2018

The Iron Triangle of Healthcare: Examining the Relationship between Quality, Efficiency, and Uncompensated Care for Florida Hospitals

Thomas C. Pennix

The Iron Triangle of Healthcare: Examining the Relationship between Quality, Efficiency, and Uncompensated Care for Florida Hospitals

By

Thomas C. Pennix

A thesis submitted in partial fulfillment
of the requirements of the
University Honors Program
University of South Florida, St. Petersburg

April 24, 2018

Thesis Director: Richard B. Smith, Ph.D.
Associate Professor, Kate Tiedmann College of Business

University Honors Program
University of South Florida
St. Petersburg, Florida

CERTIFICATE OF APPROVAL

Honors Thesis

This is to certify that the Honors Thesis of

Thomas C. Pennix

has been approved by the Examining Committee
on April 24, 2018
as satisfying the thesis requirement
of the University Honors Program

Examining Committee:

Thesis Director: Richard B. Smith, Ph.D.
Professor, Kate Tiedmann College of Business

Thesis Committee Member: Rebecca Lee Harris, Ph.D.
Professor, Kate Tiedmann College of Business

Thesis Committee Member: Thomas Smith, Ph.D.
Professor, College of Arts and Sciences

Abstract

Recent pressures on hospitals to increase quality and efficiency raise concerns over their ability to continue necessary provision of uncompensated care and maintain access to patient services. Conflicting evidence has been presented on the quality of hospitals providing uncompensated care, as well as the effect of uncompensated care provision on hospital efficiency. However, no study has examined the interplay between hospital quality, efficiency, and provision of uncompensated care. Our study seeks to address this gap by estimating the relationship between hospital efficiency and uncompensated (charity) care, and the relationship of efficiency and charity to quality, for all short-term, Florida general hospitals from 2004-2015. We find a generally negative relationship between hospital charity care rate and hospital efficiency, but also find that the most efficient hospitals provided a statistically similar amount of uncompensated care compared to the least efficient hospitals. The results also show a positive relationship between charity rate and hospital quality, and an insignificant relationship between hospital efficiency and quality. Future studies should examine the environmental factors responsible for these results.

1. Introduction

Hospitals have faced a difficult financial environment since passage of the Balanced Budget Act (BBA) of 1997, with renewed intensity since implementation of the Affordable Care Act (ACA). The BBA, which aimed to reduce federal healthcare spending by targeting $7 billion in Medicaid payments from 1998-2002, created lasting financial pressures for hospitals after its completion, and failed to effectively stem rising healthcare costs (Congressional Budget Office, 1977; Bazzoli 2004; Wu, 2010). Since then, ACA initiatives have made great strides in curbing increasing healthcare spending, which was slated to make up 20% of the United States' GDP in 2020, while also reducing the uninsured rate of Americans from 16.0% in 2010 to 8.8% in 2016 (Berwick, & Hackbarth, 2012; Obama, 2016; Barnett, & Berchick, 2016). In addition, the ACA continues to demand higher quality and efficient performance from hospitals through pay-for-performance programs and new payment systems such as bundled payments. Despite these merits, the effects of the ACA's initiatives to reduce spending while also pushing for increased quality and efficiency, coupled with the residual effects of the BBA and managed care organizations that negotiate for lower prices and lower patient utilization of certain hospitals, raise concerns over the future provision of uncompensated care still needed by 8.8% of Americans (Bian, 2006; Thorpe, Seiber, & Florence, 2001).

Uncompensated care (such as charity care, bad debt, and Medicaid repayments that do not totally cover the cost of care provided), is treatment provided to uninsured or underinsured patients for which hospitals are not fully reimbursed. Uncompensated care, then, represents a financial burden that will be harder for hospitals to accommodate under pressures to improve quality and efficiency. Recently, public efforts to reduce the rising costs of healthcare have focused on increasing the quality of service provided to patients through reducing hospital errors

or patient readmissions while also encouraging hospital efficiency by reducing wasteful spending. Specifically, pay-for-performance programs such as the Hospital Readmissions Reduction Program, the Electronic Health Record, the Hospital-Acquired Condition Reduction Program, and the Hospital Consumer Assessment of Healthcare Providers and Systems, financially reward hospitals that are high performers in quality and efficiency standards while financially penalizing low performers (CMS.gov, 2017). Connecting funding to performance for hospitals in this manner may cause hospitals to reduce uncompensated care provision in order to remain competitive with other hospitals. For one, uncompensated care has been found to inherently decrease hospital efficiency, as hospitals are not reimbursed for their services (Ferrier, Rosko, & Valdmanis, 2006). Secondly, uninsured patients requiring uncompensated care are typically sicker than insured patients due to a lack of access to standard, preventative, or therapeutic care. Because of this, uninsured patients typically require costlier services and are readmitted more often compared to insured patients after treatment (Bradbury, Golec, & Stevens, 2001; Hadley, 2007). Recognizing these factors raises a concern that hospitals will decrease uncompensated care provision in the face of heightened competition.

Because hospitals are not reimbursed by patients for uncompensated care, the ability of hospitals to afford uncompensated care provision is possible through other funding mechanisms, namely the publicly-funded Disproportionate Share Hospital (DSH) payment system. DSH payments were designed to at least partially reimburse hospitals for treating indigent patients. Hospitals that receive the most DSH payments--hospitals having the highest Medicaid share and providing the most uncompensated care--are termed safety-net hospitals (Zwanziger, & Khan, 2008; Ku, Jones, Shin, Byrne, & Long, 2011). Safety-net hospitals play a key role in uncompensated care provision, but there are worries that the penalties from new pay-for-

performance programs and higher Medicaid utilization will decrease the already low margins of safety-net hospitals and hinder the ability of these hospitals to continue necessary uncompensated care provision. Previous studies have found that safety-net hospitals tend to perform worse compared to non-safety-net hospitals in pay-for-performance programs, making them the likely target of financial penalties (Joynt, & Jha, 2013; Werner, Goldman, & Dudley, 2008; Chatterjee, Joynt, Orav, & Jha, 2012). These penalties will hit safety-net hospitals especially hard, as these hospitals already have large Medicaid shares that will only increase as previously uninsured patients gain health insurance under the ACA. Moreover, hospitals providing large amounts of uncompensated care will have their funding directly reduced through DSH payment cuts scheduled to begin in the 2020 fiscal year according to the Bipartisan Budget Act of 2018 (P.L. 115-123). After delaying these budget cuts several times since 2014, policymakers have increased the planned reduction amounts per year, with $4 billion being cut from DSH funding in 2020, and $8 billion being cut each year thereafter through 2025 (macpac.gov).

The previously discussed examples raise questions for the future provision of uncompensated care and the quality of the hospitals providing it. The ways that hospitals will balance efforts to increase efficiency and quality while also maintaining access to services is not very clear. Despite the worrisome examples provided earlier, there is also some conflicting evidence. For instance, a study by Ross et al. shows the potential of safety-net hospitals to perform as well as, or even outperform, non-safety-net hospitals when viewed in the same market (Ross, Bernheim, Lin, Drye, Chen, Normand, & Krumholz, 2012). There are also a few examples of efficient hospitals managing to be of higher quality than inefficient hospitals, providing evidence that raising efficiency does not have to decrease quality or vice versa (Nayar,

Preethy, & Ozcan, 2008; Yasaitis, Fisher, Skinner, & Chandra, 2009). The contradiction between these findings and those provided earlier demonstrate the gaps in our current understanding of hospital quality, efficiency, and uncompensated care provision.

Previous research on hospital quality and efficiency has typically looked at only one or two of these dimensions. Several studies have looked at the connection between hospital efficiency and quality, but did not include uncompensated care provision (Nayar, Preethy, & Ozcan, 2008; Yasaitis, Fisher, Skinner, & Chandra, 2009). Others have looked at hospital efficiency, quality, or uncompensated care provision separately (Bradley, Herrin, Elbel, McNamara, Magid, Nallamothu, ... & Krumholz, 2006; Jacobs, 2000; Weissman, 2005). However, there only appear to be two papers that look at the connection between hospital efficiency and uncompensated care, while there has been no research on the interplay between hospital efficiency, uncompensated care provision, and quality (Hsieh, Clement, & Bazzoli, 2010; Ferrier, Rosko, & Valdmanis, 2006).

Our study addresses this gap by conducting a longitudinal analysis of Florida hospitals from 2004-2015. While constraining the sample size to one state may limit the generality of the findings, it also eliminates many variables that tend to obscure results taken from hospitals in multiple states (Davidoff, LoSasso, Bazzoli, & Zuckerman, 2000; Ross, Bernheim, Drye, Chen, Normand, & Krumholz, 2012). Though different states may have similar uncompensated care regulations, each state has different, specific rules towards implementing these regulations. Therefore, evaluating only Florida hospitals will naturally control for many unseen variables not examined in this paper.

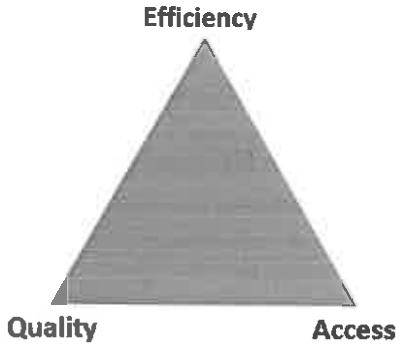


Diagram 1: Iron Triangle of

When interpreting these results, it will also be helpful to view them through the lens of the "Iron Triangle," (see Diagram 1). This economic concept was introduced by William Kissick (1994) and set the goals of efficiency (cost containment), access, and quality in healthcare at different corners of a triangle. According to the Iron Triangle, attempts to improve one of these factors will necessarily come at the cost of one or both of the other factors (Kissick, 1994). The Iron Triangle, then, is at the center of what our study is attempting to address, as it sets a conceptual framework for the interaction of healthcare efficiency, access, and quality. Efficiency will be measured through hospital productivity, which shows how effectively hospitals manage their money. The second corner of the triangle, access, will be seen from the rate of uncompensated care provided by Florida hospitals. The final factor, quality, will be evaluated in our study through the Patient Safety Indicators (PSI) developed by the Agency for Healthcare Research and Quality (AHRQ), which tracks adverse events patients experience while in the hospital (AHRQ.gov). Comparing the efficiency (productivity), access (uncompensated care), and quality of these hospitals will allow us to assess the merit of the argument of the Iron Triangle.

2. Data and Empirical Design

Florida Hospital Data

Our data come from the Center for Health Information and Policy Analysis of Florida, part of the state government's Agency for Health Care Administration (AHCA). These data include annual hospital inpatient discharge information and financial data from all Florida hospitals (AHCA, 2014). Inpatient discharge data contain patient-level information on demographic characteristics, payer (i.e. insurance), diagnoses, and procedures performed during the hospitalization. Hospital-level financial data include detailed information on revenues, expenses, staff, hospital type, and control (ownership). These financial data are submitted under a uniform reporting system. Revenues and costs are reported based on activities, or types of services, rather than on the organizational structure of each hospital (AHCA 2010). Our panel sample consists of all short-term, general hospitals between 2004 and 2015.

Productivity (Efficiency)

For each hospital and year, we measure productivity as the number of adjusted total patient days (output), divided by the number of full-time equivalent (FTE) hospital service personnel (input). Adjusted total patient days is a measure that takes into account outpatient as well as inpatient admissions (American Hospital Association 2007; McCullough 2008). This measure of labor productivity is, from economic theory, inversely proportional to changes in variable (i.e. marginal) cost. Thus, increases (decreases) in this measure reflect decreases (increases) in hospital variable cost.

Rate of Charity/Uncompensated Care (Access)

For each hospital and year, we measure access in terms of the rate of charity care provided by the hospital. Specifically, we divided total revenue deducted by the hospital for the

provision of charity care, for both inpatient and outpatient services, by total hospital revenue. All dollar figures were converted to constant, 2015 dollars using the average annual Consumer Price Index for All Urban Consumers, South region (Bureau of Labor Statistics, 2017).

The extent to which a hospital serves patients supported by Medicaid can alternatively reflect access for low-income and uninsured populations. Therefore, we calculated the rate of Medicaid services provided by the hospital, dividing total deductions for the uncompensated provision of Medicaid services by total hospital revenue.

Rate of Patient-Safety Events (Quality)

Our measure of quality for competing hospitals is a relatively new outcome measure from the Agency for Healthcare Research and Quality (AHRQ), encompassing in a single measure a risk-adjusted composite of several of the patient-safety indicators (PSIs) initially released by AHRQ in 2003 (AHRQ, 2006). Because each individual PSI (i.e. an adverse, hospital-induced event) has a relatively low frequency, presenting problems of statistical power, AHRQ created the composite PSI in 2008, PSI 90, which is essentially a weighted sum of many of the individual PSIs, as a more reliable and robust measure of tracking quality within and across hospitals (AHRQ, 2008; Bardach et al., 2010; Schone et al., 2011; Smith et al., 2012). Because PSI 90 is a negative measure of quality, lower values represent higher hospital quality.

Figures 1 and 2 show the patterns and provide a sense of the interplay between quality, efficiency, and uncompensated care provision. Across the timeframe of the study, Florida hospitals have had a relatively steady increase in quality, while maintaining a consistent rate of charity care. Only hospital efficiency shows inconsistent fluctuation, increasing and decreasing sharply in 2010 and 2011, before resuming a general upward trend through 2015.

Figure 1: Charity Rate and Productivity

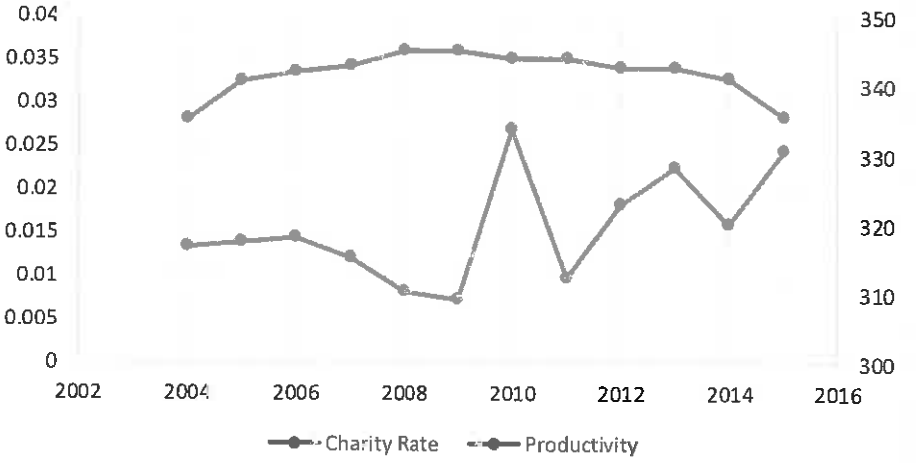
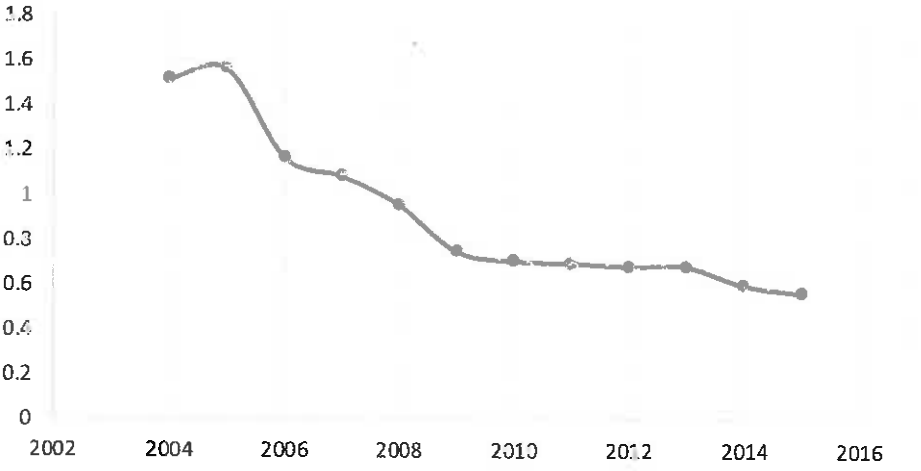


Figure 2: Quality (PSI 90)



Empirical Analysis

Our empirical analysis involves two main regression models. In the first, we estimate the relationship between hospital productivity (efficiency) and the rate of charity care (access). We convert the key independent variable, hospital productivity, into a series of dummy variables based on the quartile distribution of the underlying measure, with first quartile representing the least productive (i.e. efficient) 25 percent of hospitals in our sample, while the fourth quartile

represents the most productive 25 percent of hospitals in the sample. We also take advantage of the panel structure of our data, using hospital and year fixed effects to control for all other hospital and time-varying characteristics. This first regression model, for each hospital i (h_i), and year t, is specified as follows:

$$ccr_{it} = \beta_0 + \beta_1 * pr2_{it} + \beta_2 * pr3_{it} + \beta_3 * pr4_{it} + \beta_4(h_i * y_t) + \varepsilon_{it}, \quad (1)$$

where ccr_{it} is the rate of charity care of hospital i in year t, and $pr2_{it}$, $pr3_{it}$, and $pri4_{it}$ are dummy variables identifying the productivity-quartile of the hospital for the second, third, and fourth quartiles (first quartile, $pr1_{it}$, is the omitted variable). As indicated, all other hospital and time-varying characteristics are captured in the regression by the interaction of hospital (h_i) and year (y_t) fixed effects. The final variable, ε_{it}, represents the random-error term.

In the second regression model, we estimate the relationship of hospital productivity and provision of charity care, to the quality of care provided by the hospital, as represented by the composite rate of patient safety indicators, PSI 90. This model examines the full interplay of productivity, access, and quality, and is specified as follows:

$$psi90_{it} = \beta_0 + \beta_1 * pr2_{it} + \beta_2 * pr3_{it} + \beta_3 * pr4_{it} + \beta_4 * ccr2_{it} + \beta_5 * ccr3_{it} + \beta_6 * ccr4_{it} + \beta_7(h_i * y_t) + \varepsilon_{it}, \quad (2)$$

where $psi90_{it}$ is PSI 90 of hospital i in year t. The key independent variables are the four-quartile productivity dummies (first quartile omitted), along with four-quartile dummies ($ccr2_{it}$, $ccr3_{it}$, $ccr4_{it}$) identifying the charity-rate rate quartile of hospital i in year t, for the second, third, and fourth quartiles (first quartile, $ccr1_{it}$, is omitted). Again, all other hospital and time-varying characteristics are captured by the interaction of hospital (h_i) and year (y_t) fixed effects, with ε_{it}, representing the random-error term.

Our final sample of hospitals contains less than the complete population of general hospitals between 2004 and 2015 because of missing years or data. From the 192 short-term, general hospitals in Florida between 2004 and 2015, we had 12 complete years of data for 161 hospitals, which comprise our balanced panel of hospitals for this analysis. Descriptive statistics of the key measures are presented in Table 1. On average, lost revenue from the provision of charity care represents about three (3) percent of total hospital revenue, lost revenue from serving patients covered by Medicaid represents about 10 percent of hospital revenue, and each

Table 1: Sample Descriptive Statistics (161 Florida General Hospitals: N=1932), 2004-2015

	Description	Mean	Std. Dev.
Variables:			
Charity Rate	Hospital deductions for provision of charity care, divided by total hospital inpatient and outpatient revenue.	0.033	0.030
Medicaid Rate	Hospital deductions for uncompensated Medicaid services, divided by total hospital inpatient and outpatient revenue.	0.104	0.055
Productivity	Adjusted total hospital days[a] divided by number of full-time equivalent (FTE) patient-care personnel.	319.52	155.84
Quality (PSI 90)	Agency for Healthcare Research and Quality (AHRQ) Composite Patient Safety Indicator (PSI 90)[b].	0.917	0.452

[a] Adjusted total hospital days = Total inpatient days*[1 + (total outpatient revenue/total inpatient revenue)]

[b] The eight (8) AHRQ PSI represented by the composite PSI (PSI 90) are: pressure ulcer, iatrogenic pneumothorax, central line related bloodstream infection, in-hospital hip fracture, perioperative pulmonary embolism or deep vein thrombosis, postoperative sepsis, postoperative wound dehiscence, and accidental puncture or laceration.

full-time equivalent (FTE) patient-care worker accounts for about 320 annual adjusted patient days. The composite PSI (PSI 90) is calculated as the weighted-average rate of the hospital's patient-safety events divided by the same rate for a representative hospital population. The variable is normalized, therefore, with the value of one (1) representing a standard rate. Hence, with a mean value of 0.917, Florida hospitals in our sample provided better than standard quality of care between 2004 and 2015.

3. Results

Regression results and computed R-squares are presented in Table 2. For each model, we estimated ordinary least squares (OLS) regressions with hospital and year fixed effects. The first set of results (1) correspond to the productivity-charity rate model represented by Equation 1, while the third set of results (3) corresponds to the full-interplay model represented by Equation 2. The second set of results (2) are an alternative to the first regression, in which we used the Medicaid rather than charity-care rate as the measure of access for the dependent variable. For all three outcome variables in these regressions (charity rate, Medicaid rate, and PSI 90), a test of skewness indicated a non-normal distribution. We therefore ran each regression using the zero-skewed natural log transform of the dependent variable. Consequently, estimated coefficients for each quartile are interpreted as the percentage change in the dependent variable relative to the effect of the first-quartile hospitals. Standard errors are calculated such that they are robust to correlated errors within the same hospital.

Table 2: Regression Results (161 Florida General Hospitals, 2004-2015), OLS with Hospital-Year Fixed Effects

Specification:	1			2			3		
	Coefficient	Robust Std. Err.	t	Coefficient	Robust Std. Err.	t	Coefficient	Robust Std. Err.	t
Dependent Variable:	**Ln (Charity Rate)**			**Ln (Medicaid Rate)**			**Ln (PSI 90)**		
Independent Variables:									
Productivity (1st Quartile)—Omitted	—	—	—	—	—	—	—	—	—
Productivity (2nd Quartile)	0.015	0.037	0.40	-0.014	0.012	-1.14	0.009	0.028	0.33
Productivity (3rd Quartile)	-0.101	0.047	-2.14 *	-0.009	0.016	-0.58	0.038	0.038	1.00
Productivity (4th Quartile)	-0.097	0.063	-1.54	-0.016	0.021	-0.75	0.038	0.052	0.73
Charity Rate (1st Quartile)—Omitted	N/A	N/A	N/A	N/A	N/A	N/A	—	—	—
Charity Rate (2nd Quartile)	N/A	N/A	N/A	N/A	N/A	N/A	-0.022	0.025	-0.89
Charity Rate (3rd Quartile)	N/A	N/A	N/A	N/A	N/A	N/A	-0.071	0.034	-2.06 *
Charity Rate (4th Quartile)	N/A	N/A	N/A	N/A	N/A	N/A	-0.132	0.050	-2.63 *
N:	1932			1932			1932		
R^2:	0.867			0.949			0.693		

Note:
* $p \leq 0.05$; two-sided t test.

The first set of results (1) in Table 2 show a generally negative relationship between hospital productivity and charity rate, which supports previous research by Ferrier et al. (2006) but contradicts findings by Hseih et al. (2010). Interestingly, the negative relationship between

hospital productivity and charity rate is only significant for the third quartile ($p < 0.05$), but not the fourth. This demonstrates that the most productive hospitals provide similar amounts of uncompensated care to the least productive hospitals and suggests the presence of unseen variables affecting this relationship. The second set of results (2) of Table 2, using the alternative measure of access, hospital Medicaid rate, show an insignificant relationship between hospital productivity and Medicaid rate, which contradicts previous research (Hsieh, Clement, & Bazzoli, 2010).

Finally, the third set of results (3) in Table 2 reveal an insignificant relationship between hospital productivity and quality, which somewhat disagrees with previous research that shows a positive relationship between these two variables (Hsieh, Clement, & Bazzoli, 2010). These results also show a statistically significant relationship between charity rate and hospital quality, as measured by PSI90, for the 3rd ($p <0.05$) and 4th ($p < 0.05$) quartiles. Due to the fact that PSI 90 is a negative measure of hospital quality, the negative sign on the coefficients actually reflects a positive relationship between charity rate and hospital quality.

4. Discussion

These results both support previous research and raise some contradictions. The first set of results of Table 2 shows a generally negative relationship between hospital efficiency and charity rate, which would be expected from hospitals attempting to maximize efficiency (Ferrier, Rosko, & Valdmanis, 2006). However, this does not hold true for the most efficient hospitals, as they did not provide a statistically significant different amount of uncompensated care. Though the charity rate generally decreases as efficiency increases, the somewhat smaller and insignificant coefficient for the most efficient hospitals demonstrates that access and efficiency

do not need to be at odds with each other as the Iron Triangle suggests, and that there are feasible ways to balance uncompensated care provision and efficiency.

The third set of results in our analysis provide information regarding the impact of increased access on quality, and again suggest certain contradictions. For the hospitals observed, there was a definite finding of increasing quality as the charity rate increased. This finding stands in contrast to previous research, which typically stereotypes hospitals that provide more uncompensated care as being lower quality (Goldman, Henderson, Dohan, Talavera, & Dudley, 2007; Joynt, & Jha, 2013; Werner, Goldman, & Dudley, 2008; Chatterjee, Joynt, Orav, & Jha, 2012). Once again, our findings contradict the notion of the Iron Triangle, as hospital quality did not diminish, but improved as access increased. This may be best explained by referring to Ross et al. (2012) again, who note that safety-net and non-safety-net hospitals tend to have a lot of overlap in quality when viewed in the same market (Ross, Bernheim, Lin, Drye, Chen, Normand, & Krumholz, 2012). The fact that the sample was exclusively Florida hospitals most likely creates a better standard when comparing hospital performance, as they operate in similar market conditions, under similar rules.

The increasing quality of care associated with higher charity rates is interesting as it implies uninsured patients manage to receive treatment that is equal to or better than treatment of insured individuals. Two unique factors that may be helpful in explaining this evidence are Florida's regulatory Certificate of Need (CON), and Florida's high uninsured population. As a non-expansion Medicaid state under the Affordable Care Act (ACA), and with a sizable uninsured population, Florida hospitals face a high demand for uncompensated care, which has been shown to increase the amount of uncompensated care provided (Rosko, 2004). As one of the remaining thirty-five states with a CON, the pool of hospitals available to provide the

necessary uncompensated care is limited. CON, which was originally developed to curb rising healthcare costs created by rapid proliferation of new healthcare and payments systems, only permits entry of new hospitals into areas where it is deemed necessary (Finkelstein, 2007). Despite the ability of CON regulations to prevent unnecessary healthcare spending, it was quickly criticized after being made mandatory by the federal government, and ultimately abandoned (Meesa, Meeker, & Mukherji, 2012). The repeal and absence of CON in the remaining fifteen states has opened room for the creation of unnecessary services, including specialty and physician-owned hospitals that aggressively seek profits and reduce the earning potential of other, nearby hospitals (Garmon, 2009; Mitchell 2010). Prevention of excess services and the creation of specialty hospitals that cream-skim the most profitable patients probably allows Florida hospitals to receive a mix of insured patients to offset the costs of the uninsured, and therefore retain high quality.

The interplay between quality, efficiency, and uncompensated care provision can also be seen through figures 1 and 2., which show a steady increase in quality, a consistent rate of charity care, and inconsistent fluctuations in efficiency. However, there is a definite upward trend in efficiency after the implementation of the ACA in 2010. This observation, combined with the insignificant relationship between hospital efficiency and Medicaid rate, should help to allay fears of adverse effects on hospitals due to newly-insured patients under the ACA (Neuhausen, Davis, Needleman, Brook, Zingmond, & Roby, 2014; Werner, Goldman, & Dudley, 2008). Not only this, but the general increase in quality and relatively stable provision of uncompensated care seen throughout the study period demonstrate that the highs and lows of hospital efficiency occur without directly affecting these other two factors.

Finally, this analysis finds no relationship between productivity and quality (third set of results of Table 2). Though efficiency and quality stand at odds in the Iron Triangle, we found no evidence of a tradeoff in our study. These findings are not similar to others that have found a positive relationship between the two factors, yet the lack of a relationship still proves optimistic, as hospitals did not demonstrably sacrifice quality as efficiency improved. Hopefully, this evidence will help to reduce fears of diminished quality due to the ACA's push for increased efficiency.

5. Conclusion

The necessity to control the growing spending of U.S. healthcare has spurred efforts through the Affordable Care Act to improve hospital efficiency. These efforts have been seen before in the BBA of 1997, and the continued calls for reduced Medicaid spending raises concerns about its effect on the quality and provision of care. In terms of the "Iron Triangle" of healthcare, these efforts to increase efficiency should theoretically come at the expense of access and quality. However, the results of this paper provide contradictory evidence, and demonstrate that the Iron Triangle may not be a hard rule of U.S. healthcare. Moreover, the lack of a significant relationship between Medicaid share and quality, as well as productivity and quality, give hope towards ACA-inspired initiatives to improve hospital efficiency and cut costs.

Overall, our results suggest that improving hospital productivity does not necessarily reduce access to, or quality of, healthcare. The most efficient hospitals manage to somehow provide uncompensated care at a rate that is statistically similar to the least efficient hospitals. It is not clear exactly how or why the most efficient hospitals are able to maintain a higher charity rate compared to hospitals in the third quartile of efficiency. It is possible that a large portion of the efficiency attributed to the third quartile of hospitals is the result of significant reductions in

uncompensated care provision, rather than the result of these hospitals employing tactics to directly raise efficiency. However, future studies should compare the measures taken to raise efficiency by the most efficient hospitals with those in the third quartile. Also, increased charity care rates of hospitals are associated with higher healthcare quality, possibly due to insured individuals seeking out the services of these higher-quality hospitals and offsetting the uncompensated care costs. The exact reasons for these results, however, are unclear and should be investigated in future studies with respect to the environments that different hospitals occupy.

References:

Agency for Health Care Administration (AHCA) (2010) State of Florida Hospital Uniform Reporting System Manual 2010-1. Tallahassee, FL.

Agency for Health Care Administration (AHCA), State of Florida, Office of Data Dissemination. (2014) Hospital inpatient discharge data (FYs 2014-2014) and Hospital financial data (FYs 2004-2014). Tallahassee, FL.

Agency for Healthcare Research and Quality (AHRQ) (2008) Patient Safety Indicators Composite Measure Workgroup Final Report. Rockville, MD.

American Hospital Association (2007). AHA Annual Survey Database. Washington, D.C.

Bardach, N. S., A. T. Chien, and R. A. Dudley (2010) Small Numbers Limit the Use of the Inpatient Pediatric Quality Indicators for Hospital Comparison. Academic Pediatrics 10(4): 266–273.

Barnett, Jessica C, and Edward R Berchick. "Health Insurance Coverage in the United States: 2016." *Www.census.gov*, U.S. Department of Commerce, 12 Sept. 2017, www.census.gov/library/publications/2017/demo/p60-260.html.

Berwick, D. M., & Hackbarth, A. D. (2012). Eliminating waste in US health care. *Jama*, *307*(14), 1513-1516.

Bradbury, R. C., Golec, J. H., & Steen, P. M. (2001). Comparing uninsured and privately insured hospital patients: admission severity, health outcomes and resource use. *Health services management research*, *14*(3), 203-210.

Bradley, E. H., Herrin, J., Elbel, B., McNamara, R. L., Magid, D. J., Nallamothu, B. K., ... & Krumholz, H. M. (2006). Hospital quality for acute myocardial infarction: correlation among process measures and relationship with short-term mortality. *Jama*, *296*(1), 72-78.

Bureau of Labor Statistics (2016) Table 11A: Consumer price index for all urban consumers (CPI-U): regions1, by expenditure category and commodity and service group.

Certificate of need facts: Meesa, I. R., Meeker, R. A., & Mukherji, S. K. (2012). Certificate of need. *Neuroimaging Clinics*, *22*(3), 443-450.

Chatterjee, P., Joynt, K. E., Orav, E. J., & Jha, A. K. (2012). Patient experience in safety-net hospitals: implications for improving care and value-based purchasing. *Archives of Internal Medicine*, *172*(16), 1204-1210.

Congressional Budget Office. (1997,). Budgetary implications of the Balanced Budget Act of 1997 (Washington, DC). Retrieved January, 2018, from

Davidoff, A. J., LoSasso, A. T., Bazzoli, G. J., & Zuckerman, S. (2000). The effect of changing state health policy on hospital uncompensated care. *Inquiry*, 253-267.

Disproportionate share hospital payments. (n.d.). Retrieved March 12, 2018, from

Ferrier, G. D., Rosko, M. D., & Valdmanis, V. G. (2006). Analysis of uncompensated hospital care using a DEA model of output congestion. *Health Care Management Science*, *9*(2), 181-188.

Finkelstein, A. (2007). The aggregate effects of health insurance: Evidence from the introduction of Medicare. *The quarterly journal of economics*, *122*(1), 1-37.

Garmon, C. (2009, May). Hospital competition and charity care. In *Forum for Health Economics & Policy* (Vol. 12, No. 1). De Gruyter.

Goldman, L. E., Henderson, S., Dohan, D. P., Talavera, J. A., & Dudley, R. A. (2007). Public reporting and pay-for-performance: safety-net hospital executives' concerns and policy suggestions. *INQUIRY: The Journal of Health Care Organization, Provision, and Financing*, *44*(2), 137-145.

Goldman, L. E., Vittinghoff, E., & Dudley, R. A. (2007). Quality of care in hospitals with a high percent of Medicaid patients. *Medical care*, *45*(6), 579-583.

Hadley, J. (2003). Sicker and poorer—The consequences of being uninsured: A review of the research on the relationship between health insurance, medical care use, health, work, and income. *Medical Care Research and Review*, *60*(2_suppl), 3S-75S.

Hsieh, H. M., Clement, D. G., & Bazzoli, G. J. (2010). Impacts of market and organizational characteristics on hospital efficiency and uncompensated care. *Health Care Management Review*, *35*(1), 77-87.

Jacobs, R. (2001). Alternative methods to examine hospital efficiency: data envelopment analysis and stochastic frontier analysis. *Health care management science*, *4*(2), 103-115.

Joynt, K. E., & Jha, A. K. (2013). Characteristics of hospitals receiving penalties under the Hospital Readmissions Reduction Program. *Jama*, *309*(4), 342-343.

Kissick, W. L. (1994). *Medicine's dilemmas: infinite needs versus finite resources*. Yale University Press.

Ku, L., Jones, E., Shin, P., Byrne, F. R., & Long, S. K. (2011). Safety-net providers after health care reform: lessons from Massachusetts. *Archives of internal medicine*, *171*(15), 1379-1384.

McCullough, J.S. (2008). The adoption of hospital information systems. Health Economics 17, 649-664.

Mitchell, Jean M. "Effect of physician ownership of specialty hospitals and ambulatory surgery centers on frequency of use of outpatient orthopedic surgery." *Archives of Surgery* 145.8 (2010): 732-738.

Nayar, P., & Ozcan, Y. A. (2008). Data envelopment analysis comparison of hospital efficiency and quality. *Journal of medical systems*, *32*(3), 193-199. Neuhausen, K., Davis, A. C., Needleman, J., Brook, R. H., Zingmond, D., & Roby, D. H. (2014). Disproportionate-share hospital payment reductions may threaten the financial stability of safety-net hospitals. *Health Affairs*, *33*(6), 988-996.

Obama, B. (2016). United States health care reform: progress to date and next steps. *Jama*, *316*(5), 525-532.

Patient Safety Indicators Overview. (n.d.). Retrieved March 13, 2018, from http://www.qualityindicators.ahrq.gov/modules/psi_resources.aspx

Robin A. Cohen, Michael E. Martinez, and Emily P. Zammitti, *Health Insurance Coverage: Early Release of Estimates from the National Health Interview Survey, January – March 2017* (Hyattsville, MD: National Center for Health Statistics, August 2017),

Ross, J. S., Bernheim, S. M., Lin, Z., Drye, E. E., Chen, J., Normand, S. L. T., & Krumholz, H. M. (2012). Mortality and readmission at safety net and non-safety net hospitals for three common medical conditions. *Health affairs (Project Hope)*, *31*(8), 1739.

Rosko, M. D. (2004). The supply of uncompensated care in Pennsylvania hospitals: motives and financial consequences. *Health Care Management Review*, *29*(3), 229-239.

Schone, E., M. Hubbard, and D. Jones (2011). Mathematica, Inc. November 2011 [accessed on October 13, 2016]. Available at:

Smith, R. B., L. Dynan, G. Fairbrother, G. Chabi, and L. Simpson (2012). Medicaid, Hospital Financial Stress, and the Incidence of Adverse Medical Events for Children. Health Services Research 47(4): 1621-41.

Thorpe, K. E., Seiber, E. E., & Florence, C. S. (2001). The impact of HMOs on hospital-based uncompensated care. *Journal of Health Politics, Policy and Law*, *26*(3), 543-556.

Werner, R. M., Goldman, L. E., & Dudley, R. A. (2008). Comparison of change in quality of care between safety-net and non–safety-net hospitals. *Jama*, *299*(18), 2180-2187.

Weissman, J. S. (2005). The trouble with uncompensated hospital care. *New England Journal of Medicine*, *352*(12), 1171-1173.

Wu, V. Y. (2010). Hospital cost shifting revisited: new evidence from the balanced budget act of 1997. *International Journal of Health Care Finance and Economics*, *10*(1), 61-83.

Yasaitis, L., Fisher, E. S., Skinner, J. S., & Chandra, A. (2009). Hospital quality and intensity of spending: is there an association?. *Health Affairs*, *28*(4), w566-w572.

Zwanziger, J., & Khan, N. (2008). Safety-net hospitals. *Medical Care Research and Review*, *65*(4), 478-495.