

An Empirical Analysis on Determining Factors of Hospital Specialization Level and Strategic Typology

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Abstract

This study analyze all the hospital which is applying the national health insurance to show their level of hospitals specialization and types through the Information Theory Index (ITI) and Herfindahl-Hirschman Index (HHI). As a result the external environment, the hospitals specialization adopts the HHI (focused strategy type) in the area that has many numbers of hospitals and the in the area that has many doctors it tends to adopt the ITI (differentiated strategy type). Also, for the internal environment (organizational characteristics), the bigger hospitals has a higher ITI, on the other hand the smaller hospitals has a higher HHI, and so on. A follow up study needs for relations hospitals specialization and organizational performance.

Keywords: Hospital Specialization, Information Theory Index(ITI), Herfindahl-Hirschman Index(HHI), Strategic Typology

INTRODUCTION

The discussion on specialization began when Skinner[1] started to use the concept called "Focused Factory" that argued for focusing on and choosing competitive areas after concluding that the cause behind the reduction of productivity in the United States from 1960s to 1970s was attributed to those excessively complicated organizations. Since then, there have been several studies to contribute to securing the competitiveness with strategic differentiation policy from the early 1990s[2]. Herzlinger[3] and Meyer[4] have suggested that the concept of focused factory could enhance the efficiency of patient's treatment when it was applied the focused treatment areas and diseases. In 2000s, Leung[5] argued that the focused factory was a way to resolve the problem associated with efficiency and productivity promotion as insisting that hospitals should also move to the focused factory model. Moreover, there was the argument that health care organizations should focus on and choose service offering scope and appropriate service types. Kilduff[6] argued that organizations needed to abandon less competitive businesses

and focus on a few number of core businesses in order to cope with environmental changes. In fact, the aforementioned arguments have brought about the strategic changes as to the installation of patient-centric independent specialized centers and specialized areas within general hospitals[7, 8, 9, 10].

Most of the medical institutions in Korea have a high degree of specialization and each of them is separately embarking on new initiatives as to specialization. However, the concept of specialization has not been defined or measured consistently. Therefore, this study aims to re-establish the concept of specialization, identify the determinants to influence the hospitals specialization by using the specialization measurement tool and generate and provide the information as to the distribution of specialization types. This study will provide useful information as to what and how those hospitals embarking on specialization should prepare in the future.

THEORETICAL REVIEW

Concepts and measurement of specialization

The health medical researchers define the specialization of medical services as measuring differences between "normal things" and "traditional things". For instance, Farley and Hogan[11] defined specialization as deviation from "being normal". In other words, they regarded the tendency of specialization as minimization of same service mix provided by all hospitals and an increase in provision of less like services.

In the empirical study, Farley and Hogan[11] defined the difference between all hospitals case-mix proportions and one another hospitals case-mix proportions as the concept of specialization through calculating information theory index. Zwanziger, Melnick and Simonson[12] explained specialization as the two core concepts of unusual service that is differentiated from other hospital organizations or focused services; thus, they introduced the concept of "concentration" in addition to the concept called "differentiation".

The indices, which has been commonly used in the empirical

studies in recent years based on the services to be provided to patients, include information theory index (ITI) and Herfindahl-Hirschman index (HHI).

Information theory index is the most prominent specialization measurement index that has been frequently used in empirical studies. It was first proposed by Evans and Walker[13]. ITI (or differentiation index) provides the two objectives. First, it is to be utilized in order to measure the hospital specialization by comparing the hospitalization distribution between the diagnostic categories of hospitals that would become the base population. Second, it is to be utilized in order to evaluate the concentration of hospitalized patients by comparing the distribution of all hospitalized patients and special hospitalized patients. The general formula of ITI is as follows. θ_i is the baseline proportion in terms of the i service category of all hospitals, whereas P_{ih} represents the ratio of i service category of h^{th} hospital.

$$ITI = \sum_{i=1}^n P_{ih} \times \ln(P_{ih} / \theta_i) \quad (2.1)$$

Zwanziger, Melnick and Simonson[12] have utilized HHI in their empirical studies for measurement of specialization. HHI is calculated with the sum of squares of discharged patients by service category among all discharged patients of a corresponding hospital. In other words, HHI is utilized in measuring specialization since it is the concept to represent the concentration of service mix of a corresponding hospital. The general formula is as follows. P_i is the proportion of discharged patients for a corresponding hospital as to the i service category.

$$HHI = \sum_{i=1}^n (P_i^2) \quad (2.2)$$

This study calculated the specialization index for each target hospital by utilizing HHI of Zwanziger, Melnick and Simonson[12] and ITI of Evans and Walker[13] in accordance with Korean Diagnostic Related Group (KDRG). It is because ITI can represent the differentiation degree of service mix of a corresponding hospital by comparing the service mix provided by all hospitals as a relative concept and HHI can represent the concentration of service mix to be provided by a corresponding hospital as an absolute concept.

Determinants of specialization

According to the previous studies, reimbursement policy as the institutional determinants of hospital specialization is the most important influencing factor of specialization. Zwanziger, Melnick and Simonson[12] have analyzed the specialization of hospital industry from 1983 to 1988 in California. As a result of the analysis, they have proved that the prospective payment system (PPS) of Medicare and selective contracting plan were the very significant influencing

factors for hospital specialization.

In addition to the institutional environment, such external environment factors as competition intensity, population, etc. were found to be the precedence factors to influence the hospital specialization. Farley and Hogan[11] argued that the specialization level tended to be higher in a highly competitive market. They insisted that the specialization level was found to be higher in those areas in which the competition intensity between hospitals was high since the number of subscribers for the US Health Maintenance Organization (HMO) had increased. Eastaugh[9] suggested the empirical study result that the specialization index was high in those Eastern areas such as New York and Massachusetts in which the degree of government regulation was low while arguing the geographical location and government regulation were the important factors to influence the specialization.

As for internal environment, structural attribute was also found to be an important influencing factor for specialization. Zwanziger, Melnick and Simonson[12] said that the ownership type was an important influencing factor for choosing service mix provided by a hospital. They also argued that for-profit hospitals tended to provide other service types, which were not provided by non-profit hospitals. Through the empirical study, Farley and Hogan[11] found that the small and medium sized hospitals and training hospitals had a high level of specialization. Also, the study of Eastaugh[9] had the same study result as the study of Farley and Hogan[11]. In relation to hospital size, Eastaugh[9] found that the specialization level was high among those hospitals with moderate size and the specialization level was reduced in the hospitals with more than 760 sickbeds. Okasha[14] suggested that for-profit hospitals and small-sized hospitals tended to pursue service specialization more aggressively as compared with non-profit hospitals and large-sized hospitals. Dayhoff and Cromwell[15] argued that the precedence factors of specialization included number of sickbeds, for-profit or non-profit hospital, training or non-training hospital, market share and those external environment factors such as number of HMO and PPO subscribers, population, population of 65 years old or older, regional classification, etc.

Study Design and Analytic Method

Specialization strategies of hospitals are established by the pressure of various external environment. As the environmental factors influencing the strategies in the previous studies, market competition[16, 17, 18], population density[17], number of doctors[16, 19] attributes of competitors[20], income level[16, 17, 18], etc. were taken into consideration. This study has taken into account competition intensity and population structure factor from the perspective of suitability for external environment and strategy based on the conceptual definition of external environment and the

previous studies.

Internal environment defined by organizational attributes is also an important factor to determine what an organization performs and wants; thus, it becomes an important factor to influence organizational behavior such as implementation of strategies. Those organizational attributes, which can be considered as internal environment attributes, include size, location, ownership type, management type, customer, organizational age, lifecycle, objective, etc. These aforementioned attributes are taken into consideration as the important factors to influence organizational competence when performing strategies[16].

The organizational attributes of previous studies included such variables as number of sickbeds[21], patient type, ownership type[16], share of customer[18], payment-redemption system[17], etc. This study leveraged such variables as type of establishment, payment-redemption system, training hospital, designation or non-designation as a specialized hospital, organizational size, number of sickbeds and specialists, etc. on the basis of organizational attribute variables in the previous studies.

As for the data processing such as calculation of specialization index through the tools used in the analysis, SAS 9.1 was utilized. The statistical analyses, such as technical statistical analysis, correlation analysis, group analysis and hierarchical regression analysis, were conducting by using SPSS 18.0.

RESULTS OF STUDY

Determinants of hospital specialization

To analyze the impact of external environment factors on specialization strategic factors, multiple regression analysis was conducted through inputting the four external environment factors as independent variables. As a result of the analysis, the number of regional doctors and proportion of aged people had a significant impact as for ITI index related to differentiation. Specifically, the number of regional hospitals had a significant impact as for HHI index related to concentration, whereas the other external factors did not have a statistically significant impact on the specialization index.

To analyze the correlation between the internal environment factors and specialization index, multiple regression analysis was conducted by inputting the 8 organizational attribute factors as independent variables. As a result of the analysis, the number of sickbeds, the number of years of establishment, type classification, establishment type, DRG participation and training hospital were found to have a significant impact as for differentiation related ITI, whereas the number of sickbeds, type classification, regional classification, DRG participation and specialized hospital were the significant influencing factors as for concentration related HHI.

Table 2. Impact of external environment factors on specialization index

External Environment	Differentiation Index (ITI)			Concentration Index (HHI)		
	Standardization Regression Coefficient	T value	p	Standardization Regression Coefficient	T value	p
(Constant)		2.399	0.017		8.229	0.000
Number of Regional Hospitals	-0.034	-1.079	0.281	0.089	2.846	0.004
Number of Doctors Per One Thousand	0.152	5.647	0.000	-0.024	-0.875	0.382
Proportion of Aged People	-0.069	-2.247	0.025	-0.059	-1.900	0.058
Per Capital Regional Income	-0.017	-0.645	0.519	-0.041	-1.492	0.136
Statistic	R ² = 0.024 F = 8.726 p = 0.000			R ² = 0.020 F = 7.282 p = 0.000		

Note) ITI, HHI index average is log transform

Table 3. Impact of organizational attribute factors on specialization index

Organizational Attributes		Differentiation Index (ITI)			Concentration Index (HHI)		
		Standardization Regression Coefficient	T value	p	Standardization Regression Coefficient	T value	p
(Constant)			-0.130	0.897		4.131	0.000
Number of Sickbeds		0.411	11.566	0.000	0.111	2.963	0.003
Number of Years of Establishment		-0.119	-4.115	0.000	0.014	0.461	0.645
Type Classification1)	General Hospital	-0.006	-0.205	0.837	-0.424	-13.721	0.000
	tertiary Hospital	0.173	5.012	0.000	-0.263	-7.185	0.000
Establishment Type2)	Educational Foundation Hospital	-0.120	-3.345	0.001	-0.003	-0.074	0.941
	Other Corporate Hospital	-0.122	-2.283	0.023	0.007	0.127	0.899
	Personal Hospital	-0.088	-1.495	0.135	-0.053	-0.850	0.395
regional classification 3)	Small and Medium Size Regions	-0.029	-0.769	0.442	0.155	3.876	0.000
	Urban Areas	0.042	1.179	0.238	0.191	5.066	0.000
	Metropolitan Areas	0.001	0.029	0.977	0.206	4.986	0.000
	Capital City Region	0.062	1.812	0.070	0.144	3.973	0.000
DRG Participating Institution4)		0.098	4.003	0.000	0.086	3.297	0.001
Training Hospital Designated Institution4)		0.091	2.623	0.009	0.006	0.176	0.861
Specialized Hospital Designated Institution4)		0.019	0.808	0.419	0.095	3.855	0.000
Statistic		R ² = 0.271			R ² = 0.181		
		F =37.778			F =22.492		
		p = 0.000			p = 0.000		

Note 1) Type classification: based on hospital level

2) Establishment type: based on public corporate hospital

3) Regional classification: based on district

4) DRG hospital, training hospital and specialized hospital: based on non-participating / non-designated institution

5) ITI, HHI index average is log transform

Table 4. Specialization Strategic Type on Cluster Analysis

Specialization Index	Cluster Type				F-value	p
	Cluster(1)	Cluster(2)	Cluster(3)	Cluster(4)		
ITI	0.313	0.092	0.666	7.280	1234.2	0.000
HHI	0.040	0.275	0.217	0.019	1463.5	0.000
No. of Hospitals	595	424	275	143		
Classification	General Type	Concentrate Type	Integrate Type	Differentiate Type		

Note) ITI, HHI index average is not log transform.

Types of specialization strategy

As a result of the group analysis, the explanation power has increased significantly up to 4. Since then, the increment of explanation power was not large; thus, the 4 groups were set as an optimal number of groups. When the number of groups was set at 4, the explanation power of group model was 75.4 percent.

As a result of K-mean group analysis, the differentiation and concentration indices, the two specialization indices between the groups, had a statistically significant difference, and they were classified into the four sub-groups.

DISCUSSIONS AND CONCLUSIONS

This study aimed to provide useful information in establishing the direction of specialization strategies for the aspect of hospital management through measuring the two specialization indices classified as differentiation and concentration and analyzing the impact of external environment and organizational structure attribute factors on specialization level for the 1,437 hospitals over a certain size.

The number of regional hospitals representing the competition intensity among the external environment factors as a determinant of specialization was found to have a positive correlation with the concentration index, whereas the number of regional doctors was found to have a positive correlation with the differentiation index. In other words, the concentration index was found to be high when the number of regional hospitals was high and the increase in the number of doctors per one thousand people was found to have a high concentration index. This study proved that the competition between hospitals increased the degree of specialization in the direction of concentration, whereas the competition between doctors increased the degree of specialization in the direction of differentiation.

As a result of analyzing the correlation between the internal environment factors of organizational attributes and the specialization indices, an increase in the number of sickbeds that represent the size of a hospital was found to have a

positive correlation with both of the concentration and differentiation indices. This finding may be attributed to the institutional difference of health policy between the United States and Korea and also the difference caused by medical demands.

As for establishment type that can indicate the commerciality indirectly, those educational foundation and other corporate hospitals had a low level of differentiation index than the public corporate hospitals and they did not have any correlation with the concentration index. As for regional classification to represent the degree of urbanization, only the concentration index was found to have a correlation. In general, the concentration index was found to have a positive correlation in city and metropolitan city regions rather than gun regions. The previous studies also indicated that urban regions generally had a higher specialization level than the rural areas[11].

As for DRG participation, those DRG participating institutions had a high level for both of the differentiation and concentration indices as compared with the non-participating institutions. As for implementation of DRG system, most of the empirical studies indicated that it was an important factor to represent the specialization of medical services in addition to the competition between hospitals[11, 12].

As for designation of training hospitals, those designated institutions were found to have a higher differentiation index than the non-designated institutions. On the other hand, the designated institutions had a higher concentration index than the non-designated institutions in accordance with the designation of a specialized hospital. Moreover, it was possible to know that the training hospitals were providing differentiated services from those normal hospitals due to the medical education.

The above study results would be utilized as useful data to attempt specialization or measure a specialized hospital. However, this study focuses on identifying the determinants and strategy types of specialization; thus, it has the limitation that it does not provide direct research information as to the outcome of specialization. Nonetheless, many empirical studies have indicated that specialization had a positive

correlation with organizational outcomes such as cost efficiency, financial achievements, etc. It is expected that there will be a follow-up study on identifying the relationship between specialization level and organizational achievements.

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