Explaining hospital performance via the cube one framework

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Abstract

Purpose – The purpose of this paper is to introduce a relatively new theoretical perspective – the Cube One framework – which along with the Cube One Input-Output model provide a conceptual explanation of overall hospital performance. Further, this framework provides information pertinent to organizational improvement.

Design/methodology/approach – Multiple sources of data, including the US Department of Health and Human Services' Centers for Medicare & Medicaid Services (CMS) patient satisfaction ratings, the "US News & World Report's Best Hospitals" (disaggregated) ratings, the American Hospital Directory efficiency metrics, and Glassdoor employee satisfaction ratings, were used to test five hypotheses.

Findings – Three sets of capabilities: patient-, employee-, and efficiency-related were positively associated with hospital performance. The model explained 38 percent of the variance in hospital performance.

Practical implications – By adopting a multi-disciplinary, three-dimensional approach, the framework allows hospital leadership to diagnose areas for improving overall performance.

Social implications – Hospitals have divergent stakeholders such as patients, patient's families, employees, government agencies, insurance companies, administrators, boards of directors, and the community. Management capabilities regarding patients, employees, and the organization itself are crucial to the success of hospitals and all who depend on them.

Originality/value – By utilizing a three-dimensional approach, the Cube One framework views performance from multiple perspectives.

Keywords Productivity, Efficiency, Employee satisfaction, Hospital performance, Patient satisfaction

Paper type Research paper

Introduction

Notwithstanding the extensive literature on healthcare administration, it has been only during the past two decades that comprehensive theoretical approaches have been advanced to explain hospital performance (e.g. Adler *et al.*, 2003; Aiken *et al.*, 1994; Castelli *et al.*, 2007; Donabedian, 1988; West *et al.*, 2002, 2006). Previously, many research efforts have been narrowly focussed, addressing the efficacy of specific techniques and sub-criteria of hospital performance (e.g. Ashmos *et al.*, 1998; Freeman, 2002). A review of the literature reveals both the difficulty of and lack of consensus regarding the definition and measurement of hospital performance. Analyses largely based on financial gauges (e.g. Ehreth, 1994) seem too restrictive for organizations dedicated to helping people. For example, Lemieux-Charles *et al.* (2003, p. 761), studied performance indicators in healthcare organizations in Canada, and found that performance measures operate at

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different levels, "Institutional legitimacy is typically governed by different values (efficiency and cost containment) than technical/managerial legitimacy (quality of care and specialty training), and these differences can create tensions within an organization."

Healthcare leaders themselves have identified the need for both financial and clinical measures in assessing hospital performance (Love *et al.*, 2008) and this combination has, on a limited basis, been tested empirically (e.g. Griffith and Alexander, 2002). Along these lines, when members of the World Health Organization European Regional Office developed a tool to assess hospital performance, they adopted a multidimensional approach, including clinical effectiveness, safety, patient centeredness, production efficiency, staff orientation, and responsive governance (Veillard *et al.*, 2005). Judgments of performance seemingly differ based on stakeholder perspective, as Miller *et al.* (2005, p. 239) noted, "Quality and safety of healthcare is a multidimensional construct depending on one's vantage point as a policy maker, purchaser, payor, researcher, or patient." Therefore, it can be argued that, both financial metrics and measures relevant to multiple healthcare related indicators are useful in capturing the bigger picture of non-profit organizations (Kirk and Nolan, 2010), a category that includes many US hospitals.

Consistent with multidimensional conceptualizations of hospital performance, research has examined the relationship between hospital performance and numerous variables, including: hospital characteristics – e.g., primary mission, whether for-profit or non-profit – (Brand *et al.*, 2012; Kirk and Nolan, 2010); culture (Gerowitz *et al.*, 1996); patient satisfaction (Shwartz *et al.*, 2011); employee satisfaction (Unruh, 2008; Harmon *et al.*, 2003); efficiency (Nayar *et al.*, 2013; Shwartz *et al.*, 2011); HRM practices (e.g. West *et al.*, 2002, 2006); regional variations in productivity (Bojke *et al.*, 2013). Concurrently, studies have examined relationships among component variables. For example, research has consistently found positive associations between measures of nurse satisfaction and patient satisfaction (Atkins *et al.*, 1996; McHugh and Sloane, 2011; Otani *et al.*, 2012). Adopting a broad perspective, Sparrow and Cooper (2014, p. 4) have likewise noted that "organizational effectiveness requires the satisfaction of multiple constituencies – each having an influence on the priorities against which organizational performance should be judged."

Although numerous independent variables have been examined, arguably the most central criteria of hospital performance reflect their primary mission: namely, the quality of healthcare provided; the patient cure rate; and patient survival, especially from curable diseases (West *et al.*, 2002, 2006).

Although prior empirical studies have shed light on important bivariate relationships, the absence of a comprehensive explanatory theoretical framework has been notably absent. The present research, responsive to this deficiency, employs a new, validated approach toward conceptualizing and explaining organizational performance – the Cube One framework (e.g. Kopelman and Prottas, 2012). Adopting a multiple stakeholder perspective, this framework views the organization in the context of an open and interactive system of human, financial, and technological resources. This framework functions not only as a theory but also as a model permitting active intervention by hospital managers based on diagnostic information.

Conceptual framework

The Cube One framework posits that organizational performance is driven by three sets of practices:

(1) customer-directed practices which influence the satisfaction and loyalty of revenue providers;

(2) employee-directed practices which influence the satisfaction and loyalty of the organization's internal customers, employees, who convert inputs to outputs; and

(3) enterprise-directed practices which influence the ability of the organization to attract and retain capital via the efficient use of resources, human and non-human.

In short, it is practices that drive organizational performance, and as Tsoukas and Chia (2002, p. 577) succinctly put it: "Organizations do not simply work; they *are made* to work" (emphasis in original).

Empirically, organizations can be classified in terms of the frequency and quality of their enactment of each set of practices. Organizations can be categorized as being relatively High, Middle, or Low, in the enactment of each set of practices. Organizations that are High with regard to all three sets of practices (High, High, High) are classified as being in Cube One; organizations Low in the three sets of practices (Low, Low, Low) are classified in Cube 27. A schematic representation of the Cube One framework is provided in Figure 1.

There are three assumptions, or postulates, that undergird this framework. First, as noted above, enacted practices – not mission statements or even espoused policies – are posited to drive organizational performance. Second, it is assumed that equifinality applies with regard to enacted practices; thus there are many ways for an organization to satisfy the objectives of the three main parties (customers or patients, employees, and the enterprise itself). Alas, there are no "silver bullets" or ideal sets of practices that can be delineated or specified. Rather, healthcare organizations should be concerned with the extent to which patient-, employee-, and enterprise-directed practices are enacted. Third, it is assumed that the interests of the three parties are not inherently antithetical or mutually contradictory. Technology can be used, for example, to reduce patient waiting times and provide instantly available medical

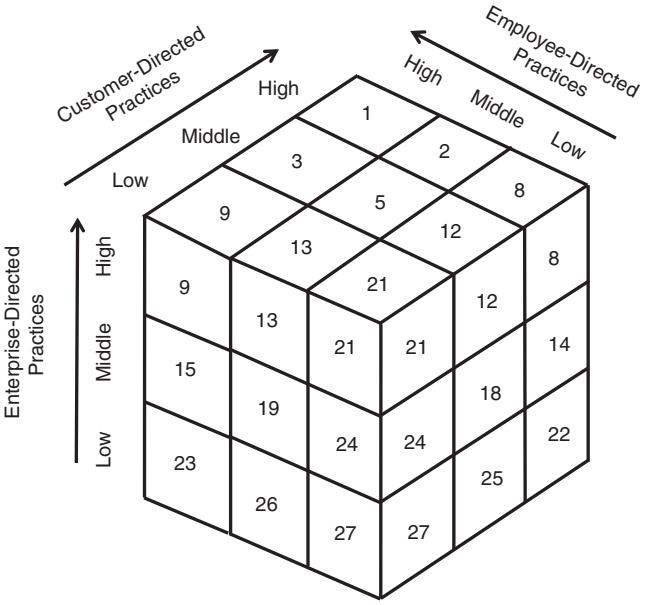

Figure 1.
Schematic representation of the cube one framework

records to all authorized health providers, thereby increasing efficiency as well as patient and employee satisfaction.

Having described the Cube One framework and accompanying assumptions, it remains to be explained more fully why organizations classified in Cube One should be the most successful, and those in Cubes 2-4 should be next most successful, and so forth. The explanation rests in the Cube One Input-Output Model – see Figure 2. Each set of practices leads to a particular intermediate outcome, i.e., capability. Organizations that enact high levels of patient-directed practices achieve the capability of satisfying and earning the loyalty of patients. Likewise, employee-directed practices lead to an organization having the capability to satisfy and retain valued employees. And enterprise-directed practices lead to an organization's capability of being efficient/productive. Stated more formally, capabilities mediate between the three sets of practices and organizational performance.

We have no a priori basis for asserting that any one capability is most important and should be seen as most central to performance – even in a hospital setting. Surely, the primary mission of hospitals is to achieve superior healthcare outcomes for patients – but employees and systems are essential ingredients. Whether patient satisfaction is most closely related to hospital performance is an empirical question that we address below.

To date, evidentiary support for the validity of the Cube One framework has come from three sources. First, survey research studies have collected data from samples of employed, or recently employed, respondents who worked in approximately 800 (Letzler *et al.*, 2012) and 700 (Kopelman and Prottas, 2012) organizations. Differences in rated performance between organizations in Cube One and Cube 27 were 7.4 standard errors and 14.2 standard errors, respectively. As hypothesized, the median correlation between each of the three sets of practices and organizational performance reached a level which Cohen (1992) described as large (Letzler *et al.*, 2012: $r = 0.50$; Kopelman and Prottas, 2012: $r = 0.52$). A second source of evidentiary support has come from two longitudinal cross-lagged studies using market capitalization data. Assessments of management practices were drawn from *Fortune*'s ratings of America's Most Admired Companies, and these were examined along with relative

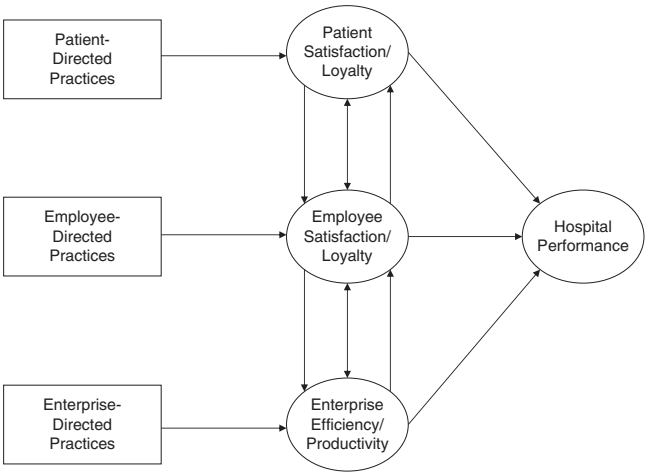

Figure 2.
The cube one input-output model

levels of market capitalization (Kopelman, 2010; Massimino and Kopelman, 2012). A third approach to model validation has entailed in-depth case studies of AltaVista, Google, Continental Airlines, Zappos, Four Seasons, and Nordstrom (Kopelman and Chiou, 2010, 2011; Kopelman *et al.*, 2012).

To date, no research using the Cube One framework has focused exclusively on healthcare organizations. In our view, this framework is uniquely suited to healthcare settings, because we see patient satisfaction/loyalty, employee satisfaction/loyalty, and efficiency/productivity as requisite precursors of positive health outcomes, which are central to hospital performance. The present inquiry applies this framework to explain differences in performance using a sample comprised of the best-performing US hospitals. We begin by looking at each capability as it pertains to hospital performance, and then examine the three capabilities in concert.

Patient-directed practices are those behaviors and procedures which engender patient comfort, satisfaction, and loyalty. Specifically, these practices are focussed on patients' physical well-being, their interactions with hospital staff, and the environment patients experience within the hospital. According to Donabedian (1988, p. 1744), "Clearly, the interpersonal process is the vehicle by which technical care is implemented and on which its success depends. Therefore, the management of the interpersonal process is to a large degree tailored to the achievement of success in technical care."

The Cube One Input-Output Model theorizes that the frequency and quality of patient-directed practices will contribute to patient satisfaction/loyalty which, in turn will influence overall hospital performance. More formally, we posit that:

H1. There will be a positive relationship between the capability of patient satisfaction/loyalty and hospital performance.

Employee-directed practices are seen as a second requisite condition for successful organizational performance. Employee-directed practices are those which engender employee satisfaction and loyalty, such as growth opportunities, work/life balance, and shared information via effective communication. Employee involvement and morale have been shown to influence the impact of composite business practices on organizational effectiveness (Vandenberg *et al.*, 1999). As has been noted widely (e.g. Rosenbluth and Peters, 1992; Schneider and Bowen, 1985), it is not reasonable to expect that in a service setting, employees will treat customers better than they themselves (employees) are treated.

West *et al.* (2006, p. 985) in a study of hospitals in England, stated, "We and others propose that human resource policies and practices are likely to influence patient care quality by impacting both technical and interpersonal aspects of quality care." Further, West *et al.* (2006) assert that HR policies and practices may also affect: human resource outcomes (e.g. turnover, absenteeism); organizational outcomes (e.g. productivity, inpatient mortality); and financial outcomes (e.g. profits, market value). Recognizing the importance of employees in the delivery of healthcare, the Canadian Council of Health Services Accreditation accreditation standards have included employee work life as a dimension of quality (cf. Lemieux-Charles *et al.*, 2003). We therefore posit that:

H2. There will be a positive relationship between the capability of employee satisfaction/loyalty and hospital performance.

Enterprise-directed practices encompass a wide variety of actions undertaken to increase efficiency with regard to all resources. Such practices range from those that focus on internal benchmarking and service process improvements, to those that emphasize more efficient uses of capital and technology. According to Donabedian

(1988, p. 1745), "Technical quality affects the degree to which achievable improvements in health can be attained. Inefficiency is ascertained by the extent to which expected health improvements are achieved in an unnecessarily costly manner. Thus, lower quality and inefficiency coexist because wasteful care is either directly harmful to health or is harmful by displacing more effective care." Therefore we posit that:

H3. There will be a positive relationship between the capability of efficiency/productivity and hospital performance.

The three sets of capabilities (patient satisfaction/loyalty, employee satisfaction/loyalty, and efficiency/productivity) in concert will be very highly related to organizational performance. Thus, we posit that:

H4. The combined levels of the three capabilities (patient, employee, and enterprise) will be strongly and positively related to hospital performance.

The framework also suggests that the three sets of capabilities are not independent, rather, they will be interdependent, positively influencing one another. As an example, West *et al.* (2006, p. 985), point out that Preuss (2003), "suggests that investments in high performance work systems will yield superior health care – and reduced costs – because these systems increase employees' capacity to interpret 'equivocal' information on an ongoing basis and allow them to act directly upon this information."

The effects of such interactions should be synergistic, magnifying the positive relationships of two or more practices with hospital performance. We therefore posit that:

H5. The combined levels of patient-, employee-, and enterprise-capabilities combined with the interactions among them, will be more strongly and positively related to hospital performance than the combined capabilities absent any interactions.

Methods

Procedure

Our sample is comprised of all hospitals listed in one or more of 12 major specialty areas in the 2013 Best Hospitals special issue of US News & World Report (US News & World Report Best Hospitals, 2013). The 12 specialties are: cancer; cardiology; diabetes; ear, nose and throat; gastroenterology; geriatrics; gynecology; nephrology; neurology; orthopedics; pulmonology; and urology. In total, data is compiled on 16 specialties, however, hospital rankings in four specialties "are ranked solely based on their reputation among specialists" (Comarow, 2012, p. 86). Due to the lack of other criteria, we exclude them in our study. The Comarow (2012) report describes how the number of listed hospitals was reduced from a universe of 4,793 hospitals:

> To be considered for rankings in any of the 12 data-driven specialties, a hospital had to meet any of four criteria: be a teaching hospital, be affiliated with a medical school, have at least 200 beds, or have at least 100 beds plus four or more medical technologies […] The hospitals next had to meet a volume requirement to be ranked in a particular specialty. Additionally, other criteria are examined that are unique to each particular specialty. (Comarow, 2012, p. 86)

In the present research, the summary US News Best Hospitals score is captured for the top 50 hospitals in each of the 12 major specialties. Where hospitals were listed in more than one major specialty area, we computed the mean score, yielding a sample of 136 hospitals with the mean score as the dependent variable for the study. We note below the potential problem of range restriction resulting from examining a sample of the highest rated US hospitals.

Measures

Independent variables. In terms of the Cube One framework, the independent variables are: patient satisfaction scores (which reflect the patient satisfaction/loyalty capability); employee satisfaction metrics (which reflect the employee satisfaction/loyalty capability); and financial and efficiency metrics (which reflect the efficiency/productivity capability).

Patient satisfaction data were obtained from the US Department of Health & Human Services' CMS. According to the CMS web site (Centers for Medicare & Medicaid Services, 2013), "the HCAHPS (Hospital Consumer Assessment of Healthcare Providers and Systems) Survey, also known as the CAHPS® Hospital Survey or Hospital CAHPS®, is a standardized survey instrument and data collection methodology that has been in use since 2006 to measure patients' perspectives of hospital care." The HCAHPS is a transparent measure that provides reliable and valid data (Giordano *et al.*, 2010). Hospital-level survey results for ten of the patient survey questions (see the Appendix) are publicly reported on the Hospital Compare web site (Centers for Medicare & Medicaid Services, n.d.). CMS also publishes national and state averages for these ten questions.

For the present study, we utilized three measures of patient satisfaction. Two are questions from the CAHPS® Hospital Survey: the proportion of patients who gave their hospital a rating of "9 or 10" on a scale from 0 (lowest) to 10 (highest), and reported they would definitely recommend the hospital (this item is binary; patients are not asked to rate the hospital on a ten-point scale). This second metric corresponds closely to what Reichheld (2006) in *The Ultimate Question* found to be the best predictor of customer loyalty – far greater than customer satisfaction – namely, how likely is a customer (patient) to recommend a company (healthcare organization) to a friend or colleague. We calculated the mean score of all ten CMS practice-related questions as an overall measure of patient satisfaction. The total sample size in our study for patient-directed practices is 126 hospitals.

We selected two fields of employee satisfaction data from Glassdoor.com. First, an overall satisfaction rating on a five-point scale with endpoints of very satisfied and very dissatisfied. Second, for each hospital we obtained the percentage of employees who "would recommend this company to a friend." Glassdoor data were collected from 125 hospitals, 34 of which had 40 or more reviews during the data collection period (September 2012-July 2013). We did not include hospitals with fewer than 40 Glassdoor reviews in empirical analyses so as to minimize sampling error (see Table 2 in Cohen, 1992) and the potential biases of respondents resulting from a non-random sample of current and former employees. In total, 2,337 separate reviews provided the data for employee satisfaction in the present research.

Hospital efficiency was assessed using three metrics – two generated from the American Hospital Directory (AHD) database, and one from CMS. The first AHD metric, profit margin, reflects overall efficiency. The profit margin calculation is (revenue-cost)/revenue. This measure corresponds closely to the calculation of productivity in Bojke *et al.* (2013, p. 194).

The second metric, the CMS Medicare ratio, compares "whether Medicare spends more, less or about the same per Medicare patient treated in a specific hospital, compared to how much Medicare spends per patient nationally" (Centers for Medicare & Medicaid Services, n.d.). Thus by definition, 1.00 is the national average of the Medicare ratio. The Medicare ratio is price standardized and risk adjusted for the

patient population. On the whole, the Medicare Ratio is analogous to the Market Forces Factor metric in Bojke *et al.* (2013), the Cost Weights measure described by Castelli *et al.* (2007), and the DRG Cost Weights metric utilized in Medin *et al.* (2013). Medicare spending has been linked to hospital inefficiency, albeit not always at significant levels (Hsieh *et al.*, 2010; Ozcan and Luke, 1993; Rosko, 2004).

The third metric is the average occupancy rate for each hospital, calculated from AHD data as the ratio of total patient days to total staffed beds per annum. Occupancy rate (Harrison *et al.*, 2005; Valdmanis, 2010) has been used as a measure of efficiency in empirical studies. Because the efficiency/productivity data are not available for every hospital in our study, we have slightly different sample sizes for each metric: profit margin (133 hospitals), the Medicare ratio (123 hospitals), and average occupancy rate (134 hospitals).

Dependent variable. The source of hospital performance data is the US News & World Report Best Hospitals (2013) scores for the twelve primary medical specialties. To circumvent the multiple arbitrary weightings (e.g. scoring two points for being in the top ten, one point for being in the next ten, and zero points for being grouped in the next 30 hospitals), we averaged hospital scores across specialties. There were 603 scores, in total, for the 50 best hospitals; the three extra cases arose where two hospitals were tied for 50th place. The ultimate source of the rankings, though, reflects a fairly non-transparent ("proprietary") formulation which consists of the following major components and weights: reputation (32.5 percent), survival score (32.5 percent), patient safety (5 percent) and overall structure (30 percent). As Murphy *et al.* (2012) noted, a hospital's reputational score is based on the average of responses from board-certified physicians who are asked to nominate those hospitals in their specific field of care, irrespective of expense or location; more specifically, they are required to consider the best hospitals for patients with serious or difficult conditions. The survival score is based on the measure of mortality 30 days after admission for all Index of Hospital Quality driven specialties. The value for expected deaths is adjusted by the severity of the illness, using the patient's principal and secondary diagnoses. Six components comprise the patient safety index which focuses on accidental injuries to patients and preventable adverse events (Murphy *et al.*, 2012). In total, components comprise the overall structure dimension. Some sub-criteria include: whether the hospital is deemed a nurse magnet hospital; nurse staffing ratio scores; patient services; patient volume; and whether the hospital uses advanced technology (Murphy *et al.*, 2012).

US News follows the Donabedian paradigm. According to Donabedian (1988, p. 1745), "The information from which inferences can be drawn about the quality of care can be classified under three categories: 'structure,' 'process,' and 'outcome.' […] This three-part approach to quality assessment is possible only because good structure increases the likelihood of good process, and good process increases the likelihood of a good outcome."

Analyses

Intercorrelations and regression analyses were performed on organizational-level data. Bivariate correlations were calculated for the three measures of enterprise efficiency, the three measures of patient satisfaction, the two measures of employee satisfaction, and hospital performance. We then performed a multiple regression at the hospital level, using the independent variable metrics found to have the highest associations with hospital performance. Additionally, a regression analysis

was performed incorporating two- and three-way interactions using the method described by Dawson (2014a).

Findings

H1, which predicted a positive relationship between patient satisfaction/loyalty capability measures and hospital performance, was supported. Mean patient satisfaction, willingness to recommend, and proportion of patients rating the hospital a 9 or 10, were all significantly associated with hospital performance ($r = 0.18$, $p < 0.05$; $r = 0.29$, $p < 0.001$; and $r = 0.26$, $p < 0.01$, respectively). Descriptive statistics and intercorrelations among all of the variables are provided in Table I.

For *H2*, we found partial support. Mean employee satisfaction was strongly correlated with hospital performance ($r = 0.40$, $p < 0.01$). The correlation between employee willingness to recommend the hospital to a friend and hospital performance, however, only approached statistical significance ($r = 0.24$, $p = 0.09$). As noted below, the sample size for employee satisfaction metrics was only $n = 34$.

We also found partial support for *H3*. Whereas hospital performance was positively associated with profit margin ($r = 0.28$, $p < 0.001$), we did not find significant correlations between hospital performance and average occupancy rate ($r = 0.14$), or the Medicare ratio ($r = 0.06$).

A multiple regression analysis was performed to test *H4*, which posited a sizable association between hospital performance and patient-, employee-, and enterprise-directed capabilities examined in concert. The analysis incorporated the three strongest measures among the independent variables, which were: average employee satisfaction score, profit margin, and the proportion of patients who would definitely recommend the hospital. In total, 28 hospitals had data for all three measures.

As shown in Table II, the multiple regression of these three independent variables yielded a level of association ($R = 0.62$) that exceeded all of the bivariate correlations with hospital performance (see Table I). Specifically, the highest bivariate level of explained variance increased more than twofold from 16.15 to 37.90 percent when a variable from each of the three capabilities was included in the analysis. Examining these three independent variables in concert, both average employee satisfaction and profit margin had significant coefficients ($p < 0.05$). Future research might test the comprehensive model by specifying measures in a manner other than selecting metrics based on bivariate correlations.

H5 predicted that interaction effects among some or all of the independent variables would enhance explained variance in hospital performance. We tested four regression models. Three regressions examined two-way interactions; the fourth model included the three independent variables, plus all three two-way interaction terms, and the three-way interaction.

In examining two-way interactions between the three variables, there was one significant two-way interaction, between average employee satisfaction and the patient would definitely recommend the hospital, see Table III and also Figure 3. The two main effects and the interaction effect were all significant ($p < 0.01$ or $p < 0.02$). The positive relationship between hospital performance and employee satisfaction is more pronounced for patients with higher satisfaction.

The other two-way interactions and the three-way interaction analyses yielded no positive results, indicating that the interaction between the dimensions is less pronounced than was predicted, or may reflect shrinkage in statistical power due to small sample size ($n = 28$; with only 20 degrees of freedom).

Table I. Descriptive statistics and correlations of all variables

	Variable	*N*	Mean	SD	1	2	3	4	5	6	7	8	9
1.	Patient satisfaction[a]	126	0.71	0.03	1.00								
2.	Patient would definitely recommend	126	0.78	0.05	0.82***	1.00							
3.	Patient rating 9 or 10	126	0.72	0.05	0.91***	0.93***	1.00						
4.	Employee satisfaction (average)[b]	34	3.40	0.27	0.14	0.34*	0.27	1.00					
5.	Employee would recommend	34	0.70	0.13	0.01	0.15	0.10	0.88***	1.00				
6.	Profit margin	133	0.03	0.03	0.24**	0.21**	0.24**	0.03	−0.09	1.00			
7.	Average occupancy rate	134	0.76	0.11	−0.00	0.17*	0.08	0.18*	0.14	0.04	1.00		
8.	Medicare ratio	123	1.00	0.04	0.22**	0.18*	0.17*	−0.07	−0.03	0.14*	0.10	1.00	
9.	Hospital performance[c]	136	66.57	7.88	0.18*	0.29***	0.26**	0.40**	0.24	0.28***	0.14	0.06	1.00

Notes: [a]Average response to ten items including variables 2 and 3; [b]five-point Likert scale; [c]100-point scale. ***$p < 0.001$; **$p < 0.01$; *$p < 0.05$; Significance levels are one-tailed tests

Summary output

Regression statistics	
Multiple R	0.62
R^2	0.38
Adjusted R^2	0.30
SE	7.03
Observations	28.00

Anova

	df	SS	MS	F	Significance F
Regression	3.00	724.94	241.65	4.89	0.01
Residual	24.00	1,186.13	49.42		
Total	27.00	1,911.07			

	Coefficients	SE	t-statistic	p-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	11.11	24.00	0.46	0.65	−38.42	60.64	−38.42	60.64
HHS patient: recommend hospital	18.58	29.15	0.64	0.53	−41.58	78.73	−41.58	78.73
Glassdoor employee: average	11.49	5.26	2.18	0.04	0.63	22.34	0.63	22.34
AHD efficiency: profit margin	143.35	52.12	2.75	0.01	35.77	250.93	35.77	250.93

Table II. Regression table utilizing three variables with the highest correlations

Summary output

Regression statistics	
Multiple R	0.61
R^2	0.37
Adjusted R^2	0.30
SE	7.06
Observations	28.00

Anova

	df	SS	MS	F	Significance F
Regression	3.00	716.18	238.73	4.79	0.01
Residual	24.00	1,194.89	49.79		
Total	27.00	1,911.07			

	Coefficients	SE	t-statistic	p-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	732.96	265.94	2.76	0.01	184.09	1,281.83	184.09	1,281.83
HHS patient: recommend hospital	−877.76	332.46	−2.64	0.01	−1,563.93	−191.59	−1,563.93	−191.59
Glassdoor employee: average	−200.74	78.56	−2.56	0.02	−362.89	−38.60	−362.89	−38.60
Interaction: employee × patient	264.94	97.84	2.71	0.01	63.00	466.88	63.00	466.88

Table III. Regression table patient satisfaction, employee satisfaction and the two-way interaction

Practical implications

The present research investigated the applicability of the Cube One framework to explain and diagnose hospital performance using data from four different sources. Obtaining data from multiple sources mitigates the common method variance problem (Podsakoff *et al.*, 2003). An interesting finding in the present research is that relatively

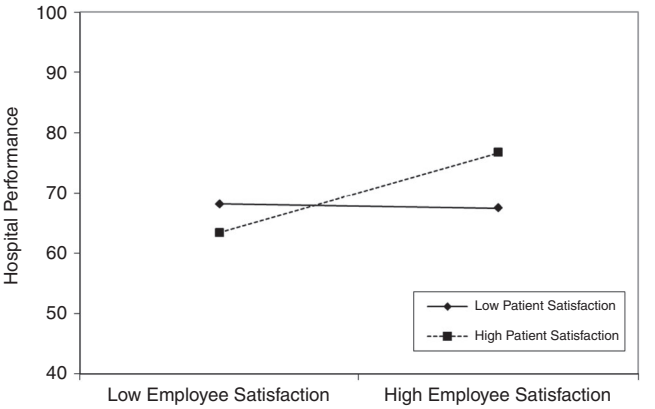

Figure 3.
Interaction effect between patient satisfaction and employee satisfaction

Source: Schematic facilitated by Dawson (2014b)

low levels of multicollinearity were found among the three independent variables. Indeed, the mean intercorrelation among measures of the independent variables was quite low ($r = 0.23$). This reflects an important strength of the present analysis – namely, the use of multiple independent sources of data. However, it must be noted that there are inherent restrictions when using publicly reported data originally collected for other purposes, including that the data might not be available at the desired level of detail.

Hospitals are unique in the service industry because the nature of their business can have life or death consequences. It is an environment where mistakes often cannot be undone, and where "customers" requiring a "service" often feel vulnerable, frightened, in physical and emotional pain, and uncertain about their future. Hospitals must satisfy divergent stakeholders such as patients, the patient's families, employees, government agencies, suppliers, insurance companies, their administration and board of directors, and the community at large. In an environment such as this, management practices toward customers (patients), employees, and the organization itself are crucial to the success of hospitals and all who depend on them.

In connection with the effects of patient satisfaction, all three CMS measures of patient satisfaction were significantly correlated with the US News Best Hospitals average specialty score for hospital performance. The overall CMS score includes ratings on questions such as whether doctors and nurses communicated well with them, whether help was available when they needed it, and whether their room and bathroom were clean. Clearly, these are patient-directed practices. The US News hospital performance scores do not include patient satisfaction data in their ratings. However, because the US News score is a composite of reputation, patient outcomes, patient safety, and structure, it is reasonable to deduce that patient-directed practices contribute to the US News score on hospital performance.

We found that the single strongest predictor of hospital performance was the average employee satisfaction (Glassdoor, n.d.) rating. In light of the service nature of hospitals, it is not surprising that employee-directed practices and consequent employee satisfaction would be the strongest performance predictor. However, Glassdoor data are not a random sample of employee opinions, and there is, therefore, a potential for sample bias. Yet the significant association with the US News & World

Report Best Hospitals performance data cannot be attributed to common method variance. Unfortunately, Glassdoor sample sizes were small with only slightly more than one-fifth of the best hospitals meeting our requirement of a minimum of 40 ratings. In contrast to these Glassdoor data limitations, both the patient data and the enterprise data originated from government studies sampling tens of thousands of patients and thousands of hospitals in a systematic, comprehensive way.

There was mixed support for the hypothesis that efficiency-related practices would be related to hospital performance. The most "bottom line" indicator of efficiency, profit margin, was most strongly related to hospital performance. Productivity is improved by either increasing outputs using the same resources, or, by maintaining the same level of output while using fewer resources. Decreasing resources that lead to increased wait times – what might be characterized as "cost savings productivity" – will often decrease patient satisfaction. However, a decrease in resources resulting from process improvements – what might be labeled "client-focused productivity" – holds the potential for both enhanced efficiency and patient satisfaction. Hospitals which conserve resources while effectively serving patients may in the long run be more efficient than hospitals which cut back on patient care to save money.

It is interesting to note that profit margin correlated significantly with all three measures of patient satisfaction. Of course, correlation does not imply causality, but the questions of causal priority could be addressed in future research. Does patient satisfaction lead to a higher demand for, and increased profitability among certain hospitals? Or, alternatively, do more profitable hospitals possess the resources to initiate processes – perhaps effecting shorter, less stressful hospital stays – which increase patient satisfaction? This premise was supported by Lemieux-Charles *et al.* (2003, p. 767) when they found, "[…] the availability of organizational resources affected HCO's [healthcare organization] ability to implement staff and patient satisfaction recommendations, improve staff/patient ratios, improve the physical environment, or upgrade equipment."

Within a broader scope, performance measures have implications beyond individual hospitals or healthcare organizations. Castelli *et al.* (2007, p. 105) conducted a study on the National Health Service in the UK and stated "Measurement of output and productivity in non-market services is not just of interest to those working within the national accounts tradition but is also important for policy-makers charged with providing, funding and/or regulating these services." Likewise, Medin *et al.* (2013, p. 80), in an international study of hospital productivity in the Nordic countries stated, "Therefore, the execution of systematic comparison of the provision of health care could be helpful for sharing experiences in solving comparable problems and identifying best practices. This type of information should provide evidence for policy makers in identifying optimal structures in the provision and reimbursement of health care."

The present research substantially modified the US News Best Hospitals scores on hospital performance. An average across-all-specialty US News performance metric was calculated and employed to avoid the arbitrary cutoffs in the US News Honor Roll ranking. Notwithstanding the seeming subjectivity and the semi-transparency of the US News Best Hospitals rating data, some support was found for the hypotheses examined in the present research.

As noted above, the present research has a "built-in" level of range restriction, given that the sample consisted of what might be arguably described as the top 2.8 percent of US hospitals. Hence, it is plausible that stronger results would be obtained with a sample more representative of the universe of US hospitals.

Hospital performance is critically important to many stakeholders, including patients, employees and the greater society. Providing the best possible care for patients, in an environment where employees have the skills and motivation to excel in their work, while using resources efficiently is a common theme, across varying healthcare systems and countries, although specific measures vary by study. With the patient, employee and enterprise/efficiency practices and associated capabilities, the framework permits flexibility regarding specific measurements, tailored to the priorities of healthcare organizations, in order to provide relevant measures that make sense in the context of the industry.

Whether related to healthcare systems such as in the USA that are a combination of government, profit and not-for-profit hospitals, or whether related to National Health Care Systems such as in England, the same factors govern the; patient, employee and efficiency dimensions which are of paramount importance to the mission of providing healthcare to society. Finding better ways to achieve optimal outcomes while preserving resources enable more and better care to be provided. This has implications not only at the hospital level, but at national levels where allocations of funding decisions are made.

Ultimately, the fundamental purpose of the present inquiry was to see whether a relatively new model, the Cube One framework, has relevance for explaining, diagnosing and improving hospital performance. In the present research there was some support since all three dimensions were significantly associated with hospital performance. Theoretically, when hospitals are classified as High, Middle, or Low in terms of the three dimensions, a number of improvement-related inferences can be made. In brief, the present research advances a theory-based approach to the assessment of hospital performance that is useful for empirical analysis, and diagnostic and action-directed purposes.

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Appendix. Patient survey questions from the US Department of Health & Human Services' CMS

The following ten items are reported by CMS:

(1) The proportion of patients who reported that their nurses "Always" communicated well.

(2) The proportion of patients who reported that their doctors "Always" communicated well.

(3) The proportion of patients who reported that they "Always" received help as soon as they wanted.

(4) The proportion of patients who reported that their pain was "Always" well controlled.

(5) The proportion of patients who reported that staff "Always" explained about medicines before giving it to them.

(6) The proportion of patients who reported that their room and bathroom were "Always" clean.

(7) The proportion of patients who reported that the area around their room was "Always" quiet at night.

(8) The proportion of patients at each hospital who reported that Yes, they were given information about what to do during their recovery at home.

(9) The proportion of patients who gave their hospital a rating of 9 or 10 on a scale from 0 (lowest) to 10 (highest).

(10) The proportion of patients who reported Yes, they would definitely recommend the hospital.

Note that an "Average Rating" has been calculated by the present researchers to represent an overall patient satisfaction score.

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