The impact of health system membership on patient safety initiatives

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Abstract:
Background: Research in configurations and strategic groups has a rich history of revealing performance differences for hospitals and health care systems.
Purposes: To assess the relationship between hospital-led health system configurations and the adoption of patient safety practices. In particular, the adoption of computerized physician order entry (CPOE) and intensive care unit physician staffing (IPS) is analyzed.
Methodology: Analysis of variance was used to detect differences in patient safety measures based on health networks and systems' initial configuration clustering, and regression was used to assess group membership, controlling for hospital-level characteristics. The 2002 American Hospital Association survey and the first 3 years of the Leapfrog Group annual survey (2003-2005) are used for the analyses.
Results: There were significant differences in CPOE and IPS adoption and implementation levels based on health systems' configurations. Centralized physician/insurance health systems and moderately centralized health systems were the highest configurations in terms of CPOE adoption. Group membership was not positively related to the use of IPS relative to hospitals that are not classified using the taxonomy. In fact, there is a significant and negative adoption rate for both patient safety measures in facilities classified in the independent hospital systems category.
Conclusion: There are systematic differences in the adoption of CPOE and IPS patient safety measures based on health system configurations. The configuration with an insurance company as part of its structure was more likely than other groups to be adopting CPOE.
Practitioner Implications: Given the durability of group membership, the Leapfrog Group and other patient safety initiatives could explicitly target configurations most likely to adopt and implement patient safety programs.
Key words: health networks, organizational configurations, patient safety initiatives, strategic groups

Article:

Health care managers in the 21st century confront complex managerial challenges, including the need to efficiently process information, quickly adapt to turbulence in their competitive environments, and select and implement effective strategies (Marlin, Huonker, & Sun, 2002). The strategic group model is one approach to help managers make sense of their environment and aid in executing effective strategies, leading to optimal performance for their organizations (Marlin et al., 2002). The use of such configurations in hospital research has a particularly long tradition and has been codified in the American Hospital Association (AHA) annual survey using a taxonomy developed by Bazzoli, Shorten, Dubbs, Chan, and Kralovec (1999).

A member in the most prominent taxonomy used in health care research is an empirically identified set of firms with similar organizational structures used to pursue similar strategies (Bazzoli et al., 1999). Such classification schemes have been useful to aid in identifying differences in health care performance above and beyond the effect of organizational resources in regard to financial performance and more specific hospital-based measures (Short, Palmer, David, & Ketchen, 2002). Despite the usefulness of classifications in explaining such measures in previous research, little is known about the relationship between group membership and a number of measures idiosyncratic to health care (Castle, 2003).

Differences in patient safety practices represent one key organizational process measure of critical interest to health care policymakers, payers, and consumers. Consequently, the lack of understanding concerning the relationship between hospitals in different types of system types and patient safety practices presents an important gap in the health care literature. The Institute of Medicine (IOM, 2001) has released a series of reports highly critical of hospitals' and health systems' care quality and patient safety practices in the United States. As a result of these reports, both private and public organizations have begun to exert pressure on hospitals and health systems to implement the promotion of patient safety. The publicity surrounding IOM's reports, coupled with other organizations' calling for rapid change, represents a new environmental imperative for hospitals' and health systems' leadership (Pfeffer, 1981; Warden, 1999). Implementing the call for changes represents a new strategic initiative and major financial investment for most hospitals and health systems. Despite the intuitive appeal of such widespread initiatives, configurations research suggests that substantial mobility barriers exist that make changing strategies difficult. For example, some organizations may find it easier than others to realign their configurations in ways that are substantively different from their prevailing form (Greenwood & Hinings, 1993). In the health care industry, many administrators have expressed little intention of changing their system affiliation despite inferior organizational performance (Churchman & Woodard, 2004).

The purpose of this research is to explore the relationship between hospitals and health system membership and their adoption of patient safety initiatives. This exploratory analysis is offered to provide answers to two key questions: (a) Do hospitals in different types of systems differ in their adoption of patient safety programs? and (b) Which types of systems exhibit the highest performance in regard to adopting and implementing patient safety initiatives promoted by outside organizations? The health care organization taxonomy reported in the AHA annual survey (Bazzoli et al. 1999; Dubbs, Bazzoli, Shone & Kralovec, 2004) is used to classify the hospitals and systems into groups. Two patient safety measures recommended by the IOM and actively promoted by the Leapfrog Group (Birkmeyer, Birkmeyer, Wennberg, & Young, 2000) are analyzed over a 3-year period (2003-2005). In particular, the rates at which different groups adopt and implement computerized physician order entry (CPOE) systems and intensive care unit professional staffing (IPS) are assessed.

Strategic Groups in Health Care

Strategic groups are sets of organizations that have similar resource profiles and follow similar strategies. The appeal of studying these groups is that the mobility barriers that help create and sustain group differences are also likely to produce systematic differences in organizational actions and performance. There is a rich history testing the effects of strategic groups in the health care industry (Marlin, Huonker, & Hasbrouck, 2004), and research has found that group differences impact performance even after controlling for resource differences at the hospital level of analysis (Short et al., 2002).

The AHA has institutionalized one framework for defining such configurations. The AHA annual survey includes the categorization scheme for health systems developed by Bazzoli and colleagues in 1999 and updated in 2002 (Dubbs et al., 2004). This taxonomy differentiates hospitals using a configuration approach suggested by McKelvey (1975) and empirically demonstrated by Miller and Friesen (1984). A similar configuration approach has been used to classify individual health care organizations (Reeves, Duncan, & Ginter, 2003) and predict differences in for-profit and nonprofit organizations' performance outcomes (Reeves & Ford, 2004). The Bazzoli team's classification scheme used to study organized delivery systems focused on three features: (1) the array of hospital services provided, (2) physician—organization relationships, and (3) provider-sponsored insurance products.

The framework assigns hospitals to one of five groups (see Table 1 for complete descriptions). Centralized health systems have a moderate number of products/ services where hospital service delivery, physician arrangements, and insurance product development are centrally organized. Centralized physician/insurance health systems also have a moderate number of products/ services, but hospital services are relatively decentralized and individual hospitals have discretion over services offered. Moderately centralized health systems are distinguished by the presence of centralized activities in some cases and decentralized activities in

others. Decentralized health systems lack an overarching structure for coordination, and independent hospital systems are largely affiliations of autonomous hospitals.

Table 1

Health system cluster code descriptions

Label	Description
Centralized health system	A delivery system in which the system centrally organizes individual hospital service delivery, physician arrangements, and insurance product development. The number of different products/services that are offered across the system is moderate.
Centralized physician/ insurance health system	A delivery system with highly centralized physician arrangements and insurance product development. Within this group, hospital services are relatively decentralized, with individual hospitals having discretion over the array of services they offer. The number of different products/services that are offered across the system is moderate.
Moderately centralized health system	A delivery system that is distinguished by the presence of both centralized and decentralized activity for hospital services, physician arrangements, and insurance product development. For example, a system within this group may have centralized care of expensive, high-technology services, such as open heart surgery, but allows individual hospitals to provide an array of other health services based on local needs. The number of different products/services that are offered across the system is moderate.
Decentralized health system	A delivery system with a high degree of decentralization of hospital services, physician arrangements, and insurance product development. Within this group, systems may lack an overarching structure for coordination. Service and product differentiation is high, which may explain why centralization is hard to achieve. In this group, the system may simply serve a role in sharing information and providing administrative support to highly developed local delivery systems centered around hospitals.
Independent hospital system	A delivery system with limited differentiation, hospital services, physician arrangements, and insurance product development. These systems are largely horizontal affiliations of autonomous hospitals.

Note. Recent research using existing theory and American Hospital Association (AHA) annual survey data identified a reliable set of five distinct groups of health systems that share common strategic/structural features. This new identification system was developed jointly by AHA's Health Research and Educational Trust and Health Forum and the University of California-Berkeley. A health system is assigned to one of five categories based on how much they differentiate and centralize their hospital services, physician arrangements, and provider-based insurance products. Differentiation refers to the number of different products or services that the organization offers. Centralization refers to whether decision making and service delivery emanates from the system level or individual hospitals. Reprinted with permission of the AHA.

The Bazzoli et al. (1999) taxonomy has been used to comparatively study health systems' efficiency (Carey, 2003; Rosko & Proenca, 2005). Generally, these studies have demonstrated that more centralized systems are able to achieve greater efficiency compared with independent or less centralized systems. To this end, there has been a trend among hospitals to join systems or move toward more centralized structures to gain such efficiencies. However, "the evidence suggests that system formation has primarily served to increase market power, not improve patient care quality or hospital efficiency, at least in the short run" (Cuellar & Gertler, 2005, p. 213).

In addition to differences in efficiency related to strategic group membership, research has found evidence that group membership is linked to differences in the adoption of innovation and use of new modalities (Lee, Alexander, & Bazzoli, 2003). Consequently, membership in a particular group also has substantive implications for differences in health care outcomes (Bazzoli et al., 1999). As such, we approach our empirical analysis by posing an overarching research question rather than a formal hypothesis: Does the adoption of patient safety initiatives information systems (viz., CPOE) and staffing (viz., IPS) differ based on group membership?

Methodology

Data Sources

The 2002 AHA survey was used to identify an organization's strategic group. The AHA and Leapfrog data sets were linked using Medicare identification numbers. The Leapfrog Group's initial 3 years of survey data, starting in 2003 and running through 2005, were the basis of this study. Three years of performance data are useful for providing stable performance measures (Short et al., 2002). Overall, 1,463 facilities were analyzed.

The Leapfrog survey is targeted toward hospitals in the country with the largest patient volume. As a result, the survey years generally focused on nonfederal, short-term hospitals with 100 or more beds. By virtue of the criterion selected, most facilities invited to participate are in the Top 50 metropolitan areas in the United States ranked by population. In 2003, the first year of the Leapfrog survey, 4,719 hospitals fit this description. However, Leapfrog did not ask all of them to participate in the survey.

The Leapfrog Group sought to maximize its impact by leveraging regional employers that purchased a significant amount of health care services. The first survey year (2003) included 19 regional markets with 1,379 hospitals that were sent the request for information. By 2005, the number of targeted markets had grown to 31 of the 50 largest metropolitan statistical areas in the United States and included 1,881 hospitals.

Hospital Resources and Control Variables

To provide a set of control variables that encompasses a number of potential influences on patient safety, we relied on a classification used in previous studies of hospital performance that assesses organizational characteristics from three categories: physical, intangible, and case complexity. We selected at least one measure from each category to use as controls (cf. Short et al., 2002).

To assess physical resources, we measured the number of system facilities in a given MSA. Hospital systems that encompass multiple hospitals are making an increased investment in their property, plant, and associated equipment in a given market. Such a measure also indicates a greater market presence that can enhance a system's competitive position. In addition, the number of staffed beds was included to control for economies of scale associated with having a larger facility. Intangible resources are assets and skills that are generally a function of human innovation or entrepreneurial ability (Michalisin, Smith, & Kline, 1997). To measure intangible resources for hospitals relevant to the adoption of safety initiatives, we included two categorical variables: one assessing membership in Baldridge quality programs and another assessing whether the facility participated in teaching programs. To control for the complexity of cases that a hospital treats, we created a variable that is a ratio of the high-risk surgical treatments performed divided by the number of admissions. The specific surgeries included are (a) coronary artery bypass graft, (b) percutaneous coronary intervention, (c) abdominal aortic aneurysm repair, (d) pancreatectomy, (e) esophagectomy, (f) valve replacement, and (g) bariatric surgery, which have been demonstrated to be key indicators of quality (Birkmeyer, 2000). Descriptive statistics for the control variables are shown in Table 2.

Patient Safety Measures

The Leapfrog Group annual survey provided the two patient safety process measures that were drawn from three consecutive years. Both the CPOE and IPS adoption variables were measured on a 4-point scale. The highest level of adoption is fully implemented (Level 4). The next two highest levels of adoption, labeled good progress (Level 3) and good early-stage effort (Level 2), indicate that a hospital is moving toward the fully implemented standard within the next 2 to 3 years. The final reporting level, willing to report publicly (Level 1), indicates that the hospital has no current plans to adopt the patient safety practice.

The CPOE and IPS variables of the Leapfrog Group survey were chosen because they are measures of hospitals' and health systems' strategic intents and actions decided upon by the organizations themselves. The organizational configuration measure developed by Bazzoli et al. (1999) and updated by Dubbs et al. (2004) was developed to predict hospitals' and health systems' strategic behavior. Data drawn from the AHA survey

lead the Leapfrog Group longitudinal data's start by 1 year to assess how existing structures influence patient safety initiatives.

Table 2

Descriptive statistics for control measures

AHA taxonomy	Average system density in MSA[a]	Average MSA population (in 1,000's)	Percentage of hospitals with Baldridge-like quality programs	Percentage for-profit hospitals in group	Percentage teaching hospitals in group	Average no. of beds	Complex procedures per admission (%)
Centralized health system	0.435	1,350	76.50	0.00	49.2	272	1.75
Centralized physician/ insurance health system	0.633	450	75.00	0.00	43.9	271	3.22
Moderately centralized health system	0.389	750	67.90	3.30	42.6	286	1.87
Decentralized health system	0.534	725	69.00	65.30	25.9	217	2.42
Independent hospital system	0.271	1,350	52.90	20.50	36.1	197	3.45
Unaffiliated hospitals	0.315	450	65.50	4.60	32.5	207	0.97

Note. AHA = American Heart Association.

[a]A system density equal to 1 would indicate that every hospital in the market was part of the same system.

This approach was taken for two reasons. First, from a theoretical perspective, strategic groups are considered highly stable because they reflect decisions and behaviors that are long-term, costly, and difficult to change (McGee & Thomas, 1986). Therefore, it takes an extended period after determining an organization's configuration to observe significant changes in their strategic activities. Second, we wanted to explore the predictive capability of the strategic group measure. In addition to those organizations described in the strategic group measure, independent hospitals were added to the analysis and were treated as the reference group in our regression analysis.

Analytic Approach

To assess the effects of group membership on performance in adopting the two measures of interest while controlling for hospital characteristics, we used analysis of variance (ANOVA). Next, two linear regressions were performed. The first included the strategic groups as a block of binary variable. The second regression included the identified resource control measures as a second block to determine whether the group variables' explanatory power was significantly different than that of a model using just the resource measures (Short et al., 2002).

Results

The control variables performed in a manner consistent with expectations. Larger hospitals with teaching programs that performed more complex procedures were more likely to adopt CPOE technology and intensivist staffing. With respect to IPS, teaching hospitals already possessed the necessary personnel to meet this Leap.

To detect differences in patient safety measures based on group membership, ANOVA tests were used. As shown in Table 2, the analyses indicate that strategic group membership, as measured using the taxonomy developed by Bazzoli et at. (1999), is significantly correlated with hospitals' and health systems' decisions to adopt and implement patient safety staffing and systems recommended by the Leapfrog Group for both CPOE ($f = 15.58$, $p < .001$) and IPS ($f = 29.95$, $p < .001$; see Table 3). Moderately centralized health systems were the

most likely to have adopted CPOE technology, followed by centralized physician/insurance health systems, and independent hospital systems were significantly less likely to adopt. Members of the centralized and decentralized health systems were no more likely to have adopted and implemented CPOE than were unaffiliated hospitals. Also, IPS was found to differ significantly based on group membership, but only organizations in independent hospital systems differed significantly from unaffiliated facilities, and they were less likely to use intensivist staffing, consistent with the results of the CPOE analyses.

Table 3

Descriptive statistics and estimates of group differences for patient safety measures

	Patient safety measure					
	Computerized physician order entry			Intensive care professional staffing		
Cluster type	No. of hospitals in group	*M*	*SE*	No. of hospitals in group	*M*	*SE*
Centralized health system	96	1.48	0.08	94	1.65	0.11
Centralized physician/ insurance health system	36	1.66	0.13	33	1.60	0.20
Moderately centralized health system	297	1.53	0.05	287	1.57	0.06
Decentralized health system	411	1.23	0.03	404	1.25	0.04
Independent hospital system	47	1.50	0.11	46	1.73	0.21
Independent hospitals	576	1.48	0.03	536	1.64	0.06
Overall	1,463	1.43	0.02	1,400	1.52	0.03
F tests of group differences	9.63*			6.71*		

*$p < .01$.

Regression tests were used to assess the influences of group membership, controlling for a number of hospital-level resource and quality control variables. As shown in Table 4, group membership significantly explained variance in CPOE and IPS above and beyond the influence of the control measures. Compared with unaffiliated hospitals (the excluded reference group), centralized physician/insurance health systems, moderately centralized health systems, and decentralized health systems were more likely to adopt CPOE. Moderately centralized health systems were more likely to adopt IPS. Overall, both ANOVA and regression were consistent in finding that strategic group membership is useful for identifying differences in patient safety measures.

Discussion

Our findings have implications for understanding differences in the adoption of patient safety initiative for health systems situated in each group identified by the AHA health system clusters. In the following sections, we briefly highlight each configuration in an effort to make sense of health systems' level of adoption of key patient safety initiatives. Our hope is to shed light on how each of these configurations can most effectively leverage the existing resources of health systems and optimize their groups' performance potential. Our secondary goal is to describe why certain groups' lack of response to patient safety initiatives may be acceptable based on the limitations and goals of their hospital system.

Centralized health systems were not significantly different from unaffiliated hospitals in their adoption of CPOE or IPS. The high degree of centralization and close ties to physician practices make it more difficult for this group to change its staffing with respect to IPS. Furthermore, physicians might perceive CPOE adoption as being an additional financial risk (Connolly, 2005).

OSF Saint Francis Medical Center in Peoria, IL, is an example of a centralized physician/insurance health system. Having a large market presence in a relatively small community gives the system a significant

competitive advantage. The system has an extensive medical practice as part of the organization. Therefore, when CPOE systems are adopted, there are fewer groups of physicians to negotiate with to establish the system parameters, and the management organization may have greater influence within the practice. Level of CPOE adoption is highest among this strategic group's members.

In addition to employing physicians, St. Francis also has its own health plan. Therefore, there is an added impetus to improve data management and streamline claims processing through greater use of information technology (IT). Furthermore, the return on savings realized from using CPOE stays within the strategic alliance, or the system in many instances, thus correctly aligning the investment and return functions. To facilitate these functions (both practice and payment), it is likely that the group's members already possessed integrated ITs to some degree.

Table 4

Regression results for group membership controlling for hospital characteristics

	Computerized physician order entry		Intensive care professional staffing	
Independent variables	Equation 1	Equation 2	Equation 1	Equation 2
Resource and control variables				
System hospitals in MSA	.015	−.01	.013	−.021
MSA size	.009	.023	.052*	.062**
Quality programs	.016**	.012	.010	.007
Teaching hospital	.135***	.132***	.205***	.205***
No. of staffed beds	.149***	.130***	.193***	.186***
Complex procedures per admission	.154***	.163***	.201***	.209***
Group membership				
Centralized health system		.017		−.002
Centralized physician/insurance health system		.044*		.015
Moderately centralized health system		.082***		.005
Decentralized health system		.020		.014
Independent hospital system		−.089***		−.080***
df	(6, 1,359)	(11, 1,354)	(6, 1,359)	(11, 1,354)
R^2	.096	.112	.189	.196
F	24.15***	15.58***	52.70***	29.95***
Change in R^2		.02		.007
F change		4.89***	14.63**	2.34**

Note. All coefficients are standardized. Hospitals not reporting any system affiliation were used as the excluded reference group.

*$p < .10$.

**$p < .05$.

***$p < .01$.

Hospitals in the moderately centralized health systems category had the highest level of CPOE adoption among the strategic groups. Carolinas Healthcare System is located in the Charlotte MSA and is one example of such an organization. With diverse group service lines and facility relationships, technical coordination is one of the main services that members are seeking. Therefore, it is logical that this would be an area that builds on existing IT initiatives.

Decentralized health systems' group members did not adopt CPOE systems at significantly different rates than did unaffiliated hospitals. Hospital Corporation of America and Tenet are examples of such systems. Although they do facilitate information sharing and administrative support, it is generally not at a clinical level. Multiple groups of loosely affiliated physician practices that refer to a hospital may have independently purchased various information systems that are difficult to integrate into a focal hospital's CPOE system. With respect to the vendors, they would not view a decentralized system as a single entity. Therefore, every hospital faces the full, first dollar cost of purchasing an expensive system.

The traditionally loose relationship of decentralized health systems with their panel of physicians may also explain their relatively low adoption rate of the IPS standard. In hospitals without IPS, primary care physicians may be reticent to relinquish care of their patients to intensives (Pronovost, Waters, & Dorman, 2001). Because decentralized health systems typically have no global contractual mechanism with their physician panels, they may have difficulty bargaining collectively with their physicians and, in turn, lag other strategic groups in adopting this Leap.

Independent hospital systems were systematically less likely to adopt the patient safety Leaps advocated by the Leapfrog Group than were unaffiliated hospitals. Their relatively low use of quality programs (see Table 3) is another indication that such programs are not part of these organizations' core strategies. Similar to other configurations, the loose affiliation may hinder rather than promote the extensive coordination necessary to expeditiously implement such an initiative.

Practitioner Implications

Our finding that hospitals in different types of health systems differ in their adoption and implementation rates with respect to patient safety initiatives suggests that organizations, such as the Leapfrog Group, the Institute for Healthcare Improvement, and Centers for Medicare & Medicaid Services, might modify their initiatives' strategies to fit particular hospitals' characteristics. For example, Leapfrog might create pay-for-performance programs in markets that contain hospitals that are more likely to adopt but are currently lagging behind the national average. Such a strategy might allow for a more efficient use of resources that would optimize the goals of those hoping to hasten the adoption of care processes that would result in fewer preventable medical errors.

Future Research and Limitations

The findings of our study should be viewed in light of the particular research on hospital configurations that it seeks to extend. We relied on a taxonomy institutionalized in the AHA data set based on considerable health care research and found it to have some explanatory power (Bazzoli et al., 1999; Dubbs et al., 2004). However, the addition of other resource-related variables also added significantly to the explained variance. Therefore, the AHA strategic groups' measure might be further refined by including additional key variables that might differentiate group membership based on case mix complexity and scale. Alternatively, other frameworks for clustering individual hospitals might be better suited to exploring questions on patient safety practice adoptions. Such a taxonomy could include the system classification schema as a component.

We endeavored to control for a set of theoretically defined variables that conceptually encompasses a number of hospital resources culled from research in strategic management, but there are endless potential variables that might also influence the adoption of patient safety practices. Because we rely on patient safety measures based on 3-year averages, our ability to make causal inferences is limited. As more years of Leapfrog data become available, a more rigorous longitudinal analysis will become increasingly feasible. Furthermore, the Leapfrog survey was targeted at the larger, urban markets, and inferences to rural areas cannot be made. Therefore, the trends detected may be changing rapidly, and the findings should not be generalized to future behaviors or across areas with smaller populations. In summary, each of the limitations of the current study suggests possibilities for future research efforts to refine the existing measure or create new ones.

Conclusion

Understanding the relationship between strategic group membership and patient safety initiatives has important implications for policymakers and advocates, managers, researchers, and health care administrators. For policy-makers and advocates, a reliable and validated taxonomy provides a contextual framework to assess organizational policies and initiatives. For advocacy groups, such as Leapfrog, they may be able to better target their programs at organizations or strategic groups with greater capacities for change. Hospital and health system managers can also use the taxonomy to evaluate whether their current balance between centralization and decentralization of decision-making activities fits the emerging environmental imperative for improved patient safety staffing and systems. For researchers, a taxonomy that provides an efficient and robust classi-

fication of hospital and health systems that is linked to critical patient safety practices can enrich organizational descriptions. For hospital administrators, the taxonomy may motivate improved planning at the corporate level that is necessary for the development of improved patient care staffing practices and systems that seamlessly cut across businesses.

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