JOURNAL OF HEALTH CARE FINANCE

August/September 2014

Hospital Specialization: Benefits-Focused Product Line Planning

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ABSTRACT

Trends in hospital specialization are studied using multiple regression analysis for the period 2005-2014. The observed 34.1 percent rise in specialization was associated with a 10.1 percent decline in unit cost per admission. The number of specialized hospitals has grown by 186 percent in the past decade. Other hospitals are getting more specialized by reducing their product lines. Specialization has been highest in competitive West Coast markets and lowest in New York state. General hospitals in competition with specialty hospitals have a strong incentive to contain costs, and decrease the array of services offered. The term "underspecialization" is advanced to capture the inability of some hospitals to selectively prune out product lines in order to specialize. Such hospitals spread resources so thin that many good departments suffer. Unit cost per case (DRG-adjusted) is higher in the less specialized of the general hospitals.

INTRODUCTION

The Affordable Care Act (ACA) passed in March 2010 ran to 906 pages and laid down myriad rules. Implementation of the ACA has had a major impact on hospital strategic planning. General hospitals find it increasingly difficult to squeeze sustainable profit margins from third party payors. The number of specialty hospitals has increased 186 percent since 2002.[1] Moreover, the 89 percent of hospitals that are not specialized have increasingly specialized their product line services. Market forces have stimulated "focused factories" (highly specialized departments) within the general hospital.[2] This paper offers a cost analysis of this trend towards specialization. Two supply side responses emerged in the face of payment reform and declining patient admissions. First, a hospital could implement a macro strategy to reap economies of scale[3] through a facility-wide cost containment program, or merger. Secondly, a hospital could implement a micro strategy to specialize, operating fewer but higher volume departments, and producing departmental economies. Under the specialization strategy each individual department reaps economies through productivity enhancement and trimming variable costs.[4]

The nation is moving from episodic care in general hospital silos to a population health management focus that stimulates hospital specialization to enhance quality and reduce costs. Specialization breeds better quality. With higher volume physicians get better, plus reach out to maximize service quality for the patient. Sixty hospitals in this current study establish a relationship with a pharmacy to fill prescriptions before discharge and deliver them to the patient bedside. Patient adherence to medication is vastly improved. The patient receives a second dose of health education at the bedside. Specialization and focused-factory-delivery contracts help patients get well and stay well.

Specialization, and modest diversification, may be an optimal strategy for American hospitals that are not the sole provider in their community.[5] A hospital with poor cardiac surgery or oncology might drop these services and acquire more specialized services like sleep disorder treatment or bariatric weight loss surgery. The trend to specialize is supported by the prevalence of physician specialists. More recently, the urge to specialize is supported by advocacy groups for a myriad of conditions that push through state laws requiring coverage by every health plan.

Will small unspecialized hospitals exist in 20 years? To remain small, and an unfocused general hospital trying to do all things for all patients, is not a good strategy for the future. Only a few communities will preserve the small hospital market. Such small, sole-community provider with 25-75 beds has a monopoly hold on the market and lacks the opportunity to specialize and reap economies of scale in high-volume specialty departments.

Cost analysis of the hospital economy has a long history.[6] This paper includes a national sample of 234 nongovernmental acute care hospitals with 79-915 beds. The primary research question is: does specialization reduce hospital cost per admission. Previous studies of hospital behavior have used aggregate measures of "services offered" (see Figure 1) from the American Hospital Association's annual survey to assess specialization or diversification. This approach suffers from measurement error: one does not know if the departments have high volume, low volume, or no volume. This article is unique because it presents accurate, reliable data concerning patient volume for all patients for 2005-2014.[7]

Specialization should never be achieved by "dumping" market segments of people--for example, the uninsured--but rather by dropping product lines that are better served by the competition and by recommitting resources to "what you do best." This tendency in the 1990s to specialize did not confront hospitals alone: General Motors might be a more successful company if it became Specific Motors. Since 2009, GM has decreased their number of product lines by 70 percent.[8] In a decade where automakers and hospitals are now experiencing fiscal troubles, no point of differentiation is likely to prove more powerful than quality. This article will review previous research on hospital specialization before considering two basic research questions: Are hospitals becoming more specialized? Does specialization reduce cost per admission?

BACKGROUND

The demise of cost reimbursement means that low-volume departments are under scrutiny on the basis of economics (poor profit margins, poor productivity) and inferior quality. Cause and effect on the quality issue is difficult to establish, given two alternative explanations: (1) volume being too low to maintain sufficient quality, but a hospital keeps the product-line open so as not to give market share to their competition or (2) hospitals with poor quality product line providers are avoided by doctors who send patient referrals, keeping volume sent to these inferior hospitals low.[9] Irrespective of the cause-and-effect dynamics, specialization is associated with maintaining or enhancing the quality of patient care. Specialization allows nurses and physicians to develop more expertise with respect to a specific category of patients.[10]

Finkler offers the traditional argument for avoiding specialization: hospitals with a broad product scope attract more physicians.[11] As a result, hospitals offer a broad range of prestige-maximizing high-technology services, often at low volume, and consequently do not benefit financially from the wide scope of product lines offered. Trustees and other interested individuals might accrue intangible benefits (e.g., pride) from being associated with a hospital that offers so many product lines. However, in the current climate of prospective payment, many hospitals wish for the old days of cost reimbursement when low-volume departments could be maintained. Low-volume departments with high unit costs

do not get their inefficiency reimbursed in our new era of Value Based Purchasing (VBP).

Some public health planners speculate that hospitals refuse to specialize because they would rather engage in a cost-raising "medical arms race." This speculation tries to draw examples from the retail industry. There is some limited evidence that overspecialization can reap negative consequences. For example, in 2012 an Apple executive (Ron Johnson) became CEO of J.C.Penny, trimmed product-lines 30 percent (khaki pants, pantyhose) causing revenues to decline 22 percent. The CEO lost his job. The lurch towards specialization is less dramatic in the health care sector. Farley and Hogan report that hospitals specialized 9.8 percent in diagnosis-related group (DRG)-weighted terms during the initial years of the Medicare prospective payment system.[12] If the specialization is measured in terms of major diagnostic categories (major disease categories (MDCs), fewer in number than DRGs), they report a higher level of specialization (13.9 percent) during the same two years.

For all hospital managers, quality and marketing are becoming increasingly important issues. Developing areas of specialization can bring prestige to a hospital and serve as a magnet for attracting more patients. So-called "centers of excellence" may assist hospitals in gaining access to capital (donors prefer to give to centers for treatment of a particular disease or ailment). In addition to potential quality improvements, the benefits of hospital specialization for society result from eliminating expensive duplication of services and underused technology. Internal corporate planning to cut duplication of departments and equipment in a marketplace can trim costs better than community-based health planning regulations.[13]

DATA AND METHODS

The sample hospitals represent 20 percent of short-term nongovernmental hospitals with more than 75 beds. Only 61 percent of the hospitals were willing to provide data for the two study years. The sample is explained in more detail elsewhere[14], but there was no statistically significant bias present in the sample based on seven variables--urbanicity, teaching status, size, ownership control, disproportionate share patient volume, Medicare case-mix index, and length-of-stay index.

An unbiased information theory measure of specialization has to be a scalar measure of output that is independent of scale (Barer[15]) so that the analyst can measure any nonlinear impact of economies of scale by including beds and beds-squared in the equation. Utilizing the Farley and Hogan[12] measure of specialization, let B_c be defined as the baseline (average) proportion of cases in the category $_c$ and F_{cn} is the fraction of cases in the $_{nth}$ hospital observed in category $_c$. The categories for inpatient specialization will be DRGs and MDCs, creating two alternative measures for specialization (DRG-based, MDC-based).

The information theory index (I) of specialization for hospital $_n$ collapses information about differences between B_c and F_{cn}, as follows:

$$I_n = \sum_{c=1} F_{cn} X \ell n (F_{cn}/B_c)$$

This index equals zero when $F_c = B_c$ for all patient categories, and the index increases as case-mix fractions diverge. National case-mix fractions serve as the baseline. In 2013 the specialization index was over 13 percent higher in western states and 19 percent lower in New York state. The sample contains hospitals from every state (234 hospitals). The results in Figure 2 suggest that specialization has been highest in competitive West Coast markets and lowest in the most tightly rate-regulated state of New York. Hospitals have less incentive to contain costs by decreasing the array of services offered in stringent rate-setting state (New York), in contrast to flexible rate-setting states, such as Maryland, that allow management to reap all the gains from any resulting cost savings. Because the MDCs are more heterogeneous and fewer in number than the DRGs, their information theory index values are lower than the DRG index in Figure 2. For example MDC 5, the circulatory system, is a "grab bag" of cardiac surgery, pediatrics, vascular surgery, general surgery, and cardiology.

The DRG-based measure of specialization increased 34.1 percent in the period 2005-2014. The MDC-based measure of specialization increased 35.7 percent in the period 2005-2014. The average hospital in the sample exhibited a slight deviation of service scope, from an average of 42.3 percent of the services listed in Figure 1 in 2005 to 38.8 percent of services in 2014. While managing in turbulent times, it is not incompatible to reduce scope while achieving greater cash flow from a select few specialized departments. Future research should consider what strategy is optimal for various market environments.

A number of factors are hypothesized to affect specialization, including bed size, rate regulation, and ownership. For-profit hospitals have been found to specialize somewhat more, and large teaching hospitals specialize more (members of the Council of Teaching Hospitals).[16] All else equal, specialization has been found to be higher in markets with a higher density of health maintenance organizations (HMOs), hospital beds, physicians, and long-term care units.[15]

RESULTS

The DRG-based specialization index is regressed on the 13 variables outlined to account for cross-sectional variations in case-mix proportions. The results in Figure 3 agree with the hypothesized signs from previous studies and support the DRG I-index as a measure of specialization. Specialization is high in moderately sized (100-300 bed) hospitals and declines up to 650 beds. Beyond 650 beds it appears the scale of financial reserves or institutional slack enables

larger hospitals to increase specialization for a wider range of services, which is consistent with other studies.[12,14]

To discover whether specialization can trim unit cost, one has to adjust for case mix in greater detail. Because the sample size is not sufficient enough to introduce one variable for each product in the multiproduct firm, the analyst does the second best thing--builds a hedonic cost function.[17] The hedonic proxy measures for case mix include: our DRG-based specialization index, a length-of-stay weighted case-mix index, and three measures of emergency department and outpatient surgery volume. In building the cost function in Figure 3, the three measures of factor prices (if labor and debt are more expensive, then cost per admission will be more expensive) and admissions (as a measure for economies of scale rather than bed capacity) must be included (see line 4 of Figure 4). The results in Figure 4 indicate that a 34.1 percent rise in specialization yields an 10.1 percent reduction in cost per admission in the period 2005-2014. Reducing costs one percent per year is a small, but not inconsequential, improvement in efficiency. The capacity for generating cost savings is one rationale for the rise in specialization. A second rationale for specialization involves shifts in technology and physician preference for certain procedures and product lines.[18,19] From these regression equations one cannot ascertain how much of the specialization is provider/physician-driven, management-driven (selection of product lines), or payment-driven (either the reimbursement rates are too low or the inefficient departments have unusually high average cost).

The coefficients of the within-hospital regression equation explaining shifts in specialization over the period 2005-2014 are presented in Figure 5. The signs are consistent with the cross-sectional results in Figure 3, except that the fifth variable (affiliation with a medical school) and the ninth variable (bed density) have different signs. One cannot conclude much from the observation that the HMO density variable is more significant (0.01 level), but the Herfindahl index is slightly less significant (0.05 level) in Figure 5 relative to Figure 3. Not surprisingly, the western states appear to be associated with more specialization, and the New York state environment tended to retard specialization. To retard specialization also retards profits. The most substantial finding in Figure 5 is the large highly significant coefficient for cost per admission in line 7, suggesting that hospitals facing higher costs per DRG specialize more. One caveat should be introduced: it is difficult to assess reliability when examining cross-sectional data and then comparing it over a period of time.

DISCUSSION

Before starting a specialization initiative, hospital managers should approach service product-line selection prudently. Management must conduct a thorough total-cost-of-ownership (TCO) analysis, including life cycle costing upgrades and maintenance. The reduction of product lines in a more specialized hospital can reduce the inefficiency (unjustified costs) in individual hospitals.[20]

The paradigm for the decade is that specialization breeds quality, and this article has provided evidence that efficiency is improved. Primary research in this area stimulated the Obama administration value based purchasing (VBP) program. VBP will foster transparency, so consumers can identify the best performers from the rest. If you are a good quality provider you want to bond with peers, and work in specialized departments and facilities. As a nation spending 18 percent of our economy on healthcare, we will stop paying for quantity and start paying for value.

Specialization has made Denver Health the best (lowest mortality) of 115 academic medical centers (AMCs). Specialization has breed a one point mortality rate improvement, and generated $158 million in cost savings. Harvard affiliated Massachusetts General and Brigham & Women's Hospital offer another example of the benefits for quality and efficiency from the specialization strategy. The more specialized the facility the more prevalent the use of evidence-based protocols. Evidence-based medicine and value based purchasing are the future for American health care.

Our results are consistent with a study of 106 Korean hospitals concluding specialization of care improved the performance of hospital operations.[21] Their odds ratio of the ITI score was 26, meaning the more specialized hospitals were more likely to be efficient. In both countries, the hospital offering every DRG is too internally focused and provides care at a higher unit cost (with less service quality). In the United States, the obvious exceptions to this broad generalization are the few very large academic medical centers (AMCs) with departments already large enough to reap any possible economies of scale. About one-half of the 115 academic medical centers fall into this last category (22 of the 234 hospitals in this study are AMCs). In the future, the other 400 teaching hospitals may have to specialize or pool their resources and become less full-service (offering under 150 DRGs) but better positioned to survive in an era of cost competition and quality competition. This will have an impact on nurse education and physician training.[22]

Future trends are hard to project from retrospective analysis. The observed 34.1 percent rise in specialization was associated with an 10.1 percent decline in unit cost (per admission) during the period 2005-2014. However, this does not mean that an additional 34.1 percent rise in specialization will yield a further 10.1 percent decline in cost per admission. One must not forget the role of the consumer. Travel time and search time to find that "right hospital" for a given condition will rise if the average hospital offers only 150 DRGs. Future research should consider whether the cost to consumers and physicians in the search process is worth the benefits in terms of: rising levels of quality and declining unit cost per admission. With a good public information network, and rising interest in value shopping, specialization may continue to be a bargain for providers and consumers. However, physicians may not like the fact that they have practice privileges to admit patients at a smaller number of specialized hospitals. On the plus side for hospitals, they may have the economic power to charge a high fee

(like a condo fee or rent) to doctors in search of admitting privileges. The political power of some physicians within a given hospital may lead to underspecialization--the inability of some hospital managers to selectively prune out some product lines.[23] The hospitals with the weak managers will be the first to close.

Studies of specialization should consider the direction in which the specialization is planned or driven. No current evidence exists to suggest that specialization has harmed access, but in the future, specialization may produce less product differentiation, with every hospital moving in the same direction. Under such conditions, all hospitals in a market area might vacate a necessary product line and perhaps harm the health of the population. Hospitals must cultivate patient engagement. Early evidence suggest consumers are reaching out for more provider engagement. According to the *Washington Post* studies by Amy Goldstein in August 2014, ACA federal exchange subsidies have cut avertage insurance premiums 76 percent, and 81 percent of exchange users pay no more than $100 per month. A mere $100 is less than most people pay for their cell phones. ACA demand will continue to grow, and hospitals must not close the departments needed to meet that demand.

To maintain an equally high patient census, a hospital that specializes must open up the geographic range of its marketing effort. For example, when the Memorial Medical Center of Long Beach decided to market its specialized advanced cancer treatment program, patients from a wider array of zip codes were admitted. The impact of consumer behavior is more obvious for smaller hospitals. As more hospitals specialize in less than 150 DRGs, patients will have to drive by a number of hospitals to get to the ones that are right for them. More and more patients are choosing the specialized hospitals that create a point of differentiation in their minds, rather than stopping at a full-service hospital offering every DRG.[24]

Future research should consider whether any future improvement in cost efficiency per admission outweighs the cost to patients. If patients have to spend more time (travel time, lost wages) driving to fewer specialized providers, the monetary savings for payers may not be worth the resulting costs to the households. However, Bronstein and Morrissey's study suggests that patients are willing to travel.[25] They found that 50 percent of rural pregnant women bypassed the nearest rural hospital that provided obstetrics services. If mean travel distance increased by just a few miles, hospital specialization may yield net gains for society that outweigh the costs to consumers--but this generality may not be true in some unstudied rural areas where the opportunity costs for longer distances are more substantial.

Specialization into the service line called Accountable Care Organizations (ACOs) is another area of growth. Examples of strong ACO growth include Cedars-Sinai in Los Angeles, Atrius Boston, Hill Physicians Northern California, and Optimus Healthcare Partners New Jersey. Payors only let Acos keep cost savings from lowering costs when they achieve measurable quality

improvements.tormay want to move towards prospective payment that pays according to severity-adjusted burden of disease.[26] In our study economies of scale are significant but shallow (7.5 percent in the bed size range 79 to 900 beds). These results agree with Martin Feldstein's work.[27] More significantly, hospitals appear to be trying a strategy of product-line specialization. Specialization over the period 2005-2014 has reduced DRG-adjusted cost per admission by 10.1 percent. Hospitals have been able to slowly enhance productivity and trim variable costs. To operate an unspecialized general hospital in 2017 is to quote one CEO a "phenom that ain't phenominating." The future is with specialization and value based purchasing. The public wants accountable care and evidence-based medicine.

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Figure 1

Hospital-Related Services

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1. Alcoholic/chemical service (outpatient service
2. Pediatric medical-surgical care
3. Obstetrics unit
4. Medical surgical intensive care
5. Cardiac intensive care
6. Neonatal intensive care
7. Neonatal intermediate care
8. Pediatric intensive care
9. Burn care
10. Physical rehabilitation
11. Psychiatric care
12. Skilled nursing care
13. Intermediate nursing care
14. Adult day care program
15. Home health services
16. Hospice
17. Arthritis treatment center
18. Assisted living
19. Angioplasty
20. Birthing room – LDR room -LDRP room
21. Breast cancer screening
22. Cardiac catheterization laboratory
23. Children wellness program
24. Chiropractic services
25. Dental services
26. Emergency department
27. Trauma center
28. Urgent care center
29. Extra corporeal shock wave lithotripter
30. Freestanding outpatient center
31. Geriatric services
32. Health screenings
33. HIV-AIDS services
34. Hospital-based outpatient care center
35. Laser optic treatment
36. Meals on wheels
37. Oncology services
38. Occupational health services
39. Open heart surgery
40. Outpatient surgery
41. Pain management program
42. Physical rehabilitation outpatient services
43. Primary care department
44. Psychiatric child-adolescent services
45. Psychiatric emergency services
46. Psychiatric geriatric services
47. Psychiatric outpatient services
48. Psychiatric partial hospitalization program
49. Radiation therapy
50. CT scanner
51. Magnetic resonance imaging (MRI)
52. Position emission tomography (PET)
53. Single photo emission computerized tomography
54. Ultrasound
55. Reproductive health
56. Sleep disorder unit
57. Sports medicine
58. Teen outreach services
59. Transplant services
60. Women’s health center/services

Figure 2

Information Theory Index of Case Mix Specialization (I) by Geographic Location, 2005 and 2014 (n=234 hospitals)

	Sample	2005	2014	Percentage Increase 2005-2014
1-4 Index I DRG-Based				
1. New York	n=21	.481	.619	28.7
2. Western United States	n=51	.674	.923	36.9
3. Other 40 States	n=162	.619	.841	33.9
4. All States	n=234	.628	.842	34.1
5-8 Index I MDC-Based				
1. New York	n=21	.201	.259	29.0
2. Western United States	n=51	.283	.391	38.1
3. Other 40 States	n=162	.260	.352	35.4
4. All states	n=234	.260	.353	35.7

Figure 3

Variable affecting Inpatient Case-Mix Specialization, 2005 and 2014 (n=234 Hospitals)

+Variable	Hypothesized Sign	Coefficient Estimate
A. Capacity (number of beds in 100s)		
1. Acute care beds++	-	-.0914**
2. Acute care beds squared	+	.0062*
B. Management Focus (ownership, teaching status)		
3. For profit hospital	+	.0703*
4. Member, COTH teaching hospitals	+	.0997**
5. Affiliated with a medical school	+	.0019
C. Competitive location and alternatives		
6. Herfindahl index bed concentration	-	-.141**
7. In metropolitan SMSA area	+	.0446
8. Number of HMOs in the country	+	.0193**
9. Hospital beds/100 pop. in country	+	.0205
10. Physicians/100 pop. in country	+	.3386**
11. Fraction beds in long-term care units	+	.0449*
D. State Regulatory pressures		
12. Located in New York or Massachusetts	-	-.042*
13. Located in western states	+	.0188*
E. Control for bias in index specialization		
14. Inverse of the # of patient records	+	148.1*

+Ordinary least squares regression estimate with DRG-based information theory index of specialization as the dependent variable.
++National sample of 234 hospitals with greater than 75 beds.
*p<0.05, two tailed test.
**p<0.01, two tailed test
R^2-adjusted = .604
F- Ratio (14df/218df) = 22.49

Figure 4

Impact of Case-Mix specialization on Inpatient Hospital per Admission (based on a within-hospital regression equation)

+Variable	Hypothesized Sign	Coefficient Estimate
A. Hedonic descriptors for case mix		
1. ℓn (DRG-based index)	-	-.131**
2. ℓn (LOS-weighted case mix index)	+	.695**
3. Emergency dept. visits/total visits	+	-.001
4. Outpatient surgery visits/total visits	+	.0352**
5. Fraction of surgery done outpatient	+	.5148*
B. Competitive location and alternatives		
6. Herfindahl index bed concentration	-	-.1282**
7. Percent revenue not from operations	+	.1592*
8. Number of HMOs in the country	-	-.0274**
9. Hospital beds/100 pop. in country	-	- .082**
10. Physicians/100 pop. in country	-	-.0272*
11. Nonpatient care revenue/total revenue	+	.1550
C. Economies of scale [impact of volume]		
12. ℓn (acute bed admissions)	-	-.2177**
D. Management focus (ownership, teaching status)		
13. For-profit hospital	-	-.0096*
14. Member, COTH teaching hospitals	+	.1527**
15. Affiliated with a medical school	+	.0028
E. Input factor prices (labor, debt)		
16. Ratio of long-term debt/total assets	+	.2485**
17. ℓn (total interest expense/long-term	+	.0271**
18. ℓn (average expense payroll per FTE	+	.2116**

+Least squares estimate with ℓn (average cost per admission) as dependent variable and instruments used for ℓn (I) and ℓn (admissions).
++LOS = length of stay, I = information theory case mix index.
*p<0.05, two tailed test.
**p<0.01, two tailed test.
R^2-adjusted = .448
F-Ratio = 28.73

Figure 5

Variable Impacting Within-Hospital Variance in Hospital Case-Mix Specialization, 2005-2014 (n= 234 hospitals

+Variable	Hypothesized Sign	Coefficient Estimate
A. Capacity (number of beds in 100s)		
1. Acute care beds ++	-	-.0833**
2. Acute care beds squared	+	.0041*
B. Management Focus (ownership, teaching status)		
3. For profit hospital	+	.0494
4. Member, COTH teaching hospitals	+	.1096**
5. Affiliated with a medical school	+	-.0019
C. Competitive location and alternatives		
6. Herfindahl index bed concentration	-	-.0846**
7. ℓn (average cost per inpatient admit)	+	.2111**
8. Number of HMOs in the country	+	.0107**
9. Hospital beds/100 pop. in country	+	-.0502
10. Physicians/100 pop. in country	+	.3159**
11. Fraction beds in long-term care units	+	.0924*
D. State Regulatory pressures		
12. Located in New York or Massachusetts	-	-.0758**
13. Located in western states	+	.0439**
E. Control for bias in index specialization		
14. Inverse of the # of patient records	+	249.4**

+Ordinary least squares regression estimate with DRG-based index as dependent variable using an instrument for ℓn (average cost per admission).
++National sample of 234 hospitals with greater than 75 beds.
*p<0.05, two tailed test.
**p<0.01, two tailed test
R^2-adjusted = .342
F Ratio = 25.19