Hospital and Systems

Taxonomy of Health Networks and Systems: A Reassessment

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Objective. To assess a widely recognized multihospital system taxonomy.

Data Sources. The original taxonomy was based on American Hospital Association (AHA) Annual Survey Data for the years 1994 and 1995 and a reexamined version, on 1998 AHA data.

Study Design. We assess the appropriateness of using data designed to capture *local* hospital/system interrelationships to develop a taxonomy of multihospital systems.

Data Abstraction Methods. The original and reexamined taxonomies used dichotomous measures of service availability, physician practice ownership, and managed care offerings.

Principal Findings. The data and measures used to formulate the taxonomy are not appropriate for classifying multihospital systems at the company level.

Conclusions. Taxonomic studies of multihospital systems are very much needed; future taxonomic studies should make clear distinctions between systems at local versus company levels.

Key Words. Multihospital systems, local hospital clusters, hospital system taxonomy

The merger and acquisition wave of the 1990s increased dramatically the numbers of hospitals that had joined multihospital systems as well as the sizes of those systems (Spetz, Mitchell, and Seago 2000; Cuellar and Gertler 2003), sparking interest in the effects of growing system power on market competition (e.g., see Young, Desai, and Hellinger 2000; Spang, Bazzoli, and Arnould 2001; Gift, Arnould, and Debrook 2002; Cuellar and Gertler 2005) and hospital performance (Bazzoli et al. 2000; Burns and Pauly 2002). The rapid growth has also revealed how little we know about these systems. Despite their importance, we know very little about their management structures, spatial configurations, approaches to clinical and management integration, and so on. In 1999, Bazzoli and colleagues sought to fill the void by publishing what has become a widely recognized taxonomy of health systems and

networks (Bazzoli et al. 1999). In a recent report on an updated version of the taxonomy (Dubbs et al. 2004),¹ they concluded that because the “parameters appear robust with time” (p. 213) the taxonomy has emerged as a “valuable tool” for policy makers, practitioners, and researchers (p. 208)—a point confirmed by the fact that the AHA effectively endorsed the taxonomy having included it in its Annual Survey data files. In light of its rising national prominence, it is essential that the validity of the taxonomy be assessed.

We note first of all that the authors took exceptional care to apply sophisticated statistical techniques in developing the taxonomy. The attention to methodological detail has set a high standard for others to follow as they expand on this line of research. However, the taxonomy has some important limitations, one of the most important of which we address in this research brief—that the taxonomy is based on a dataset designed to capture, not whole systems (many of which stretch well beyond single markets), but *local* hospital/system interrelationships.

THE TAXONOMY

The heart of any taxonomy of hospital systems is the selection of organizational dimensions and measurements used in its calculation. Three such dimensions are used in the Bazzoli and colleagues taxonomy—integration, differentiation, and centralization. These are measured using responses hospitals provided to AHA survey questions on the availability of 78 specific services. The survey asks respondents to indicate which of the listed services their hospitals provide and which are provided by their systems (and networks). The taxonomic measures also incorporate hospital responses to questions about their involvement in various physician arrangements (e.g., independent practice associations) and managed care products (e.g., HMOs). However, the service availability responses played the key role in operationalizing the taxonomy.

Differentiation is measured as the percent of the 78 services provided by a system’s hospitals; centralization, as the percent of responses in which the system is said to provide services not offered by the system’s individual hospitals; and integration, by whether or not services are offered and/or physicians are aligned with the hospitals through contractual mechanisms.

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Significantly, the authors found that centralization—which reflects the degree to which hospitals relegated to their local systems the provision of particular services—was the primary determinant (carries “more weight”) of system type. The labeling of taxonomic categories thus reflects the importance of centralization (similar categories were found for the networks):²

1. *Independent Systems*—limited centralization and low levels of differentiation across services/products.
2. *Decentralized Systems*—low centralization of services/products and high differentiation.
3. *Centralized Physician/Insurance Systems*—moderate on all three dimensions (centralization, differentiation, and integration) for services, decentralized service provision, and high differentiation on physician arrangements and insurance products.
4. *Moderately Centralized Systems*—moderate centralization across services/products, high differentiation on services, moderate differentiation on physician arrangements and insurance products.
5. *Centralized Systems*—high centralization in services and products and moderate to low differentiation across services/products (Bazzoli et al. 1999).

The authors found that particular types of systems tended to fit within each category. The centralized systems, for example, were typically smaller and their hospitals located closer together; the decentralized were larger and more dispersed (multimarket); and independent systems had proportionately smaller hospitals and tended to be investor-owned.³

DATA AND MEASUREMENT MISMATCH: THE CENTRAL ISSUE

The primary limitation of the taxonomy, we suggest, is it classifies multihospital systems using data designed to examine *local* service configurations among clustered system hospitals. To understand this concern, one must distinguish between two levels of system definition—multihospital *companies* and system *clusters* (two or more system hospitals located within individual markets [Cuellar and Gertler 2003]). The latter are comprised of two types—single-market groupings of multimarket companies (e.g., the HCA cluster in Denver) and single-market companies (e.g., INOVA in the Northern Virginia side of the Washington, DC metropolitan area). The taxonomy classifies companies,

but uses data that pertain specifically to clusters.⁴ The AHA actually took steps to minimize the possibility that respondents might confuse clusters with companies, by instructing respondents to check services “Provided by my Health System (*in my local community*)” (emphasis added). The AHA inserted the parenthetical qualifier for a good reason—they were looking for the sharing of services among same-system members within local markets, recognizing that the sharing of services is only meaningful among system members located close together.

We focus on two particularly important issues that arise from the inappropriate use of local system data to classify whole systems: (1) the paper’s methodology introduces a bias in the assignment of systems to taxonomic categories and (2) the paper makes an unsupported assumption that local service configurations serve as proxies for the structures of whole systems.

BIAS IN SYSTEM ASSIGNMENT TO TAXONOMIC CATEGORIES

Given that the taxonomy classifies companies using local cluster data, it would be important to consider how this might bias the statistical generation of taxonomic categories. If all multimarket companies (looking at the 2001 AHA data, nearly 40 percent of the hospital companies have facilities in more than one market) were made up exclusively of local market clusters, then perhaps averaging across their markets might provide a passable indicator of their typical patterns of local service sharing. But, of course, many multimarket companies have clusters in some markets and freestanding hospitals in others. And, many have hospitals that are located at great distances from one another. Freestanding facilities, by definition, should report no services provided at the local system level, as, by definition, they have no local system partners.⁵ System hospitals that are not in the same local markets also should not generally reference the sharing of services with one another. One would therefore expect that the larger companies, which have many freestanding and widely dispersed hospitals, would make fewer references in the survey data to system level provision of services and, therefore, would tend to be classified as either decentralized or independent. Also, the smaller, single-market systems, which have no freestanding hospitals, would likely be classified as centralized. As described earlier, this is what the authors found.

Biased patterns can be observed, for example, in the published AHA classifications. Using 2001 data, Table 1 compares companies classified by the

Table 1: Cluster Type versus System Configuration Characteristics (One-way Analysis of Variance)

<i>Analysis of Variance</i>					
<i>Source</i>	<i>DF</i>	<i>Sum of Squares</i>	<i>Mean Square</i>	<i>F Ratio</i>	<i>Probability > F</i>
<i>Cluster type versus % system's hospitals that are in single markets</i>					
Cluster name	4	7.945077	1.98627	13.4808	<0.0001
Error	296	43.61266	0.14734		
C. total	300	51.557737			
<i>Means</i>					
Cluster type	#	Mean*	Standard error		
Centralized	48	0.127895	0.0554		
Centralized Phy/Ins	35	0.483985	0.06488		
Decentralized	22	0.625402	0.08184		
Independent	64	0.63642	0.04798		
Moderately centralized	132	0.481387	0.03341		
<i>Cluster type versus # hospitals per system</i>					
Cluster name	4	39,060.671	9,765.17	47.7629	<0.0001
Error	296	60,517.442	204.45		
C. total	300	99,578.113			
<i>Means</i>					
Cluster type	#	Mean [†]	Standard error		
Centralized	48	5.3958	2.0638		
Centralized Phy/Ins	35	4.9143	2.4169		
Decentralized	22	49.8636	3.0485		
Independent	64	5.5	1.7873		
Moderately centralized	132	7.2803	1.2445		
<i>Cluster type versus average distance from system center to each system hospital</i>					
Cluster name	4	7,014,396	1,753,599	15.6286	<0.0001
Error	296	33,212,582	112,205		
C. total	300	40,226,978			
<i>Means</i>					
Cluster type	#	Mean [‡]	Standard error		
Centralized	48	16.494	48.349		
Centralized Phy/Ins	35	31.573	56.62		
Decentralized	22	438.287	71.416		
Independent	64	416.589	41.871		
Moderately centralized	132	165.873	29.155		

*The mean for centralized is significantly different from all other cluster type means; there are no other significant differences, with the exception that the means for moderately centralized and independent are significantly different from one another, all tested at the α 0.05 level (using Student *t*).

[†]The mean for decentralized is significantly different from all other cluster type means; no other means are significantly different from one another, all tested at the α 0.05 level (using Student *t*).

[‡]All mean comparisons are significantly different from one another at the 0.05 level (using Student *t*), with the exceptions of centralized compared with centralized Phy/Ins and decentralized compared with independent.

five taxonomic categories on three system characteristics that are expected to be consistent with the classification bias—percent hospitals that are free-standing, number of system hospitals, and average distance for each system hospital to its system center. As expected, systems classified as centralized have significantly lower percentages of freestanding hospitals than do other system types, decentralized and independent have the highest. Also, decentralized systems are significantly larger and more dispersed on average than are more centralized systems. These patterns are fully consistent with what would be expected, given the biasing effect of using data on local service sharing to develop a taxonomy of multihospital system companies. In other words, the typology, because it is based on local interrelationship data, appears to be capturing more the multimarket configurations of these systems than degrees of local centralization, differentiation, or integration.

Given the foregoing, it should be no surprise that centralization emerges as a predominant determinant of system type, as it is based on hospital reporting of services provided at the local system level and thus is the one indicator most affected by differences across companies in spatial dispersion and the percentages of freestanding hospitals. It is also the indicator most likely to be distorted by configurational differences (e.g., size, dispersion) across companies. Put another way, a scheme that classifies whole systems using information on local service sharing will reflect system distributions of hospitals across markets (i.e., the percentage of free-standing versus clustered hospitals) possibly more than distinctive patterns of decentralization.

ASSUMPTION THAT LOCAL SERVICE DISTRIBUTION REPRESENTS COMPANY-LEVEL STRUCTURE

Second, should one assume that the configurations of services provided at the local level reflect differences in the structures of systems at the company level? The authors of the taxonomy answer this in the affirmative. They reason: “Ideally, centralization would be measured as the organizational level at which decisions are made to locate different services. In other words, was the decision made centrally by corporate headquarters or “decentrally” at the local hospital level? We use instead the actual location of the service as a proxy measure of centralization. . . . As such, it is reasonable to assume that network/system decision makers have exerted more influence in the decision-making process than have individual hospitals, as more services are provided centrally rather than decentrally” (Bazzoli et al. 1999, p. 1713).

The association between company organizational structure and the local distributions of services is reinforced at several points. The authors, for example, suggest that integration “refers to the activities and mechanisms used to achieve unity of effort across the different specialized areas” and that the degree of centralization in an organization “has implications for the speed with which decisions get made, the ability to develop new products and services, and accountability to various stakeholders” (Bazzoli et al. 1999, pp. 1686 and 1687).

However, why should one assume that Partners Healthcare System, as an example, which has two highly independent, academically based institutions (Mass General and Brigham & Women’s) at its center and a number of smaller, but relatively autonomous community hospitals at its periphery, should be classified as centralized, simply because its community hospitals report that certain services are provided at the system level? Is it reasonable to assume that the various mid-sized for-profit systems—such as Lifepoint Hospitals Inc. or Community Health Systems—that run many small, non-urban and suburban hospitals and are not known for their administrative decentralization, should nevertheless be classified as decentralized because their isolated hospitals report few services provided at the system level? Why should Intermountain Health Care, which exercises considerable corporate control over its hospitals and other businesses, be classified as decentralized because its string of urban and rural hospitals report relatively few services provided at the system level? Or, why would one assume that Quorum Health Group, which contract manages over 200 hospitals and owns (did own—Quorum is now owned by Triad Hospitals Inc.) over 20 hospitals, be classified as decentralized, because of anything having to do with system-level sharing of services, rather than because it manages so many hospitals by contract?

System structural arrangements are associated with a wide range of factors, including, for example, for-profit systems that standardize management practices and centralize decision making (the Lifepoint case), historic autonomies that are preserved in order to facilitate mergers and acquisitions (e.g., the San Francisco cluster of Sutter Health or the prestigious hospitals in the Partner’s case), public systems that have minimal levels of centralization (as in the case of the hospitals in the University of California hospital system) for historic reasons, and so on. In some cases, service distribution patterns might be associated with structural patterns, but in other cases they are not. Regardless, we suggest that the assumed relationship between service sharing and company-level structure (or, for that matter, local-cluster structure) needs

both empirical and conceptual support, before the idea is incorporated into a major scheme for classifying multihospital systems.

The appropriateness of assuming an association between service distribution and system structure might be even more questionable when applied to hospital networks. The authors defined networks as “strategic alliances or contractual affiliations of hospitals and other health organizations (e.g., nursing homes, home health agencies) that provide an array of health services” and thus are comprised “of diversified ownership . . . versus unified ownership for health systems” (Bazzoli et al. 1999, pp. 1687 and 1688).

Given that they rely on looser structural arrangements, networks are far less likely than systems to have in place the kinds of administrative structures that would lead them to configure services in keeping with operational and strategic objectives. As implied by the term, networks have been adopted for a number of limited reasons, including to accomplish information exchange, provide education, share quality improvement efforts, collaborate in staff recruiting, engage in group purchasing, and engage in joint contracting with payors (Luke, Begun, and Pointer 1989; Kaluzny, Zuckerman, and Ricketts 1995; Shortell 2000). While this might need to be confirmed empirically, we suggest that few were created to engage in the kinds of service restructuring and integration implied by the typology.⁶ The service configurations for networks are more likely to be a consequence of which hospitals happened to join which networks, and are unlikely to be related to the many subtle and often highly fragile structural forms networks use to govern their limited areas of collaboration. We suggest that a distinctive approach to classifying networks is needed, preferably one that accounts for variations in network structural form and purpose.

CONCLUSIONS AND RECOMMENDATIONS

Ultimately, the choice of dimensions on which to create a taxonomy of hospital systems depends on one’s purposes. Bazzoli et al. (1999, p. 1685) sought to create “classes of health care organizations that share strategic and structural characteristics.” This is a timely objective, given the recent rapid movement of hospitals into systems. However, as argued in this research brief, any such classification must make explicit whether it addresses companies or clusters, so as to avoid confusion in concepts and measurement.

A taxonomy of hospital companies could focus on a number of strategically important characteristics, including ownership type, system size,

spatial dispersion, preferences for urban versus rural locations, unique corporate structures, diversity among business units, and other dimensions. Of these, system size and spatial dispersion might be considered among the most important (Luke, Walston, and Plummer 2003). It would not be reasonable, for instance, to lump into the same taxonomic category two systems that are highly divergent in size—such as HCA, with its 190 hospitals, and Centra, a two-hospital system located in Lynchburg, Virginia. It also might not be appropriate to classify together systems that differ greatly in their spatial dispersion—such as Sutter Health, a tightly regionalized system centered in Northern California, and Bon Secours, a company that spreads from Michigan to Florida.

As relatively more is known about multihospital systems, perhaps priority should be given to building taxonomies of local clusters, which experienced significant growth coming out of the 1990s (Cuellar and Gertler 2003). While all clusters by definition are spatially compact, they nevertheless differ greatly in ways that are important organizationally, strategically, and from a policy perspective. Similar to multihospital systems, the clusters differ in size, in both absolute (e.g., numbers hospitals) and relative (local market shares) terms. They also differ in their outreach to rural markets, the degree to which they are integrated with the physician community, their investment in managed care businesses, their investments in ambulatory surgery and other ambulatory care services, how they coordinate to accomplish management (e.g., supply chain management) and strategic (e.g., market dominance) objectives, the degree to which they have major referral or academic institutions at their centers, how they share/coordinate services, how they apply IT strategies to integrate their systems locally, and so on, all of which characteristics merit consideration for inclusion in a taxonomy of clusters.

In sum, hospital system taxonomies need to be created for both companies and clusters. The latter should be given priority in taxonomic development, primarily because they are relatively new and have such significant potential to alter how care is organized, managed, and delivered, let alone how they will affect the competitiveness of local markets. Indeed, this is where the Bazzoli and colleagues taxonomy might have made the greatest contribution. Despite the misdirected application of local service configuration data to developing a taxonomy of multihospital companies, the measurement strategies adopted in their studies did result in a kind of taxonomy that might usefully be applied to local clusters—especially, the distinction between centralized versus decentralized service mixes.

NOTES

1. The first study compared 1994 and 1995 American Hospital Association (AHA) Annual Survey data and the later one, 1998 data.
2. Similar, but not identical categories and descriptions were used in both the 1999 and 2004 papers. Because recent AHA data use categories generated in the 1999 paper, we also rely on those classifications in discussing the taxonomy in this paper.
3. The 1999 paper reported slightly different types and numbers of systems within each category compared with those reported in 2004. The authors speculated that such shifts across taxonomic categories reflect strategic adjustments by the systems as they “navigate survival in a managed care world” (2004, p. 216). They did not assess whether or not the shifts could be ascribed to differences in how the data were reported or to statistical artifacts attributable to their having created categories using statistical clustering techniques.
4. The authors eliminated a few large multihospital systems from their statistical analyses, such as HCA and the Veterans Administration hospital system (1999, p. 1713). However, some subunits of large systems (e.g., some HCA divisions, each of which spans many markets) and most large systems were included in the analyses. We assume these adjustments were done to minimize the inappropriate application of local data to classify widely dispersed systems, although no explanations were provided for why some systems were included and others, not.
5. We note that the reporting of services “Provided by my Health System (in my local community),” on which the taxonomy is heavily dependent, might not be reliable. Freestanding hospitals by definition, regardless of whether or not they are system members, should report *no* services provided at the system level. However, we found that 24 percent of rural and 20 percent of urban freestanding system hospitals reported at least one service provided by their systems. The equivalent percentages were eight and 19 percent for *nonsystem* hospitals. This is evidence either of errors in understanding (i.e., a misunderstanding of the meaning of the term system), that some hospitals are misidentified as nonsystem members in the AHA data, or the survey respondents interpret differently what is meant by the phrase “my local community.” These numbers indicate unacceptably high levels of error in the reporting of system-level services by individual hospitals, for both system and nonsystem hospitals. Therefore, even if it were appropriate to use local service-sharing data to classify whole companies (which we argue it is not), a taxonomy that relies upon individual hospitals reporting the provision of services at the system level might not be reliable.
6. It is true that some networks have evolved joint operating agreements and structural arrangements that might otherwise make them structurally indistinguishable from systems. Thus, while it is an important empirical question as to how many might fall into this category, those that do should probably be reclassified as systems.

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