ABSTRACT

Do hospitals that participate in HVBP actually provide better quality care?

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Incentives can work wonders in promoting individuals or entities to do something they wouldn't necessarily engage in normally. Hospital Value Based Purchasing (HVBP) is a pay-for-performance program that was started by the Centers of Medicare and Medicare Services (CMS) and it aims to do just that. The end goal of this program is to provide acute care hospital patients high quality care and to better the overall hospital stay experience for patients. However, few have asked the question of whether these hospitals that participate in HVBP actually provide better quality of care to their patients in comparison to the hospitals that do not participate in this pay-for-performance program. In this paper, three response non-HVBP variables will be used in order to assess quality of care: the all cause hospital-wide readmission rate, the serious complication rate, and the median wait time in the emergency department. Through the use of multilinear regression models, the determination of whether participating hospitals provide better quality for care will be assessed

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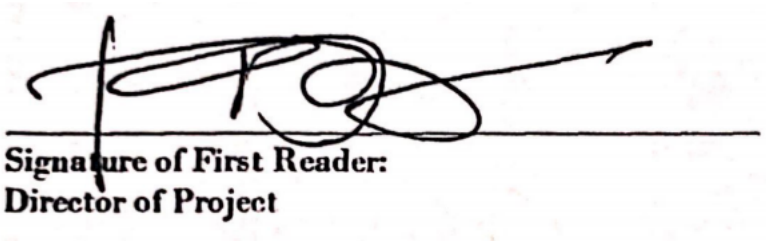

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DO HOSPITALS THAT PARTICIPATE IN HVBP ACTUALLY PROVIDE BETTER QUALITY CARE?

A Thesis Submitted to the Faculty of

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Honors Program

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TABLE OF CONTENTS

TABLE OF TABLES AND FIGURES

INTRODUCTION

In the United States, healthcare is vast. It is a $3.8 trillion industry (Centers for Medicare & Medicaid Services (U.S.), & United States, 2000). Despite the expense and being one of the most developed countries in the world, approximately 250,000 patients die each year in the United States, simply from medical errors (Makary, & Daniel, 2016). It is clear that the healthcare industry faces significant problems in both cost and quality. Further, in 2017 alone, healthcare insurers and providers spent an overwhelming $812 billion on administration costs, mostly due to the overhead in their Medicare and Medicaid costs. Indicating efficiency is also an ongoing concern (Himmelstein, Campbell, & Woolhandler, 2020).

Everyone will seek healthcare at some point in their life. However, the financial barriers to gaining access to care in the United States are increasingly burdensome. As an example, the average cost of common surgeries such as hip replacement or an angioplasty exceed $40 thousand dollars and $28 thousand dollars respectively. More complex cases drive the cost of care even higher. Valve replacement surgery costs are often in excess of $170 thousand dollars, while heart bypass surgery can cost over $123 thousand dollars (Stewart, 2020). Beyond the cost, simply gaining access to proper healthcare is a problem within itself, especially in rural areas. Additionally, there are gaps in proper access to healthcare that disproportionally affect those of different races, ethnicities, and income statuses (Caldwell, Ford, Wallace, Wang, & Takahashi, 2016).

However, perhaps the most significant concern within the U.S. healthcare system is the persistent suboptimal quality it produces, while also spending twice as much as 10 high income countries (Papanicolas, Woskie, & Jha, 2018). Additionally, medical errors are the third leading cause of death in the U.S. (Makary, & Daniel, 2016). This may be at least partially due to the reimbursement system which compensates providers far more for the care of the chronically ill than promoting wellness or preventing illness. Recently, legislators and policy makers have attempted to address this issue with the passage of the Affordable Care Act (Centers for Medicare & Medicaid Services (U.S.), & United States, 2000). One outcome of the ACA was the advancement of a series of pay-for-performance (P4P) initiatives, which aim to reward hospitals that provide a higher quality of care through monetary incentives.

The Centers for Medicare and Medicaid Services (CMS) led the way in designing P4P programs, including the Hospital Value Based Purchasing (HVBP) program (James, 2012). The purpose of HVBP is to incentivize hospitals to deliver high quality, versus merely high volume, care. The HVBP is specifically designed to improve the quality and experience of care for hospital patients (Centers for Medicare & Medicaid Services (U.S.), & United States, 2000). It does this by encouraging hospitals to improve the quality, efficiency, patient experience, and safety of care that Medicare beneficiaries receive during acute care inpatient stays (Centers for Medicare & Medicaid Services (U.S.), & United States, 2000). Hospitals who participate are assessed by a set of key metrics that determine the quality of care they provide, which result in reimbursements that are directly related to their quality-of-care ratings (Blumenthal & Jena, 2013). The

HVBP program contains 4 domains that are scored individually. These domains are (*1*) clinical outcomes, (*2*) safety, (*3*) person and community engagement, and (*4*) efficiency and cost reduction. The amount of financial benefit participating hospitals receive is determined by the combination of three factors. These factors are (*1*) Total Performance Score (TPS), (*2*) value-based incentive payment percentage, and (*3*) total amount available under the program for value-based incentive payments (Centers for Medicare & Medicaid Services (U.S.), & United States, 2000). HVBP is a large program, part of an even larger governmental entity. In 2019, CMS paid out more than $1.9 billion to roughly 2,700 hospitals in the United States. (Morse, 2019).

The literature is surprisingly silent pertaining to evaluation of the quality of HVBP participating hospitals in comparison to those not enrolled in the program. Although some studies discuss problems with HVBP or identify the performance of hospitals within the program, no comparison to hospitals that are not in the program has yet been made (Borah, Rock, Wood, Roellinger, & Johnson, 2012; Ramierez, Tracci, Stukenborg, Turrentine, & Kozower, 2016; Ryan, Krinsky, Maurer, & Dimick, 2017). Thus, examining the difference in quality of care between participating and non-participating hospitals is important to determine if participating hospitals provide better quality of care. Earlier researchers have found that individuals who are being observed perform better at the same task than those who are not (Mayo, 1933; McCambridge, Witton &. Elbourne, 2014). One could presume that organizations, like individuals, will improve performance in areas of work that are being directly observed and incentivized. Thus, it is reasonable to assume that hospitals with published quality metrics are more

likely to demonstrate higher quality scores on these measures than their counterparts whose quality metrics are not published (Hibbard, Stoackard, & Tusler, 2003).

With the above shortcomings in mind, in this study, three non-HVBP response variables will be used to assess hospital performance, including the serious complication rate, all cause hospital-wide readmission rate, and the average number of minutes patients spent in the emergency department before being sent home. Given the diversity of hospitals throughout the United States, a number of control variables will also be included in the analysis to account for specific variation at the organizational level including hospital ownership type (for profit vs not-for-profit), staffed bed size, geographic region, teaching status, case mix index, outpatient service mix, rural or urban, government operated or not, system member, market concentration, and occupancy rate.

The following chapter will contain the literature review of all the relevant works pertaining to the HVBP program. The variables selected for inclusion in this study will be justified from these articles and the reader's understanding of the HVBP program. Following the literature review, the methods of the statistical calculations will be defined, the statistical calculations will be performed, and the results section will summarize the findings. Following the results section is the discussion section, which will further interpret the statistical findings. These interpretations will also bring to light ideas that the reader might not necessarily be considering. The conclusion will wrap up the study and provide guidance for consideration for future research. This project's end goal is to determine if there is a positive relationship between the quality of care and hospitals that are participating in the HVBP program. As a researcher and potential future care

provider, I hold the general hope that hospitals who participate in HVBP will provide higher quality care. If they are not, then the question must be asked: is HVBP serving any sort of purpose towards creating quality-based care?

CHAPTER ONE

Literature Review

According to Medicare Cost Reports and Final Rule Data, for every patient discharge, the median hospital lost $82. While 45% of hospitals were indeed profitable, with 2.5% earning upwards of $2,475 per adjusted discharge, hospitals that treated higher proportions of Medicare patients had higher expenditures per discharge (Bai & Anderson, 2016). While we do very well at improving the quality of care with higher volumes in specialty care, seeking volume in primary care might not always be of the best interest to the patient (Porter & Teisberg, 2006). The U.S. healthcare system must move away from their fee for service infrastructure and focus on value-based care (Miller, 2009). According to many researchers, the volume of a hospital should be focused on specialty care and instead of swiftly addressing superficial issues in primary care patients, care providers who perform high quality should spend the time and energy to solve health issues at its foundation (Porter & Teisberg, 2006).

To motivate an organization or individual to do something counterproductive to their financial performance, there must be a motivating factor in play. It has been shown that there is a positive effect of individual financial incentives on performance (Garbers & Konradt, 2014). This is how P4P programs came into existence, specifically HVBP. In fact, the primary goal of HVBP is to incentivize care providers to delivery high value, not just high volume, health care (Blumenthal & Jena, 2013). Although this makes sense theoretically, many have asked if it actually works. Studies have been done to assess if the HVBP is actually measuring quality of care appropriately, (Borah, Rock, Wood, Roellinger, & Johnson, 2012; Ramierez, Tracci, Stukenborg, Turrentine, & Kozower,

2016; Ryan, Krinsky, Maurer, & Dimick, 2017). These studies only measured how accurate the Total Performance Score (TPS) was in assessing quality of care in hospitals. However, none of the studies in question examined if hospitals participating in HVBP provide better quality care than those who do not.

Instead of rewarding the quantity of services rendered, HVBP rewards hospitals based on the quality of care provided to patients that are part of Medicare (Centers for Medicare & Medicaid Services (U.S.), & United States, 2000). In order to gauge the quality-of-care hospitals are providing, they use key outcome measures such as mortality and complications, healthcare-associated infections, patient safety, patient experience, process, efficiency and cost reduction (Centers for Medicare & Medicaid Services (U.S.), & United States, 2000). Many of these measures continue to evolve. For example, assessing the patient experience has required modification of the questions to assess the quality of care they were provided at the hospital. Historically, the questions patients were being asked had more to do with a hotel stay than with a health care institution (Anderson, 2020).

Some have also argued that many of the published studies evaluating the impact of P4P programs suffer from methodological weaknesses that make it hard to determine whether the HVBP intervention had an effect above and beyond other changes. Damberg, Sorbero, Lovejoy, Martsolf, and Raaen (2014) assessed hospital characteristics with how they were ranked in accordance to HVBP. The authors found that most of the variation among HVBP scores was attributed to profit status, geographic region, and the number of cost per case (CPC) reported measures. Which provides valid reason to believe that they should be controlled for when studying quality of care between participating and not

participating hospitals. Another study observed how HVBP could affect the business model of the hospital. It was determined that HVBP was associated with superior hospital performance (Borah, Rock, Wood, Roellinger, & Johnson, 2012), however the researchers seem to agree that the current research contained some methodological challenges. Thus, these prior authors encountered difficulty determining if HVBP was actually what was causing these positive observations, or if there were other factors involved (Damberg, Sorbero, Lovejoy, Martsolf, & Raaen, 2014).

Another study was simply observing how the HVBP program affected hospitals. Ryan (2013) was interested in whether or not HVBP will increase disparities in health care. He found that pay-for-performance programs such as HVBP need to be altered in order for their disbursements to be more efficient and representative of the care a hospital provides (Ryan, 2013). But yet again, this is another study that chose to solely focus on participating hospitals.

There have been a few studies that look at the quality of care that participating versus non-participating hospitals provide. In one study done by Figueroa, Tsugawa, Zheng, Orav, & Jha (2016), the authors evaluated the performance of 4,267 acute care hospitals, of which 2,919 were currently participating in the HVBP program and 1,348 hospitals were ineligible and used as controls. The mortality rates were measured among all of the hospitals and then compared to be able to determine if the participating hospitals were associated with a lower 30-day risk adjusted mortality for acute myocardial infarction, heart failure, and pneumonia. The findings concluded that the evidence to suggest that HVBP led to a lower mortality rate is lacking. They also suggest, similar to other studies mentioned previously, that there are some holes in this specific

pay for performance program (Figueroa, Tsugawa, Zheng, Orav, & Jha, 2016). Another study conducted by Ryan, Krinsky, Maurer, & Dimick (2017) also examined the HVBP program to assess if participating hospitals were associated with lower mortality rates. They evaluated the performance of the hospital in respect to mortality rate and other clinical process and patient experience quality measures over the first four years that the HVBP program was in existence. It was determined that HVBP was not associated with significant reductions of mortality rate and that even in respect to the measures of clinical process or patient experience, HVBP participating hospitals showed no significant improvement (Ryan, Krinsky, Maurer, & Dimick, 2017).

While these studies are commendable and provide insights into the comparison between participating and not participating hospitals in respect to the quality of care they each provide, the use of mortality rate as the dependent variable can be problematic when assessing the quality of care. A mortality rates can be considered to be a continuous variable. However, mortality itself is a binary measure. Meaning someone is either alive or they are dead. This binary process fails to evaluate the full continuum of care. Two studies point to showing that mortality is an instance when failure is not a good measure of success. Werner and Bradlow (2006) concluded that hospital performance measures do not predict significant differences in the hospital risk-adjusted mortality rate. Additionally, these authors suggest that further studies should be developed to determine other measures that are more associated with patient outcomes (Werner & Bradlow, 2006). Another study by Shojania and Forster (2008) points to the idea of using more robust measures of performance instead of solely using the mortality rate. They found

mortality rates correlate weakly with other measures of quality care as well (Shojania & Forster, 2008).

Since mortality rate has been found to be a poor predictor of the quality of hospital care, this study will utilize alternative variables that have been used frequently in other studies to measure quality of care and evaluate how hospitals perform. While there is no one perfect way to test quality of health care, this study has attempted to compile the best measures of quality of care. In order to assess the quality of care for a hospital, one cannot simply look at a single metric to adequately determine the performance of a process as complex, multifaceted, and integrative as healthcare delivery. There are many variables that contribute to the quality of care a patient receives. Thus, to be able to draw conclusions on the comparison of the quality of care participating and not participating hospitals provide, this study uses 3 response variables in total. Each of them measures something different. Since they are distinctive variables that provide insight into various aspects of the care process, they should provide a more robust representation of the quality of treatments patients receive.

CHAPTER TWO

Methods

Data from 3,930 hospitals was gathered from the Definitive Healthcare data set (defhc.com) which complies data drawn from the Medicare Cost Reports and the CMS HVBP program. The data came from all Medicare reporting short term acute care hospitals in 2018.

The dependent variables for this study were purposefully selected to examine a diverse set of aspects of health care delivery not already measured directly in the HVBP program. It has already been established that mortality rate is not a good indicator of quality of healthcare due to various reasons. However, serious complication rate, all cause hospital-wide readmission rate, and average number of minutes patients spent in the emergency department before being sent home rate are considered to be reliable measures of quality of care. They were used in numerous other studies and paint a holistic picture of healthcare within a hospital (Haas, Gomez, Hemmila, & Nathens, 2011; Benbassat & Taragin, 2000; Chee, Ryan, Wasfy, & Borden, 2016; Das, Norton, Miller, Ryan, & Birkmeyer, et. al, 2016; Krumholz, Wang, Lin, Dharmarajan, & Horwitz, 2017; Morley, Unwin, Peterson, Stankovich, & Kinsman, 2018; Shen & Lee, 2018).

Intuitively, the serious complication rate determines how frequently an inpatient acute care hospital could have prevented a serious complication from occurring. Hospitals that provide better quality care should have a lower serious complication rate. The readmission rate indicates how many patients had to return to the hospital after they were originally discharged. Hospitals that provide higher quality care should see lower readmission rates because they have appropriately resolved the patient's health care

needs without further intervention. The average number of minutes patients spent in the emergency department before being sent home rate depicts the quality of the emergency department within the hospital, specifically triage methods and efficiency of time spent with patients. Hospitals that provide better quality of care would have a lower average time. Each of these response variables are assessing different facets of the hospital in order to address any holes in the quality of care a participating or non-participating hospital provides

The independent variable of interest is a dichotomous variable indicating whether the hospital is participating in the HVBP program, or if they are not participating in the HVBP program. Additionally, numerous control variables are included in the study to account for confounding variation associated with various hospital characteristics. These variables are also frequently used in numerous other studies regarding the assessment of HVBP and the quality of care a hospital provides. The sources for these control variables can be found in Table 1. These control variables include profit status, staffed bed size, American Hospital Association (AHA) geographic region, teaching status, case mix index, average length of stay, local wage index, outpatient service mix, rural or urban designation, government operated (or not), number of discharges, hospital compare rating, sole community provider (or not), system member (or not), market concentration (as measured via the Herfindahl-Hirschman Index), and occupancy rate. The main variable we will be using as a comparison is whether the hospital is participating in the HVBP program, or if they are not participating the HVBP program.

Below is a table that identifies the variable, categorizes it as either a control or a response variable, defines it, and provides the sources from which they originated. They were discovered from a cross examination of literature reviews.

Table 1. Variable Identification & Description

Type	Variable	Description	Source
Response	Serious Complication Rate	An expected measure based upon how often adult patients had certain serious, but potentially preventable complications related to medical or surgical inpatient hospital care (medicare.gov)	(Haas, Gomez, Hemmila, & Nathens, 2011)
	All Cause Hospital-Wide Readmission Rate	The proportion of patients that were readmitted to the hospital for any reason compared to total number of patients that were dismissed from the hospital.	(Benbassat & Taragin, 2000) (Chee, Ryan, Wasfy, & Borden, 2016) (Das, Norton, Miller, Ryan, Birkmeyer, et. al, 2016) (Krumholz, Wang, Lin, Dharmarajan, Horwitz, et. al, 2017)
	Average number of minutes patients spent in the emergency department before being sent home Rate	The number of minutes patients waited in the ED before they were sent home by hospital staff	(Morley, Unwin, Peterson, Stankovich, & Kinsman, 2018) **(a)** (Shen & Lee, 2018)
	For Profit Ownership	Whether a hospital operates as a for-profit or not-for-profit entity	(Borah, Rock, Wood, Roellinger, Johnson, et. al, 2012) (Das, Norton, Miller, Ryan, Birkmeyer, et. al, 2016) (DesHarnais, McMahon, Wroblewski, & Hogan, 1990) (Lasater, Germack, Small, & McHugh, 2016) (Sloan, Picone, Taylor, & Chou, 2001) **(a)**

	Staffed Bed Size	The number of beds that are licensed and physically available for which staff is on hand to attend the patient who occupies the bed (Emergency support Function & Health and Medical Response)	(Chee, Ryan, Wasfy, & Borden, 2016) (Das, Norton, Miller, Ryan, Birkmeyer, et. al, 2016) (Haas, Gomez, Hemmila, & Nathens, 2011) (Ryan, Krinsky, Maurer, & Dimick, 2017) (Shojania & Forster, 2008)
	Region	The area in the part of the country they are located	(Borah, Rock, Wood, Roellinger, Johnson, et. al, 2012) (Das, Norton, Miller, Ryan, Birkmeyer, et. al, 2016) (DesHarnais, McMahon, Wroblewski, & Hogan, 1990) (Gray, 1986)
	Teaching Status	A hospital will be considered a teaching hospital if it has one or more ACGME (Accreditation Council for Graduate Medical Education) approved residency programs (Healthcare Cost and Utilization Project)	(Ayanian & Weissman, 2002) **(a)** (Chirikos & Sear, 2000) **(**Das, Norton, Miller, Ryan, Birkmeyer, et. al, 2016) (DesHarnais, McMahon, Wroblewski, & Hogan, 1990) (Lasater, Germack, Small, & McHugh, 2016) (Ryan, Krinsky, Maurer, & Dimick, 2017)
	CMI (Case Mix Index)	The average relative DRG weight of a hospital's inpatient discharges, calculated by summing the Medicare Severity Diagnosis	(Aboelela, Stone, & Larson, 2007) (Lasater, Germack, Small, & McHugh, 2016)

Control		Related Group (MS-DRG) weight for each discharge and dividing the total by the number of discharges (Healthdata.gov)	
	Average Length of Stay	The average amount of time, in days, that a patient remains in the hospital before they are discharged	(Aboelela, Stone, & Larson, 2007) (Chirikos & Sear, 2000) (Hofmarcher, Paterson, & Riedel, 2002)
	Local Wage Index	The ratio of the area's average hourly wage to the national average hourly wage (CMS.gov)	(Chirikos & Sear, 2000)
	Outpatient Service Mix	The average relative weight of the procedures billed for outpatient service (CMS.gov)	(Chirikos & Sear, 2000)
	Rural or Urban	Whether the hospital is located in an urban or rural area	(Das, Norton, Miller, Ryan, Birkmeyer, et. al, 2016) (Lasater, Germack, Small, & McHugh, 2016)
	Government Operated	Whether the hospital is operated by a government entity or not	(Das, Norton, Miller, Ryan, Birkmeyer, et. al, 2016) (DesHarnais, McMahon, Wroblewski, & Hogan, 1990) (Chirikos & Sear, 2000)
	Number of Discharges	The amount of individuals that are determined to be healthy enough to be discharged from the care of the hospital.	(Ayanian & Weissman, 2002) **(a)** (Hofmarcher, Paterson, & Riedel, 2002)

	Hospital Compare Rating	A consumer-oriented website that provides information on how well hospitals provide recommended care to their patients (CMS.gov)	(Goldman & Dudley, 2008) (Halasyamani & Davis, 2007) (Silber, Rosenbaum, Brachet, Ross, Bressler, et. al, 2010) (Werner & Bradlow, 2006)
	System Member	Whether the hospital is part of a hospital system	(Gray, 1986) **(a)**
	Market Concentration HHI	The Herfindahl-Hirschman Index is a commonly accepted measure of market concentration. The HHI is calculated by squaring the market share of each firm competing in the market and then summing the resulting numbers.	(Lasater, Germack, Small, & McHugh, 2016)
	Occupancy Rate	The proportion of a hospital's inpatient capacity being utilized for inpatient care (Healthcare Financial Management)	(Chirikos & Sear, 2000) (Das, Norton, Miller, Ryan, Birkmeyer, et. al, 2016)

(a) Designates that the variable was not used directly as a control variable in a study measuring hospital performance. Instead, it was determined that quality of care delivered to patients could be, in part, attributed to differences in that variable.

The regressions were ran using a list-wise calculation. Meaning, hospitals without a complete dataset were excluded from the calculation. Each hospital was assigned a geographic region in accordance to the American Hospital Association (1-9). System member was coded so that 1 = part of a hospital system, 0 = not part of a hospital system. For teaching, 1 = teaching hospital, 0 = not a teaching hospital. For the hospital compare survey 1 = score of 5, 0 = else. In regard to whether a hospital is participating in HVBP, 1 = participating, 0 = not participating. For ownership, 1 = for profit, 0 = else. For government owned or not, 1 = government owned, 0 = not. For city location, 1 = urban, 0 = rural. All other variables can be easily interpreted by their given, uncoded, numbers. For the outpatient service mix, the inpatient and outpatient revenues were summed and used as the denominator and the outpatient revenue was used as the numerator to solve for the outpatient service mix as a proportion.

Three separate multilinear regressions were conducted for each response (dependent) variable using IBM SPSS Statistics package 27. Following an initial analysis, the “local wage index” had VIF values above 10 for all 3 of the linear regressions, thus it was removed from the dataset and the linear regressions were repeated for all 3 response variables.

CHAPTER THREE

Results

Below is Table 2, which serves as a table for the summary statistics of the linear model. It described the data that was used to create results. The referent category is the nonparticipating hospitals.

Table 2. Summary Statistics

	Mean/%	**s.d.**
All Cause Hospital-Wide Readmission Rate	15.27%	-
Serious Complication Rate	0.99	0.19
Average ED Wait Time	122.62	75.17
Participating	89%	0.32
Region 1 (CT, ME, MA, NH, RI, VT)	5%	0.23
Region 2 (NJ, NY, PA)	12%	0.32
Region 3 (DE, KY, MD, NC, VA, WV, DC)	9%	0.28
Region 4 (AL, FL, GA, MS, SC, TN, PR)	16%	0.37
Region 5 (IL, MI, IN, OH, WI)	16%	0.37
Region 6 (IA, KS, MN, MO, NE, ND, SD)	8%	.0.27
Region 7 (AR, LA, OK, TX)	14%	0.35
Region 8 (AZ, CO, ID, MT, NM, UT, WY)	6%	0.24
Region 9 (AK, CA, HI, NV, OR, WA)	14%	0.34
System Member	83%	0.37
Teaching	^5	0.24
Outpatient Service Mix	55.05%	-
Hospital Compare	11%	0.32
For Profit Ownership	24%	0.43
Government	12%	0.33
Urban/Rural	73%	0.45
Case Mix Index (CMI)	1.67	0.35
# of Discharges	10,568.99	10,981.00
# of Staffed Beds	206.94	190.86
Occupancy Rate	51.21%	-
Market Concentration HHI	34%	0.32
Average Length of Stay	4.29	1.20

To begin the analysis of the response variables the average readmission rate across the data set was 15.27%, the average serious complication rate was 0.99, and the average wait time in the emergency department was 122.62 minutes. The serious complication rate measure is an AHRQ quality indicator. It is an observed versus expected measure, meaning that when the observed rate is smaller than the expected rate, the hospitals overall are performing better than average on this quality indicator. This means that the serious complication rate of all hospitals in the data set was 0.99 times what we expected it to be. On a separate note, an interesting finding is that the standard deviation of the emergency department wait time was 75.17 minutes, which seems to be very large.

89% of the hospitals in this data set are participating in the HVBP program. Which means that there are far less hospitals that are not participating in the program than participating. 83% of hospitals are a part of some sort of system. Whereas only 6% of hospitals are ACGME accredited as teaching hospitals. A majority of the care services provided by the hospitals were outpatient services, as the service mix percentage is 55.05%. As far as the hospital compare rating goes, more received a score of less than 5 than 5 since the proportion is 0.11. About one quarter (0.24) of the hospitals in the data set are for-profit hospitals and about one-tenth (0.12) of the hospitals in the data set are government operated. Most (73%) hospitals are located in urban areas. All hospitals across the data set had an average CMI of 1.67. Something interesting to point out is that the standard deviation for the number of discharges was greater than the mean, giving the distribution a large left skew. Similarly, the standard deviation for the number of staffed beds is nearly as large as the average, meaning this distribution is heavily skewed left as

well. The average occupancy rate was 51.21% and the average length of stay was 4.29 days.

Next, included is Table 3 which provides the results from the multiple regressions that were conducted.

Table 3. Multiple Regression of all response variables

Variable	All Cause Hospital-Wide Readmission Rate			Serious Complication Rate			Average ED Wait Time		
	β	S.E.	Sig.	β	S.E.	Sig.	β	S.E.	Sig.
	N = 2852, Adj R^2 = 30.2% F = 54.664			N = 2843, Adj R^2 = 14.5% F = 21.878			N = 2710, Adj R^2 = 31.3% F = 54.731		
Participating	0.249	0.0511	0.00	0.010	0.013	0.44	-11.419	4.993	0.02
System Member	-0.061	0.039	0.12	-0.018	0.010	0.07	-3.145	3.642	0.39
Teaching	0.326	0.066	0.00	0.086	0.016	0.00	20.460	5.887	0.00
Outpatient Service Mix	-0.002	0.001	0.02	0	0	0.14	-0.117	0.099	0.24
Hospital Compare Rating	-0.818	0.043	0.00	-0.157	0.011	0.00	-18.739	3.933	0.00
For Profit Ownership	0.389	0.036	0.00	-0.035	0.009	0.00	0.005	3.282	0.99
Government Operated	0.056	0.045	0.22	0.029	0.011	0.01	10.497	3.990	0.01
Urban/Rural	-0.076	0.038	0.04	-0.006	0.009	0.55	1.809	3.328	0.59
Case Mix Index (CMI)	-0.575	0.052	0.00	-0.039	0.012	0.00	2.569	5.928	0.66
# of Discharges	0	0	0.65	0	0	0.14	0	0	0.77
# of Staffed Beds	0	0	0.04	0	0	0.01	0.039	0.017	0.02
Occupancy Rate	0.003	0.001	0.01	0.001	0	0.00	1.151	0.101	0.00
Market Concentration HHI	-0.350	0.055	0.00	-0.031	0.014	0.03	-7.784	4.926	0.11
Average Length of Stay	0.004	0.015	0.77	0,001	0,001	0.16	6.356	1.629	0.00
Region 2 (NJ, NY, PA)	-0.136	0.070	0.05	0.029	0.019	0.13	-14.234	6.310	0.00
Region 3 (DE, KY, MD, NC, VA, WV, DC)	-0.417	0.073	0.00	0.004	0.020	0.85	-34.158	6.613	0.02
Region 4 (AL, FL, GA, MS, SC, TN, PR)	-0.257	0.068	0.00	0.006	0.019	0.74	-46.373	6.108	0.00
Region 5 (IL, MI, IN, OH, WI)	-0.330	0.068	0.00	-0.007	0.018	0.69	-40.865	6.165	0.00
Region 6 (IA, KS, MN, MO, NE, ND, SD)	-0.483	0.076	0.00	0.007	0.020	0.73	-53.808	6.939	0.00
Region 7 (AR, LA, OK, TX)	-0.303	0.069	0.00	0.009	0.019	0.63	-40.465	6.336	0.00
Region 8 (AZ, CO, ID, MT, NM, UT, WY)	-0.737	0.081	0.00	0.020	0.022	0.35	-43.158	7.384	0.00
Region 9 (AK, CA, HI, NV, OR, WA)	-0.503	0.071	0.00	-0.018	0.019	0.37	-0.378	6.466	0.95

The Normal P-Plot showed no significant deviations for the dependent variable of all cause hospital-wide readmission rate. The Normal P-Plot showed slight deviations for the dependent variables of serious complication rate and average ED wait time. The adjusted R^2 values were moderate. 30.2% of changes in all cause hospital-wide readmission rate, 14.5% of changes in serious complication rate, 31.3% of changes in average ED wait time were explained by the linear model.

In regard to the independent variable of participating, all cause hospital-wide readmission rate showed great statistical significance, serious complication rate showed no significance and average ED wait time showed statistical significance. Other notable findings are that the variables teaching, hospital compare rating, government operated, and occupancy rate were significant across all dependent variables. According to the model, in comparison to not participating hospitals, participating hospitals had a 0.249% higher all cause hospital-wide readmission rate and 11.4 minutes lower average ED wait time.

CHAPTER FOUR

Discussion & Conclusion

As a reminder, the thesis of this paper was that hospitals that participate in HVBP provide better quality of care than non-participating hospitals. It is my hope as a researcher and a potential future health care provider that incentive-based programs are actually improving quality of care. Phrased another way, I hope the HVBP program actually works.

Now I will begin to interpret the results from the previous section as it applies to the overall point of the paper. It was observed that participating hospitals have a 0.249% higher readmission rate in comparison to hospitals that are not participating. This finding is statistically significant, which leads me to conclude this is bad news for HVBP. Essentially, an individual has a higher likelihood of being readmitted to a hospital that is participating in the HVBP program, than one that is not. This is concerning because one would expect hospitals that are focused on quality-based care to thoroughly and amply care for individuals in order for them to not be readmitted to the hospital.

In regard to the serious complication rate, there was no significant difference between participating hospitals and non-participating hospitals. At first glance, this might not appear to be a big deal. But it is really a story onto itself. One would expect there to be a statistically significant difference in serious complication rates, showing that participating hospitals have a lower rate. However, this is not the case. While I do not wish to delve into any counter truth arguments, it is concerning that hospitals participating in the HVBP do not have lower serious complication rates.

In contrast to the previous points that I have made, the median wait time in the emergency department sheds some positive light on participating hospitals. The mean weight time among all hospitals studied is 122.62 minutes. Additionally, on average, one would spend 11.42 minutes less waiting in the ED of a participating hospital when compared to a non-participating hospital. This is positive because I expected the median wait time to be less in participating hospitals because median ED wait time is a determinant of quality of care among all hospitals.

Now, what does this mean for the HVBP program? The results provided do not necessarily prove that the program is not working. But they also do not confirm that the HVBP program is. If the HVBP program resulted in hospitals providing better quality of care, they would have shown significantly better comparisons than what I have found.

This provides insight to the fact that much thought is needed when creating these incentive-based programs. The effectiveness of the HVBP program has not been shown to reflect perfectly on the quality of care those who participate in the program. One theory that could explain this is the TPS that hospitals receive. Perhaps, the TPS score is not constructed in a way that accurately depicts the quality of care provided in a hospital.

This study is also one of the first of its kind. There have been few studies that have actually assessed whether or not participating hospitals provide better quality of care than non-participating hospitals. Future researchers can build off of this study by including more response variables and obtaining a larger sample size. This could lead to a more declarative understanding of the level of quality of care the hospitals participating in HVBP provide. One limitation of this study is the response variables that were used. Ideally, there would be more response variables used so that the quality of care could be

thoroughly and holistically measured. However, these response variables were found to be used in many studies and seemed independent enough to be the 3 that were chosen. In future studies, researchers can either add or change the response variables that they feel appropriately measure the quality of care a hospital provides. Another limitation is that the data set is from 2018. Within the past 2 and a half years, there could potentially be impactful changes that might alter the results that were achieved in this study.

Another limitation within the data is that there is a small amount of non-participating hospitals (n=390) compared to HVBP participating hospitals (n=3500). Given the small dataset it could be possible that the variables are not accurately portraying the relationship they have with non-participating hospitals. Overall, there is no such thing as a perfect measure and there is no such thing as a perfect data set. These discrepancies could account for some errors when it comes to the conclusions made. But since these truths are inevitable, I stand firm with the conclusion that I have provided.

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