hospital Profit			$4,488

Profit Difference:		
	Scenario 1	$(3,030)
	Scenario 2	$4,488
		$7,518

Source: Medicare Cost Reports Compiled by the American Hospital Directory, 2009

As illustrated in Figure 2, we replicated the above scenario using 2009 Medicare Cost Report data for a hip fracture requiring surgical repair or MS-DRG 482. In Figure 2, Scenario 1, the hospital experiences a loss of $5,748 in net profits from treating the same patient over two episodes of care due to surgical site infection. In Scenario 2, the same hospital experiences a loss ($948) in net profits by treating two hip fracture patients in one episode of care without readmission due to surgical site infection. The difference between the two scenarios ($4,800) indicates that the hospital experienced less of a profit loss in Scenario 2 when compared with Scenario 1.

Figure 2. Hip Fracture, Surgical Repair Bed Productivity Example, 2009



Hip Fracture, Surgical Repair (MS-DRG 482)

Scenario 1	Average Revenue	Average Cost	Net Reimbursement
Patient 1, Episode 1 Hip Fracture, Surgical Repair	$9,058	$9,532	$(424)
Patient 1, Episode 2 Readmission due to surgical site infection	$31,952	$37,126	$(5,224)
Total Hospital Profit			$(5,748)

Scenario 2	Average Revenue	Average Cost	Net Reimbursement
Patient 1, Episode 1 Hip Fracture, Surgical Repair, without complication	$9,059	$9,532	$(474)
Patient 2, Episode 1 Hip Fracture, Surgical Repair, without complication	$9,059	$9,532	$(474)
Total Hospital Profit			$(948)

Loss Difference:		
	Scenario 1	$(5,748)
	Scenario 2	$(948)
		$ 4,800

Source: Medicare Cost Reports Compiled by the American Hospital Directory, 2009.

Based on bed productivity, multiple episodes without complications generate more profits than filling beds with readmitted patients due to post-surgical infections and complications (Hollenbeak, Murphy, Koenig, Woodward, Dunagan, & Fraser, 2000; Hannan, et al., 2003). The two medical conditions in Scenario 1 and 2 are the same as the ones we assessed in our study and we use them to illustrate the impact of surgical site infection and longer length of stay on bed productivity and profits. The respective DRG codes and treatment process used in the scenario was confirmed by hospital managers responsible for inpatient coding. Hospital revenue and cost figures are from Medicare Cost Reports from 2009 as compiled by the American Hospital Directory (American Hospital Directory, 2012).

Several of our additional findings also require further exploration. We found that readmissions due to kidney and urinary tract infection had a weak positive impact on operating margin. A possible explanation may be the reimbursement for kidney and urinary tract infection care enables hospitals to experience limited, but positive profits from its treatment. Standard treatments may also result in a low complication level through treatment with antibiotics (Ronald, et al., 2001). Alternatively, reimbursement levels may produce a marginal profit for treating such patients at high volume levels. It is likely that conditions that had statistically significant negative influence (COPD, CHF, and diabetes with medical management) have comorbid chronic conditions with a higher cost of care and risk of readmission (Wolff, Starfield, & Anderson, 2002). Readmission of such patients with chronic and comorbid conditions would lead to poorer hospital financial performance. Additional study is needed to fully assess the implications of this anomaly.

The hospital percentage of uncompensated care had a negative effect on operating margin in the composite score model as well as in the models for each readmission condition. For several conditions that were chronic or subject to surgical site infections the negative influence was statistically significant. For instance, uncompensated care had a negative influence on conditions such as kidney and urinary tract infection, infectious pneumonia, and hip fracture with surgical repair. Hospitals that had higher percentages of patients unable to pay for their care may experience higher levels of readmissions because such conditions may require expensive antibiotic prescriptions, physical therapy, and follow-up care by primary care physicians. Lack of insurance coverage may result in patients not having access to adequate follow-up care or prescriptions to manage their conditions (Hadley, 2003).

Further complicating this lack of insurance coverage, may be the small percentage of patients that schedule a visit with their primary care physician post-discharge (Jenks, et al., 2009; Goodman, Fisher, & Chang, 2011). Inability to afford inpatient care or being uninsured translates into patient hardship in affording the cost of follow-up care upon discharged, which may result in the patient being readmitted due to infections or complications.

Technical Complexity Index has a positive impact on Operating Margin ($\beta = 0.754$, $p < 0.10$) and on Total Margin ($\beta = 0.844$, $p < 0.01$) in the random effects model. This supports the findings which indicate that hospitals that are technologically more advanced may have better quality measures (Himmelstein, Wright, & Woolhandler, 2010) and higher quality may have positive influence on financial performance (Alexander, et al, 2006).

11. Management Implications

The negative influence of readmissions provides managers with motivation to implement initiatives that lower unplanned readmission rates. The negative influence of readmissions indicates that a business case for reducing readmissions may exist, but will require implementation along the care continuum—before, during, and after the initial hospital admission (Minott, 2008).

Managers should dedicate resources that focus on the unique care issues that patients at risk for multiple readmissions represent, particularly for patients admitted with chronic conditions, given the negative influence of readmissions (Soeken, et al., 1991; Marcantonio, et al., 1999). Managers may find it most beneficial to focus on a subset of conditions that result in high readmission volume, such as diabetes, surgical site infections, CHF, and COPD. Specific strategies have been shown to reduce readmission rates, including: (1) improving care processes within the hospital, especially those associated with surgical site infection; (2) enhancing patient comprehension of and compliance with post-discharge care instructions (Boulding, Glickman, Manary, Schulman, & Staelin, 2011); and (3) improving follow-up care and monitor the patient's clinical condition to intervene if deterioration is detected (Stone & Hoffman, 2010).

Many infections resulting in unplanned readmission may be caused by surgical errors that can increase the likelihood of infection, deterioration of the patient's physical condition, and medical complications (Encinosa & Hellinger, 2008). Managers should focus on strategies to minimize such infections with their associated cost implications. Efforts to reduce adverse patient events for surgical patients may also improve the overall quality of care and may lower long-term health care costs for hospitals (Porter & Teisberg, 2006).

A high proportion of readmissions occur relatively soon after discharge and provides support for inpatient and early outpatient interventions to reduce complications (Dharmarajan, et al., 2013). At discharge, managers should focus on enhancing the understanding of information and advice to reduce unplanned readmissions (Chollet et al., 2011). This is supported by the findings of Boulding et al. (2011) who found that patient satisfaction with discharge instructions and planning were associated with lower 30-day risk-standardized readmission rates.

Upon discharge managers can use specially trained nurses or pharmacists to provide telephone follow-up to confirm that patients or caregivers have received clear discharge instructions (Chollet et al., 2011); schedule follow up appointments with primary care physicians, particularly for chronically ill patients who visit multiple providers and specialists (Jencks et al., 2009; Goodman et al., 2011); and monitor patients and intervene before a patient's condition becomes more serious and requiring readmission (DelliFraine & Dansky, 2008).

Further, about one third of unplanned readmissions occur during the last half of the 30 day period, patients will require additional attention and interventions after the initial follow-up period (Dharmarajan, et al., 2013).

12. Limitations

Additional factors should be considered when interpreting this study. The sample of hospitals is only from Pennsylvania, a state that has a high percentage of elderly persons living in rural areas served by freestanding non-profit hospitals (Pennsylvania Rural Health Association, 2010). However, this hospital population allowed for the control of differences regulations and market factors among states. A national population may allow for confirmation of the results across diverse market, payer-mix, case mix, regulatory, and competitive environments.

The data for readmissions do not identify on which day the readmission occurred or the patient demographic factors. The model also does not control for community provider resources such as number of nursing homes or hospices.

13. Future Research

The findings presented here highlight areas in need of future research which could focus on identifying care processes that lead higher readmissions. Higher readmission rates may be a symptom of poor hospital quality and patient satisfaction (Chollet, et al., 2011; (Boulding, et al., 2011). Identification of underlying care processes that may contribute to higher unplanned readmissions and poor quality may provide managers with crucial insights into care improvement (Porter & Teisberg, 2007). Our results also indicate that not all unplanned have a negative influence on financial performance and represent opportunities for additional assessment.

Future research could also assess whether the influence on performance of readmitted medical diagnosis patients differs from surgical patients. Future study may also build on recent findings that show patients are at risk throughout the entire 30-day period and readmissions are not correlated with age, sex, or race (Dharmarajan, et al., 2013).

14. Conclusion

Unplanned readmissions are frequent, expensive, and sometimes life-threatening event that is associated with gaps in follow-up care (Jenks et al., 2009). Hospital managers need to gain a thorough understanding of unplanned readmissions in order to reduce their prevalence. Many of these readmissions should be prevented. The unplanned readmissions in this study were due to complications and infections and they had an overall negative influence on both operating margin and total margin. The negative influences of nonsurgical conditions also focus the attention on the importance of follow-up care post discharge, especially for patients with multiple chronic conditions. Many times such patients are left on their own to follow instructions they do not understand and not taking medications.

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