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Moving the Needle: Evaluating the Impact of New Care Delivery Models on Hospital Profitability

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This Special Issue of the *Journal of Health Care Finance* honors Dr. Louis C. Gapenski for his contributions to the fields of health care finance, public health finance and health administration. In his writing, teaching and mentoring, he served as a role model for all of us.

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Abstract

Objective: To evaluate the impact of emerging care delivery models on hospital profitability.

Data Sources/Study Setting: Data was collected from the 2014 American Hospital Association (AHA) survey.

Study Design: We used binary logistic regression analyses to assess the relationships between historically significant and recent evolutionary hospital care delivery characteristics and profitability measures. We considered four profitability measures: operating margin, net patient revenues, net income and return on assets. Our independent variables of interest focused on hospitalist staffing, patient centered medical home and accountable care organizational development.

Data: We had a usable sample of 2,049 hospitals from the AHA dataset.

Principal Findings: Our findings suggest medical home development is significantly associated with improved financial performance across four profitability measures – operating margin, net patient revenue, net income and return on assets. Hospitalists are associated with improved operating margin and net patient revenue. Accountable Care Organizations were neither positively or negatively associated with any measures of financial performance.

Conclusions: Hospitals that have progressively taken steps to adopt patient centered medical homes as a care delivery modality appear be well positioned to have stronger organizational financial performance. Additional organizational enhancements such as hiring hospitalists are associated with better financial performance.

Key Words: financial performance, hospitals

Background

With the passage of the Health Information Technology for Economic and Clinical Health (HITECH) Act in 2009, the Patient Protection and Affordable Care Act (PPACA) in 2010, the Hospital Readmissions Reduction Program (HRRP) in 2012 and more recently the Medicare Access and CHIP Reauthorization Act (MACRA) of 2015, the health care industry in the United States is experiencing one of its most tumultuous periods in its history. In the wake of these legislative and regulatory changes, the American College of Healthcare Executives indicates financial challenges currently rank as the dominant priority of hospital CEOs' concerns, while patient safety and quality ranked second (ACHE, 2015). Understandably, the industry is encountering a proliferation of alternative care delivery models, broad increase in electronic health record utilization and meaningfully altered physician alignment structures. What is not known is how all of the aforementioned acts have impacted hospital profitability and thus contribute to continued economic sustainability.

Numerous authors have previously considered factors that support hospital profitability with varying results depending on source data and chosen financial health measure. Gapenski, Vogel, and Langland-Orban (1993) evaluated the factors associated with improved operating margin and return on assets of a sample of 169 hospitals in the state of Florida. The authors found teaching hospital status, debt utilization, labor intensity, age of plant and service mix were universally significant in all models. Pink, et al. (2007) provided a comprehensive assessment of the diversity of profitability measures used in the literature finding evidence of 114 measures in use by various authors since 1990. Holt, et al. (2015) developed a comprehensive review of the organizational factors that influence hospital financial performance as measured by total margin, operating margin and return on assets. The authors concluded ownership, governance, management strategy, integration, and quality all play important roles in hospital profitability based on the preponderance of the management literature. None of the reviewed literature specifically evaluated any of our targeted variables of interest. However, each of these studies provide guiding influence regarding both how hospital profitability can be measured as well as what factors influence improved financial outcomes. We seek to build on this body of work by examining the effects of the substantive recent changes to both the clinical and administrative aspects of service delivery in the health care industry. This research project will re-consider several historically significant hospital structural characteristics along with numerous recent evolutionary changes coming as a result of the transformative legislative, regulatory and reactive market changes to assess their associated impact on hospital profitability.

Methods

Data and Sample

The AHA Annual Survey Database and the AHA Financial Module reflect an annual census of American hospitals, based on self-reported data provided to the American Hospital Association. Input is also reported by the United States Census Bureau and other accrediting organizations to provide insight on over 1,000 data fields. The database provided the necessary dependent variables for the study: net patient revenue, operating income, return on assets and operating margin. The

AHA database also provided the independent variables of interest and control variables needed for our study as well. The AHA data used in this study is from 2014. Our unit of analysis is hospitals in the United States and US territories.

Measures

Dependent Variables

Consistent with Gapenski, Langland-Orban & Vogel (1993), Holt, et al. (2015) and several other authors, we considered operating margin and return on assets as the profitability variables of interest that reflect operating efficiency. We also considered net income and net patient revenue as alternative indicators of hospital financial performance, as those are measures of overall profitability. Operating margin captures the difference between total operating revenue and operating expenses divided by total operating revenue. It is expressed as a percentage and is a measurement of the proportion of a hospital's revenue remaining after paying for variable costs of production such as wages, supplies, etc. Return on assets (ROA) is an indicator of how profitable a company is relative to its total assets. ROA gives an idea as to how efficient management is at using its assets to generate earnings. Calculated by dividing a company's annual earnings by its total assets, ROA is displayed as a percentage. Net income is a company's total earnings or profit for a given reporting period. Net income is calculated by taking revenues and adjusting for business expenses, depreciation, interest and taxes. Net income is expressed in dollar terms. Net patient revenue includes gross inpatient revenue plus gross outpatient revenue minus deductions from revenue that the hospital is not paid, such as charity care and contractual allowances. Net patient revenue is conveyed in dollar terms.

Due to the existence of extreme outliers and non-normal distribution of the residuals for our dependent variables, we opted to evaluate and report each dependent variable in dichotomous form. We constructed binary variables for organizations demonstrating positive (above zero) operating margin, return on assets and net income. We further considered net patient revenue as a binary variable with the median point serving as the cut line to differentiate 'above average' or not.

Independent Variables

This study considered several independent variables of interest based on contemporary changes having occurred or accelerated since the implementation of the HITECH and PPACA legislation and corresponding changes in payment structure. We considered the association between each of the following variables and our chosen measures of profitability: specifically how does accountable care organization (ACO), patient centered medical home (PCMH) development, and hospitalist staffing influence hospital financial performance?

An ACO is a network of physicians and hospitals that shares financial and medical responsibility for providing care to patients in the hopes of limiting unnecessary spending. ACO's have the broader goal of coordinating care across the entire continuum of health care from physicians to hospitals to other clinicians. The idea is that, by improving care coordination within an ACO and reducing fragmented care, costs can be reduced and outcomes improved. ACO participants can

then keep some of the money that they helped save or receive bonuses relating to performance on quality measures. Growth in ACO's established by hospitals and systems has been continual since 2011, the first year data were collected, moving from 6 percent to 25 percent in 2014 (AHA, 2016). Our analysis considered ACO participation as a dichotomous variable (ACO participation = 1).

The Patient-Centered Medical Home (PCMH) is a care delivery model whereby patient treatment is coordinated through their primary care physician to ensure they receive the necessary care when and where they need it, in a manner they can understand. The objective is to have a centralized setting that facilitates partnerships between individual patients, and their personal physicians, and when appropriate, the patient's family. Care is facilitated by registries, information technology, health information exchange and other means to assure that patients get the indicated care when and where they need and want it in a culturally and linguistically appropriate manner. (ACP, 2016). This definition is heavily based on input from numerous clinical societies. In 2004, the American Academy of Family Practice (AAFP) launched a project to determine the ideal family practice care delivery model. The committee defined 11 essential characteristics, the first of which is a medical home for all patients (Kuzel, 2009; AAP, 2007; ACP 2006). There is some evidence that PCMH has led to reduced medical spending (Vats, Ash and Ellis, 2013). Our analysis considered PCMH development as a dichotomous variable (PCMH developed = 1).

Hospitalists are physicians whose primary professional focus is the general medical care of hospitalized patients. Their activities include patient care, teaching, research, and leadership related to hospital medicine (Pantilat, 2006). The emergence of the hospitalist specialty began more than 15 years ago, but hiring continues to grow and with the pressure to control health care costs on the rise, that trend shows no signs of slowing. The implementation of the Affordable Care Act and Medicare reforms have tied hospitals' reimbursements to their ability to improve patient satisfaction, reduce the average length of stay and prevent readmissions (David, 2014). Because hospitalists practice in the most expensive segment of the healthcare system, they are perfectly positioned to improve value. In theory, hospitalists have the potential to improve coordination of care within the hospital setting (Hoffman, Hatefi and Wachter, 2016). Our analysis considered hospitalists providing care as a dichotomous variable (hospitalists provide care = 1).

Control variables included an indicator for whether the facility receives a portion of financing from capitation, percent of financing received on a shared risk basis, rural versus urban location, government ownership, sole community provider status, network membership, for profit versus not-for-profit, teaching status, system membership, case mix, wage index, total debt to net assets, average length of stay, critical access hospital status, contract management, Joint Commission accreditation, total number of beds, government payer mix and outpatient versus inpatient service mix. We also controlled for regional market nuances by pooling facilities into one of the nine AHA regions. Our use of these control variables is consistent with prior research (Gapenski, Vogel and Langland-Orban, 1993; Langland-Orban, Gapenski and Vogel, 1996; Pink, et al. 2007; Holt, et al., 2015; AHA, 2016).

Analyses

This is an exploratory analysis to evaluate the financial impact of each of our independent variables of interest. The unit of analysis for this study was hospitals in the United States, Puerto Rico and

the Virgin Islands. The original dataset contained 6,009 valid records. Many of the variables of interest had a large number of missing entries. For example, the dichotomous variable "ACO" was missing 1,682 observations. While we considered using multiple imputation methods, the number of missing values made this impractical. Instead, we included those records with complete data in our final analysis (n=2049). We conducted four multivariate logistic regression analyses using an alpha level of $\alpha = .05$. We analyzed each of the measures of hospital profitability in separate forward conditional selection logistic regressions (.05 entry, .10 removal) with the baseline referent group identified by the zero-coded categorical variables and retained all independent variables of interest within each model as covariates. We used IBM SPSS version 23 for all data analyses (IBM Corps, 2014). Results of our analysis are reflected in Table 2 below.

Results

Table 1 displays the mean and standard deviation for all variables included in the final study. Our approach of dividing each dependent variables into a dichotomous form provided a sufficient separation of financial results for further analysis: operating margin (M = .497, SD = .500), net patient revenue (M = .856, SD = .351), net income (M = .767, SD = .423) and return on assets (M = .751, SD = .432). Most of our primary independent variables of interest are well represented in the study data: ACO development (M = .350, SD = .477), hospitalists provide care (M = .880, SD = .325) and medical home development (M = .300, SD = .458).

Table 1. Descriptive Statistics

	Mean	**Std. Dev.**
Positive Op Margin	0.497	0.500
Above Avg Net Px Rev	0.856	0.351
Positive Net Income	0.767	0.423
Positive ROA	0.751	0.432
Accountable Care Organization	0.350	0.477
Hospitalists Provide Care	0.880	0.325
Medical Home	0.300	0.458
No EHR	0.010	0.101
Revenue received from capitation	0.609	3.590
Percent Revenue from shared risk	1.471	6.960
Payer Mix	0.706	0.142
Service Mix	0.545	0.147
Rural	0.225	0.418
Government	0.148	0.355
ALOS	5.242	5.775
Sole Community Provider	0.093	0.290

Table 1. Continued.

	Mean	Std. Dev.
For Profit	0.098	0.297
Network Member	0.442	0.497
Teaching	0.471	0.499
System Member	0.686	0.464
Case Mix Index	1.571	0.330
Wage Index	0.975	0.186
Total Debt to Net Assets	0.439	25.09
Total Facility Beds	239.2	231.1
Contract Managed Hospital	0.073	0.260
Critical Access Hospital	0.000	0.000
Joint Commission Accreditation	0.803	0.398
Region1 (CT, ME, MA, NH, RI, VT)	0.043	0.204
Region2 (NJ, NY, PA)	0.120	0.325
Region3 (DE, KY, MD, NC, VA, WV, DC)	0.108	0.310
Region4 (AL, FL, GA, MS, SC, TN, PR)	0.125	0.331
Region5 (IL, MI, IN, OH, WI)	0.176	0.381
Region6 (IA, KS, MN, MO, NE, ND, SD)	0.069	0.253
Region7 (AR, LA, OK, TX)	0.204	0.403
Region8 (AZ, CO, ID, MT, NM, UT, WY)	0.055	0.228
Region9 (AK, CA, HI, NV, OR, WA)	0.099	0.298

N = 2,049 hospitals

Table 2 shows the final stepwise outcomes for positive operating margin and above average net patient revenue and Table 3 shows the final stepwise outcomes for positive net income and positive return on assets. Each table includes only those variables that meet the $\alpha = .05$ threshold. Our results indicate a positive association with medical home development with all four dimensions of hospital profitability: operating margin (OR = 1.251, 95% CI = 1.009 – 1.552, *p*=.041), net patient revenue (OR = 2.534, 95% CI = 1.319 – 4.867, *p*=.005), net income (OR = 1.371, 95% CI = 1.050 – 1.790, *p*=.021) and return on assets (OR = 1.479, 95% CI = 1.146 – 1.908, *p*=.003). One possible interpretation of our findings is the odds for those organizations that have developed patient centered medical homes are 25% more likely to experience positive operating margin, 153% more likely to generate positive net patient revenue, 37% more likely to generate positive net income and 48% more likely to create positive return on assets when compared with organizations that haven't adopted PCMHs. We show a positive association with hospitalist staffing in two of four areas: operating margin (OR = 1.732, 95% CI = 1.253 – 2.396, *p*=.001) and net patient revenue (OR = 2.308, 95% CI = 1.406 – 3.791, *p*=.001). Our results suggest that the odds of organizations that employ hospitalists are 73% times more likely to create positive operating margin and 130% times above average net patient revenue when compared with organizations that don't employ hospitalists. Our other independent variable of interest, accountable care organization (ACO) development, did not reflect any significant positive or negative associations with our dependent

measures of hospital profitability. Nagelkerke pseudo R^2 values for each regression equation are reported at the bottom of Tables 2 and 3.

Table 2. Stepwise Logistic Regression Results: Operating Margin and Patient Revenue

Variable	Positive Operating Margin				Above Average Net Patient Revenue			
	β	Exp(β)	S.E.	Sig	β	Exp(β)	S.E.	Sig
Hospitalists Provide Care	.550	1.732	.165	.001 ***	.837	2.308	.254	.001 ***
Medical Home	.224	1.251	.110	.041 *	.930	2.534	.333	.005 **
Payer Mix (% Medicaid & Medicare)	-1.410	.243	.378	.000 ***				
Service Mix (% Outpatient)					2.294	9.914	.930	.014 *
Rural	-.418	.658	.133	.002 **				
Government	-.820	.441	.154	.000 ***				
ALOS					-.225	.799	.034	.000 ***
For Profit	.388	1.474	.167	.020 *				
Teaching					-.654	.520	.265	.014 *
System Member	.523	1.688	.110	.000 ***				
Case Mix Index	1.021	2.777	.185	.000 ***	2.043	7.714	.295	.000 ***
Wage Index	-.966	.381	.287	.001 ***	3.541	34.510	.864	.000 ***
Total Debt to Net Assets								
Total Facility Beds	-.001	.999	.000	.011 *	.051	1.052	.004	.000 ***
Joint Commission Accreditation					.628	1.873	.229	.006 **
Reg 2 (NJ, NY, PA)	-.487	.615	.153	.001 ***				
Reg 3 (DE, KY, MD, NC, VA, WV, DC)								
Reg 4 (AL, FL, GA, MS, SC, TN, PR)					-.875	.417	.335	.009 *
Reg 5 (IL, MI, IN, OH, WI)								
Reg 7 (AR, LA, OK, TX)	-.279	.757	.131	.034 *	-1.102	.332	.248	.000 ***
Constant	-.168	.845	.525		-9.456	.000	1.328	
Omnibus Test	$X^2 = 267.38$, df = 12, N = 2049, p < .001				$X^2 = 1075.22$, df = 11, N = 2049, p < .001			
Nagelkerke R Square	.163				.727			

Table 3. Stepwise Logistic Regression Results: Net Income and Return on Assets

Variable	Positive Net Income				Positive Return on Assets			
	β	Exp(β)	S.E.	Sig	β	Exp(β)	S.E.	Sig
Hospitalists Provide Care								
Medical Home	.315	1.370	.136	.021 *	.391	1.478	.130	.003 **
Payer Mix (% Medicaid & Medicare)	-1.437	.237	.426	.001 ***	-1.432	.238	.418	.001 ***
Service Mix (% Outpatient)								
Rural								
Government					-.355	.702	.145	.014 *
ALOS	-.026	.974	.010	.012 *	-.018	.982	.009	.054 *

Table 3. Continued

Variable	Positive Net Income				Positive Return on Assets			
	β	Exp(β)	S.E.	Sig	β	Exp(β)	S.E.	Sig
For Profit								
Teaching								
System Member								
Case Mix Index	1.033	2.808	.222	.000 ***	1.398	4.048	.200	.000 ***
Wage Index								
Total Debt to Net Assets	.006	1.006	.003	.054 *	.016	1.017	.007	.019 **
Total Facility Beds	.001	1.001	.000	.001 ***				
Joint Commission Accreditation								
Reg 2 (NJ, NY, PA)	-.458	.633	.167	.006 **	-.336	.715	.161	.037 *
Reg 3 (DE, KY, MD, NC, VA, WV, DC)					.420	1.522	.187	.024 *
Reg 4 (AL, FL, GA, MS, SC, TN, PR)								
Reg 5 (IL, MI, IN, OH, WI)	.558	1.747	.172	.001 **	.562	1.754	.162	.001 ***
Reg 7 (AR, LA, OK, TX)	-.285	.752	.141	.044 *				
Constant	.479	1.615	.502		-.043	.957	.474	
Omnibus Test	X^2 = 173.95, df = 9, N = 2049, p < .001				X^2 = 181.43, df = 9, N = 2049, p < .001			
Nagelkerke R Square	.123				.126			

N = 2,049 hospitals; Region1 (CT, ME, MA, NH, RI, VT) is referent region; *p<.05; **p<.01; ***p<.001

In addition to our variables of interest, notable secondary findings include the expected negative impact of the average length of stay, increased percentage of Medicaid & Medicare proportion of total payer mix and government orientation across at least two or more measures of hospital profitability. Similarly, case mix is strongly positively associated with all four measures of profitability. Interesting individual findings include a very strong and sizable association between outpatient service mix and net patient revenue (OR = 9.914, 95% CI = 1.603 – 61.332, *p*=.014) and only one measure of profitability (operating margin) where for profit ownership (OR = 1.474, 95% CI = 1.063 – 2.045, *p*=.020) and system membership (OR = 1.688, 95% CI = 1.361 – 2.094, *p*=.000) are positively associated. One area of conflicting guidance pertains to the impact of the wage index reflecting a negative association with operating margin (OR = .381, 95% CI = .217 – .668, *p*=.001) but a significant and sizable connection to net patient revenue (OR = 34.510, 95% CI = 6.352 – 187.507, *p*=. 000).

Our findings were mixed with respect to supporting the work conducted by Gapenski, Langland-Orban and Vogel (1993). We confirmed teaching hospital status is negatively associated with net patient revenue (OR = .520, 95% CI = .309 - .875, *p*=.014) and outpatient service mix is strongly associated with net patient revenue (OR = 9.914, 95% CI = 1.603 – 61.332, *p*=.014). However, we found debt utilization to be slighly positively associated with net income (OR = 1.006, 95% CI = 1.000 – 1.013, *p*=.054). Several of our control variables had no association with our dependent variables that are noteworthy for their lack of impact. These included capitated and risk based

financing, EHR adoption, sole community provider status, network membership and contract management of the hospital.

Discussion

We found that of the three recent organizational changes (i.e. PCMH development, ACO participation, and use of hospitalists), PCMH is most consistently aligned with measures of hospital profitability. We found some impact of hospitalists, in regard to its positive association with operating margin and net patient revenue. Surprisingly, we did not find an association between ACO participation and any measure of hospital profitability we tested.

As the United States health care industry evolves in the wake of the PPACA, HITECH and MACRA legislation, hospital and health system leaders continue to struggle with appropriate areas of investment that will simultaneously improve patient safety and quality while maintaining profitability in an industry that is slowly transitioning from a fee-for-service to a value-based perspective. Patient centered medical homes are an increasingly valuable modality for health care that helps maintain continuity of care and improves integrated medicine on an outpatient basis (DeVries, et al., 2012; Paustian, et al., 2014). Through this integration and focus on wellness, PCMHs have been shown to save costs (Vats et al., 2013) and reduce avoidable utilization (Saultz & Lochner, 2005). This allows hospitals to operate more efficiently, thereby improving efficiency measures such as operating margin and return on assets. The reduction in costs similarly improves hospital profitability.

Hospitalists serve a similar capacity to PCMHs, but within the inpatient setting, by helping to reduce costs. Hospitalists align resources to improve patient care, more quickly respond to patient needs and possibly reduce patient safety concerns, readmissions and ultimately costs (Turner, et al., 2014; Cipolle, et al., 2016). Similarly, use of hospitalists may be supportive in financial enhancement efforts. Although the use of hospitalists and PCMHs have moderately different impacts depending on the area of financial interest, the consistently positive impact shared between the two approaches is encouraging and worthy of continued development, adoption and research.

Surprisingly, we did not find a significant relationship between accountable care organizations and higher levels of profitability. Previous studies on cost savings found mixed results. A study on Pioneer ACOs found a savings per beneficiary to care for patients that belong to an ACO (Nyweide et al., 2015), while a separate study of Florida ACOs did not find a cost savings when comparing highly integrated ACOs, compared to freestanding hospitals (Chukmaitov et al., 2015). It is possible that since ACOs require comprehensive and integrated electronic health record and data analytic systems to coordinate care (Berkowitz & Pahira, 2014), those initial organizational costs impact the level of profitability. It is also possible that the financial benefits of the ACO model of care delivery is not yet mature enough to be fully captured in financial reports analyzed as part of this study.

Limitations and Future Research

Our research is an initial exploratory effort related to understanding how recent evolutionary changes in care delivery are associated with hospital profitability. While drawing from a larger sample than earlier studies, we appreciate that this study is a single cross section from the American Hospital Association and limited to just over two thousand facilities. A logical next step beyond our current work is to further develop the dataset via imputation and/or evaluate the data longitudinally, examining our chosen variables and other emergent factors that may have a logical connection to financial performance. Some have also debated that the precision and sufficiency of Medicare Cost Report data off of which the AHA financial data is based may not be reliable (Magnus & Smith, 2000; Kane & Magnus, 2001). These concerns provide a basis for similar research evaluating other comprehensive hospital data sets. Future studies might examine our findings as well as scrutinize additional areas of profitability in keeping with the breadth of measures evaluated by Pink, et al. (2007).

We hypothesize that our findings are a function of the dynamic healthcare environment. However, the variables associated with hospital performance are likely to evolve across time. We suggest that future research build off of this study and examine other organizational characteristics and care delivery modalities relationships as they emerge in a post-MACRA environment. As new operating results become available, the results could prove instructive to health care leaders and policy makers alike.

Conclusions

As the United States' health care industry continues to evolve as a result of recent disruptive and transformative legislation and regulations, care delivery will increasingly migrate towards a population health and value-based approach. However, health care leaders must also maximize revenues and constrain costs. Our results suggest that adoption of patient centered approaches can not only improve the quality of care but can help health care leaders move the needle towards sustained financial viability. Patient centered medical homes and hospitalists have been shown by other researchers to be clinically efficient and effective care delivery methods. Our research demonstrates that both of these approaches may also positively impact hospital profitability across numerous dimensions while controlling for several other organizational characteristics.

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