Hospital Care and Capacity in the Tri-State Region of Indiana, Kentucky, and Ohio: Analysis and Insights

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Hospital Care and Capacity in the Tri-State Region of Indiana, Kentucky, and Ohio: Analysis and Insights

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ABSTRACT. Hospitals are a significant part of the burgeoning healthcare sector in the United States (U.S.) economy. Despite the availability of what some describe as the world’s best healthcare, the U.S. suffers from wide discrepancies in healthcare provision across hospitals and regions of the country. Specifically, capacity, utilization, quality, and even financial performance of hospitals vary widely. Based on secondary data from 533 hospitals in the adjoining states of Indiana, Kentucky, and Ohio, this study develops several comparative
metrics that enable benchmarking, which, in turn, leads to several inferences and implications for hospital administrators. The paper concludes with implications for hospital administrators and suggestions for future research.

**KEYWORDS.** Healthcare marketing, healthcare utilization, hospital capacity, hospital performance

The healthcare system in the United States (U.S.) is a diverse and complex mosaic involving private for-profit and non-profit hospitals, government-owned and operated hospitals, a matrix of private and public health clinics, private doctors’ offices and public clinics, publicly funded community health centers, locally operated charity clinics, and care provided through private philanthropy among others. Though the world’s best healthcare is arguably provided in the U.S., there are several recent and significant challenges that are adversely affecting the U.S. healthcare system. Theses challenges, such as an increasing uninsured population, unbridled price inflation, ambiguous economic incentives, and a growing influx of new healthcare technologies, have all combined to raise critical questions regarding the capacity of the U.S. healthcare system. Stated simply, how well does the U.S. healthcare system adequately serve its population? Given the complexity of the U.S. healthcare system, the question of adequate system capacity is perhaps best addressed by empirically investigating geographically focused regions and linking such analyses to corresponding regional demographics. This study aims to explore this question for one such region—the tri-state region of Indiana, Kentucky, and Ohio.

In this paper, a framework for understanding the healthcare system capacity for acute care in the tri-state region comprised of the states of Indiana, Kentucky, and Ohio is developed. Hospital care, capacity, and quality, as well as the need for such services, are examined in this region of the U.S. via a variety of measures. To estimate the need for hospital care, for example, the region’s demographic profile is considered. State-by-state hospital capacity measures and assets, as well as differences in asset utilization and provision of healthcare across the three states, are also considered. Based on inter-regional disparities, several comparative assessments from the perspectives of capacity, utilization, and service quality are developed. Representative
of research on regional development of the healthcare sector, this study provides empirical comparative metrics that can be used as relevant benchmarks by hospital administrators.

The paper is organized into three sections. The first section reviews hospital care and utilization in the tri-state region. The demand side of the healthcare industry is addressed with data on population demographics and number of patient visits to hospitals. The second section examines hospital capacity and healthcare service quality. A new metric based on idle capacity is developed to assess excess hospital capacity and performance. The last section concludes the paper with implications for hospital administrators, public policy, and future research.

HOSPITAL CARE AND UTILIZATION IN THE TRI-STATE REGION

The service sector is one of the most important economic sectors in the US and accounts for a major part of the U.S. Gross Domestic Product (GDP) (Hellander 2004). The service sector, however, possesses a number of complexities making the marketing of services more difficult than marketing physical goods [e.g., intangibility, perishability, heterogeneity, and inseparable and simultaneous production, consumption, and evaluation (Lovelock and Wirtz 2007)]. Within the services sector, healthcare is one of the fastest growing industries. It is estimated that healthcare spending will continue to grow faster than GDP in the coming decades (“Healthcare Outlays Accelerated . . . 2002). The healthcare industry and markets, however, have experienced a significant degree of turbulence over the past several decades. In order to survive in today’s uncertain environment, healthcare organizations are finding that they must regard patients as consumers (or customers). Creating and maintaining effective relations with these consumers is not only paramount but difficult as well (Para 1997). Although healthcare faces many of the same constraints and opportunities as other service industries, there are certain aspects that are unique to healthcare (e.g., the personal importance placed on healthcare and the large role played by third-party payers such as insurance).

An overview of several demographic and macroeconomic statistics for the tri-state region of Indiana, Kentucky, and Ohio are summarized
in Table 1. Ohio is the most populous state with approximately 11.46 million people, followed by Indiana with 6.27 million, and Kentucky with 4.17 million. The percentage of the population without medical insurance is lowest in Ohio at 12.1%. Percentages of the population without medical insurance in Indiana (13.9%) and Kentucky (14.0%) are, like Ohio, substantially lower than the national average of 15.6%. The Gross State Product (GSP) and the Per Capita GSP for each state and the region also provide relevant information. While there are substantial differences in the GSP across states, the Per Capita GSP figures are fairly consistent (between $32,450 and $36,484). As would be expected, Ohio also has the largest number of hospitals, accounting for approximately 44% of the total hospitals in the tri-state region.
Table 1 also reports statistics on the number of hospitals, outpatient visits and surgeries, net patient service revenue, annual net hospital income, and hospital total assets in each state. Hospital care coverage is assessed using the number of hospitals, number of outpatient visits, and total surgeries (a primary hospital activity).

Two important financial-based measures are traditionally used to evaluate hospital performance, namely, the ‘efficiency’ and the ‘effectiveness’ with which hospitals deliver healthcare. In the financial literature, efficiency is treated as a relative measure reflecting deviations from the maximum attainable output from a given level of input (English et al. 1993; Kwan and Eisenbeis 1992). Return on assets (ROA) (defined as the proportion of net income to total assets) is a direct measure of asset efficiency as it represents the surplus produced by deployed resources. ROA will increase when assets are used with greater efficiency. The notion of effectiveness, however, is directly related to whether or not a business is targeting the right customer segments in order to guarantee profit-generating revenue. An organization’s profit margins are directly related to how well the organization targets its products/services at the right customer segments. The effectiveness of hospital care delivery is measured by Operating Margin (OM), which is defined as the proportion of net income to net patient service revenue.

As displayed in Table 1, hospital care utilization in the tri-state region varies widely across the three states. Some discernible patterns are evident when hospital care is seen from the perspective of various utilization metrics. Ohio, for instance, possesses the largest number of hospitals–its hospitals service 44.3% of all outpatient visits and 52.8% of all surgeries in the tri-state region. While Ohio’s hospitals generate 53.6% of total revenues in the tri-state region, they account for only 36.7% of the net income. Furthermore, the ROA and OM of Ohio’s hospitals are the lowest in the region (1.84 and 5.51%, respectively).

Although Indiana possesses the second largest number of hospitals, its hospitals account for the largest share of net profits in the region. Indiana hospitals account for 30.8% of all hospitals in the tri-state region, handling 36.9% of all outpatient visits and 25.4% of all surgeries, and garnering 28.6% of total revenues and 43% of total net income. Indiana’s ROA is 3.71% while its OM represents the highest in the tri-state region at 12.09%. Hence, hospitals located in Indiana appear to exhibit a higher degree of effectiveness than those located in Ohio or Kentucky.
Kentucky has the smallest number of hospitals in the region accounting for 25.5% of the total. Kentucky’s hospitals handle 18.8% of all outpatient visits and 21.7% of all surgeries, and garner 17.8% of total revenues and 20.2% of total net income. Kentucky’s hospitals have the highest ROA at 3.87% and an OM of 9.14%. Hospitals located in Kentucky, therefore, appear to exhibit a higher degree of efficiency than those located in Ohio or Indiana.

Although the data reveal that Ohio offers the greatest coverage in terms of number of hospitals, total number of outpatient visits, and number of surgeries, the state does not appear to provide the most efficient or effective delivery of hospital care. In fact, Indiana seems to have the most effective delivery of hospital care with the highest OM, and Kentucky seems to have the most efficient hospital care delivery with the highest ROA. This empirical evidence, per guidelines from grounded theory (see Strauss and Corbin 1990), suggests that an increase in hospital coverage may lower both ROA and OM. The observed pattern may be a result of higher levels of competition in Ohio resulting in hospitals locating into less populated and more remote areas where the need for health care is not concentrated thereby making the utilization of assets less efficient. (Two possible alternate explanations exist. One explanation suggests that Ohio may have a higher level of charity care compared to either Indiana or Kentucky. This possibility was not examined in the present paper. A second explanation suggests that, although adding more hospitals to a given state may result in spatial convenience due to increased hospital care coverage for its population, increased coverage may come at the expense of lower ROA and OM (see Rosenbloom (2004)).

Additional insight may be obtained by shifting the point of comparison from the percentage of the region’s hospitals to the percentage of the region’s population. The distribution of hospitals across the states does not directly correspond with the distribution of population. Ohio, for instance, accounts for over half of the region’s population (52.3%), but only accounts for 44.3% of the hospitals. A closer observation of the data suggests that while the annual number of surgeries and net patient service revenue relate closely to a state’s population, annual outpatient visits relates more closely with the number of hospitals in the state. Furthermore, OM seems to relate most directly to the ratio of annual outpatient visits to state population. The OM of hospitals in the states examined, therefore,
appears to be affected by the propensity of residents to visit a hospital on an outpatient basis. Residents of Ohio may make a greater number of outpatient visits to non-hospital facilities. Moreover, ROA seems to relate most directly to the ratio of hospitals to the population in the state. The ROA of the hospitals examined, therefore, seem to be affected by the relative number of hospitals in a state. Interestingly, hospitals in states with relatively more hospitals appear to experience higher ROAs.

**HOSPITAL CAPACITY AND SERVICE QUALITY**

The management (or lack thereof) of demand or capacity has important implications for performance (Bazzoli, Brewster, May, and Kuo 2006). Hospital capacity is a rather unique aspect of the healthcare industry that can act as either an opportunity or a constraint. Hospital services are largely capacity-driven and capacity is typically measured in terms of the number of beds available (Gaynor and Anderson 1995). Prior research suggests that more successful health service organizations are better able to manage their capacity resources than are less successful organizations (Li and Benton 2003). Capacity management can also play a vital role in customer perceptions of service quality, not to mention hospital revenues and costs, ultimately affecting the competitive advantage afforded one hospital over another (Bazzoli, Brewster, May, and Kuo 2006; Brettenhauer and Cote 1998; Green and Nguyen 2001).

An inability to manage hospital capacity can lead to patient delays, suboptimal patient care, vacant beds, and lost demand and revenue (Isken 2002). Past research suggests that the annual cost of excess hospital capacity in the US runs in the billions of dollars (Keeler and Ying 1996). Issues of capacity or patient occupancy, as well as service quality, should be of primary importance to healthcare marketers and providers.

Service quality has important implications in terms of creating a competitive advantage for a healthcare firm. Firms that are adept at service quality can build competitive positional advantages which can be enduring and difficult to emulate (Rappert and Wren 1998). Service quality is explicitly linked to issues of demand and capacity (Grönroos 2000; Lovelock 2007). Generally, perceptions of service quality are associated with the interface between production and
marketing (Grönroos 1993) and relate positively with a firm’s ability to handle levels of demand and/or capacity (Green 2004). Nationwide, both the number of hospital beds and occupancy rates have been declining in recent years due to changes in technology, staff skills, patient expectations, and reimbursement methodologies (Keeler and Ying 1996; Li and Benton 2004). Although researchers generally agree that overcapacity existed during the 1980s and 1990s (e.g., Ennis, Schoenbaum and Keller 2000; Green 2002/2003; Madden 1999), the situation seems to have changed more recently as has been evidenced by growing reports of capacity shortages (e.g. Abelson 2002; Japsen 2003). Bazzoli et al. (2006) suggest that both overcapacity and undercapacity exist as many individual hospitals have not adapted effectively to the demand levels they face. The situation is similar for the other major component of capacity – nursing personnel (Green 2004). Given the “frontline” position of nursing personnel (nurses often perform the role of primary caregiver as well as managers of many clinical units (Green 2004)), the availability and quality of nursing has been shown to affect significantly patients’ perceptions of quality of care (Aiken et al. 2002).

In such an environment, healthcare providers and those in charge of marketing healthcare services need to focus on strategies to ensure that healthcare services meet and even exceed patient needs and expectations thereby contributing to perceptions of superior service quality. A focus on continuous service development and improvement can lead to both an intrinsic culture and external reputation of service quality that may be more sustainable compared with strategies based on other resources and skills that are easier to imitate or substitute (e.g., strategies based on low costs) (Barney 1991).

To gain a sustainable competitive advantage and thereby increase market share and profitability, healthcare providers are often interested in investigating (1) what constitutes better healthcare from a consumer’s perspective, (2) what factors influence patient satisfaction, and (3) which of these factors can be most effectively controlled and exploited (Braunsberger and Gates 2002). As discussed earlier, a factor that healthcare providers can and need to manage effectively is the utilization of hospital capacity. Given the degree of competition in the healthcare field, hospitals need to ensure optimal capacity utilization (the goal of utilizing hospitals at their highest efficiencies), such that they can provide better service and create sustainable competitive advantages (see Figure 1). Research shows that optimal
capacity utilization on the part of hospitals leads to perceptions of superior service quality and increases in referrals on the part of patients (Green 2004).

In the next section, hospital capacity utilization in the tri-state region of Indiana, Kentucky, and Ohio is examined and a metric is introduced by which hospitals can be compared one to another in terms of capacity utilization. Hospital capacity is most commonly examined in relation to use of available beds given the relatively fixed nature of beds at most hospitals. Hospitals generally possess greater freedom in altering the supply of most other capacity issues, including the staffing of nurses, than they are in altering the supply of beds.

**MEASURING HOSPITAL CAPACITY IN THE TRI-STATE REGION**

Central to a discussion on hospital care is the institutional capability of the hospitals. Indeed, no hospital can provide greater care
than is allowed by the extent of internal resource capabilities that are readily available at its disposal. Ultimately, a region’s capacity to provide acute healthcare is related directly to the aggregate capability of hospitals in that region.

In the tri-state region of Indiana, Kentucky, and Ohio, hospital capacity is measured in terms of the number of beds that are licensed and actually staffed. Table 2 lists the different hospital capacities across the region. Table 2 also provides information about the number of hospitals, the per bed asset value, per bed annual revenues, and the per bed net income for each of the three states. Since Ohio leads the other two states in the number of hospitals, it also accounts for the largest number of both licensed and staffed beds. Across the three states there are differences in the number of beds licensed and those that are actually staffed. Obviously, the number of licensed beds in each state is more than the number of staffed beds. Beds that are licensed but not staffed may provide a measure of flexibility, but they also represent fixed costs. The staffing of additional beds can increase capacity but can have detrimental effects if the needs of the current population are being met with existing staffed beds.

Excess hospital capacity in each state can be measured according to the number of staffed inpatient beds in relation to inpatient hospital visits per one thousand residents (“Market Spider:...” 1997). The lower this number (ratio) for a given state, the more efficient the hospitals within that state are managing excess capacity. A measure for calculating excess hospital capacity is as follows:

\[
E_{HC} = \left( \frac{TSB}{THA} \right) \times 1000
\]

| TABLE 2. 2004 Hospital Capacity in the Tri-State Region |
|----------------------------------|------------------|------------------|-----------------|------------------|
| Number of Hospitals              | 164              | 136              | 233             | 533              |
| Number of Licensed Beds          | 27,620           | 22,204           | 54,474          | 104,298          |
| Number of Staffed Beds           | 21,469           | 17,845           | 38,431          | 77,745           |
| Total Hospital Admissions        | 729,127          | 638,980          | 1,716,618       | 3,084,725        |
| Per Bed Asset Value              | $653,343         | $354,056         | $627,366        | $571,806         |
| Per Bed Annual Revenues          | $200,364         | $149,708         | $209,406        | $193,207         |
| Per Bed Annual Net Income        | $24,217          | $13,688          | $11,541         | $15,534          |
| Total Lost Revenue               | $148,958,767     | $59,665,992      | $185,152,263    | 393,777,022      |

Hospital financial information is from Verispan.
where $E_{HC} = \text{Excess Hospital Capacity}$, $T_{SB} = \text{Total Number of Staffed Beds}$, and $T_{HA} = \text{Total Number of Hospital Admissions}$.

By this measure it can be seen that excess capacity for Indiana is 29.44, Kentucky is 27.93, and Ohio is 22.39. The average $E_{HC}$ for the Tri-State is 25.20. The lower $E_{HC}$ score for Ohio seems to indicate that hospitals in Ohio are managing their excess idle capacity more efficiently compared with both Indiana and Kentucky. Excess capacity in hospitals is closely related to occupancy ratios.

**CONCLUSION**

As the most populous state in the tri-state region, Ohio offers the most extensive healthcare coverage. Ohio hospitals, however, appear to be neither the best managed nor the best performing as per traditional financial performance measures (e.g., ROA, OM, etc.). Perhaps indicative of the common adage that bigger is not always better, Ohio’s hospital sector appears to be less successful which could ultimately negatively affect the healthcare available to Ohio residents. Compared to financially healthy hospitals, for example, under-performing hospitals would presumably be less able to provide uncompensated care to the poor and uninsured (Magnus, Smith, and Wheeler 2004). But, do these traditional financial performance measures tell the whole story? Based on a new measure of hospital performance (excess hospital capacity) the condition of Ohio’s hospital sector may not be as straightforward as initially perceived by traditional financial metrics. Herein lies what can be considered as the primary contribution emerging from this research and hence the focus of this the final section of the paper (see Figure 2).

As discussed above, recent healthcare data from the tri-state region suggests that Ohio hospitals are under performing relative to hospitals in neighboring states (see Tables 1 and 2). From a managerial perspective, such a situation might indicate financial distress and potential demise on the part of under performing organizations. In calculating an estimate of each state’s excess hospital capacity, however, a contradiction and/or an alternative perspective regarding this situation appears. As an indicator of healthcare performance, the proposed excess capacity index measures hospital capacity as the degree of utilization within the hospital. According to this capacity utilization measure, Ohio’s hospitals appear to be performing
relatively well. So how should these seemingly opposing views regarding the performance of Ohio’s hospitals be interpreted?

In response to this question, two plausible scenarios seem to support the contention that Ohio hospitals may not be under performing (relatively speaking) despite what traditional financial performance measures (ROA and OM) seem to suggest. First, the less-than-desirable ROA and OM figures pertaining to Ohio hospitals may be associated with lower prices charged by these hospitals on the part of a greater degree of competition. Price competition among Ohio hospitals is widespread (e.g., “Blue Cross to Pass Savings…” 1995; “Hospitals Tackle Price Variations” 1994; “Medicare to Show…” 2006).

At the same time that competition may be driving down prices charged by Ohio hospitals, these hospitals may also be spending more on improving satisfaction and service quality-related aspects associated with patient care. As alluded to earlier, the ability to manage excess capacity is known to be associated with enhanced service quality (Li and Benton 2003) and service quality has become
a significant factor in the delivery of healthcare in the US. Not only are Ohio hospitals routinely rated high in terms of quality, but patients, businesses, and insurance companies in Ohio are known to use such ratings to choose a hospital (e.g., “Area Businesses to Give…” 1996; “High Stakes Riding…” 1993; “Hospitals Rebel…” 1997). To be sure, superior customer quality and satisfaction levels can and often do lead to increases in repeat patient patronage (loyalty) and new patient visits via positive word-of-mouth and referral rates. If this is true, hospitals in Ohio may be building a competitive advantage over hospitals in neighboring states.

Together, lower prices and higher spending on quality likely have a negative effect on traditional financial performance measures. In this way, traditional performance measures may not be telling the whole (or accurate) story in terms of hospital performance, both in the region examined and elsewhere. Hospitals strives to keep human beings alive and well. Accordingly, hospitals generally cannot afford to streamline assets and operations in strict proportion to demand as do non-healthcare businesses and organizations. Indeed, the inability to provide products and services precisely when needed may result in the loss of human life (as compared with inconvenience and/or lower profits in non-healthcare businesses and organizations). The new measure of excess capacity proposed and utilized in this research appears to offer hospital administrators and public policy makers a new perspective as far as hospital performance is concerned. This new index, along with traditional performance measures, can provide a “balanced score card” (Kaplan and Norton 2004) that can be used to improve the way in which hospitals are evaluated and ultimately run.

**Future Research**

Future research is needed to confirm many of the assumptions made in this research. Although there is plenty of anecdotal evidence to suggest that price competition and an emphasis on service quality abound among Ohio hospitals, scholarly research addressing these phenomena directly is needed to confirm these assumptions. In the same way, more research is needed to validate the newly proposed measure of excess hospital capacity. Although this index has intuitive appeal and appears to add to the repertoire of hospital performance metrics, more study is needed to further confirm the validity and reliability of the measure both on its own and in conjunction with
other traditional measures of hospital performance. Moreover, the contentions that there are relationships between the number of hospitals in a state and ROA and OM, and between OM and outpatient visits and ROA and the relative number of hospitals in a state need further examination. Lastly, the analysis not only needs to be extended to include all healthcare providers so that a more complete picture of healthcare can emerge, but it also needs to be extended to other regions of the country to permit comparisons.

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