

The Clinic Efficiency of Department of Obstetrics and Gynecology in Taiwan

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Abstract Most of studies were measuring the efficiency of hospitals in the past. The way of measuring efficiency base on the unit of hospital, and it was difficult for measuring the efficiency of each department in hospital. Besides, the situation of each hospital is different from the same department in other hospital. The research data in this study was obtained from National Health Insurance Database in 2008. The main research methodology was data envelopment analysis (DEA). The out-patient services efficiency measuring model with examination fee, drugs fee, and the number of dosing days as input, and the number of treatment as output was applied in this study. The admission services efficiency measuring model with examination fee, drugs fee, and days of hospitalization as output, and the number of treatment as output was applied in this study. This study measure the efficiency of public hospitals, university hospitals, army hospitals, private hospitals, and religious hospitals based on these two models. After all, No matter the out-patient services or the admission services of department of obstetrics and gynecology, the efficiency of public hospitals, university hospitals, army hospitals, private hospitals, and religious hospitals are not the same. The average of efficiency score of university hospital is better than other type of hospitals. Most of benchmark hospitals are private hospitals. For these inefficiency hospitals, they could learn how to improve efficiency of department of obstetrics and gynecology from these benchmark hospitals.

Keywords Efficiency, Department of Obstetrics and Gynecology, Hospital

1. Introduction

Implementation of National Health Insurance (NHI) caused a great impact on the health care environment in Taiwan, and the elimination of the economic barriers and improves health care services nearly. For the hospital manager, the implementation of NHI means the reallocation of medical resource in Taiwan. The influences of the implementation of the health insurance system include positive effect and negative effect. The positive effect of the response to the implementation of the NHI are these hospital improved the service quality, efficiency, the type of service, and service item for survive in health care environment. The negative effect was the hospital will not survive if they didn't modify the way of dealing with the impact of NHI. It could be found that most of local hospital or small hospitals were closed and more medical center and clinics were built after the implementation of NHI.

Under the rule of NHI, payment was the same in different sickness but a few types of patients (such as preterm children, and the mentally disordered). The medical fee was calculated with times. In the Fee-For-Service system, some physicians

reduced the days of dosing days, and asks people revisit more for getting more medical fees. Besides, bureau of national health insurance only check the payment with long-day treatment, and didn't focus on these short-term treatment, and the waste of medical resource come from these situation.

In the past, most of studies are done with measuring the efficiency between hospitals. The way of measuring efficiency based on the unit of hospital is difficult for measuring the efficiency of each department in each hospital. Besides, the situation of each hospital was different from the same department between in other hospital.

Most of studies that measuring the efficiency of health care organization were focus on whole hospital. Besides, each hospital is different, and it was not suitable for measuring efficiency with data envelopment analysis (DEA). So the object of this study was measuring the efficiency of department of obstetrics and gynecology of Taiwanese hospital, and detecting the optimum range of clinic charges with these efficiency hospitals.

2. Relevant Literature

2.1. The Efficiency of Medical Organization and Data Envelopment Analysis

Data envelopment analysis (DEA) method is usually used

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in the assessment of the relative efficiency of the multi-input and multi-output organization. For its powerful in measuring the efficiency of non-profit organizations, lots of study measuring the efficiency of health care organization with DEA, such as hospital.

The first study of the application of DEA in measuring the efficiency of medical organization is Nunamaker's study[2]. Much study applied DEA in measuring the efficiency of medical organization recent year. However, most of these studies are measuring the efficiency of medical organization base on whole hospital process. Not the same as other business organization; the output of medical organization is built by each department. For medical organization manager, the efficiency of each department is very important.

Most of study that about hospital efficiency are applied with DEA CCR mode, such as Nunamaker[2], Chilingirian and Sherman[3], Magnussen and Nyland[4], Zhang[5] and so on. As measured by the productivity of hospitals or physicians consider is the size of the hospital, the selection of variables, most of the total to choose a physician, the total number of beds, non-physician medical personnel the total number of variables as input variables; production the variable part is selected outpatient visits, hospitalization, surgery attendances variables.

2.2. The Inputs of Medical Organization

For measuring physician efficiency and effectiveness in providing hospital services, Chilingirian and Sherman[3] build a model with days of hospitalization as inputs. Magnussen and Nyland[4] explore the possibilities and limitations of obtaining and interpreting efficiency measurement on the level of the clinical department with a DEA model with total costs, overhead costs, clinical department cost, and ancillary costs as inputs. In Linna, Häkkinen, and Magnussen's study[6], cost efficiency in Finnish and Norwegian hospitals was compared using national discharge data and identical definitions for cost and output measures, and a DEA model with the net operating costs were used as input was used in the calculation of cost efficiency. Zhang[5] measuring the efficiency of Taiwan medical institutions with a model with medical fee and the number of dosing days as inputs in 1997.

Based on these studies, the inputs of DEA efficiency measuring model of out-patient services in this study are examination fee, drugs fee, and the number of dosing days, and the inputs of DEA efficiency measuring model of admission services in this study are examination fee, drugs fee, and days of hospitalization.

2.3. The Outputs of Medical Organization

Magnussen and Nyland[4] find that measured efficiency depends critically on the chosen model specification. Some department types, notably children's departments have systematically lower levels of measured efficiency with a DEA model with weighted discharges, weighted inpatients, weighted day care, and long term care as outputs. In Linna,

Häkkinen, and Magnussen's study[6], the results revealed marked differences in efficiency, in both within country and across country comparisons, with a DEA mode with admissions grouped according to diagnosis related groups (DRGs), outpatient visits, day care and inpatient days as output. Zhang[5] measuring the efficiency of Taiwan medical institutions with a model with treatment as inputs in 1997.

Based on these studies, the output of DEA efficiency measuring model of out-patient services and admission services in this study is treatment.

3. Methodology

The main methodology of this study was applied DEA for measuring the relative of clinic efficiency. DEA was a relatively new technique for measuring company efficiency using a frontier approach. The DEA technique supplements traditional approaches and provides more comprehensive insights into organizational performance. DEA was a powerful tool that can be utilized to analyze and improve company performance[7] and was being generally used generally as a tool for measuring the efficiency of various organizations[8, 9]. DEA thus represents a good tool for performance measurement.

DEA was a linear programming model devised by Charnes, Cooper and Rhodes[10]. It measures the efficiency, or productivity, for each member of a set of comparable producing units. Charnes, Cooper and Rhodes extended the approach of Farrell[11] to establish a model that broadened the single-input and single-output ratio measurement of efficiency of a single Decision Making Unit (DMU) into a multiple-input and multiple-output setting. Their extended model measures efficiency. DEA focuses on measuring the efficiency of DMUs. Meanwhile, efficiency represents an attempt to produce a given output with minimum inputs[12].

In the DEA approach, no particular structure was superimposed on the research data for identifying the efficient units[13]. Instead, a best-practice structure was empirically constructed by applying linear programming to inputs and outputs. Moreover, this feature also means that units with different configurations of inputs and outputs can be recognized as efficient in production process implementation. DEA determines the inefficiency of a particular unit by comparing it to efficient units with similar configurations. This arrangement contrasts with parametric techniques where a particular measure of inefficiency was associated with statistical averages that may or may not be applicable to the composition of that unit.

3.1. Efficiency Measuring Model Department of Obstetrics and Gynecology in Taiwan

The efficiency measuring model of out-patient services and admission services in this study is based on the study that Chilingirian built for measuring of physician productivity [14] and Zhang built for measuring the efficiency of Taiwan

medical institutions[5]. The efficiency measuring model of out-patient services is as Figure 1. The input items are examination fee, drugs fee, and the number of dosing days. The output item is treatment. The efficiency measuring model of admission services is as Figure 2. The input items are examination fee, drugs fee, and days of hospitalization, and the output item is treatment.

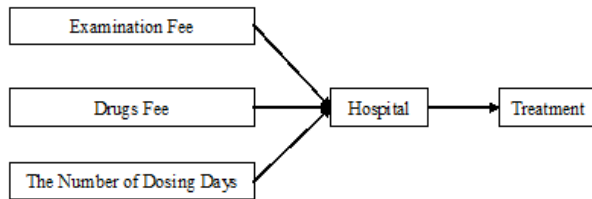


Figure 1. The efficiency measuring model of out-patient services

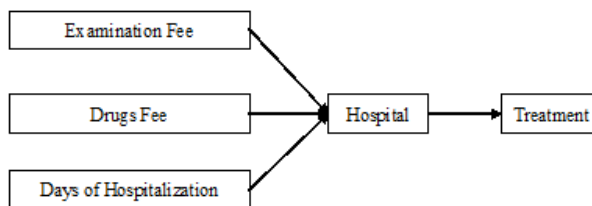


Figure 2. The efficiency measuring model of admission services

The National Health Insurance database does not provide relevant information on the quality of medical care, so the efficiency measuring model in this study didn't include the item of the quality of healthcare care item. For consider the efficiency of the diagnosis and treatment of medical institutions, rather than productivity, physician costs and partly by the examination fee, so the efficiency measuring model didn't include the number of physicians.

3.2. The Effective Variables of Clinic Efficiency

The aim of this study is to explore the efficiency score of department of obstetrics and gynecology of different types of medical institutions in Taiwan. There are five types of hospital in this study: public hospitals, university hospitals, army hospitals, private hospitals, and religious hospitals. Public hospitals include public medical center, public clinic, national hospital, county hospital, and veterans' hospital. University hospitals include public university hospital and private university hospital. Private hospitals include private

clinic, private hospital, and private medical center.

3.3. Research Data

The data set for the study was obtained from nationwide population-based databases obtained from the National Health Insurance (NHI) in Taiwan. The NHI files comprise comprehensive information on all medications prescribed to all insured individuals. This study is focus on both outpatient out-patient services and admission services 400000-people-sample databases from January 1, 2007 to December 31, 2007. There were 5151151 out-patient services records and 44717 admission services records inside it. For this study focus on the clinic efficiency of department of obstetrics and gynecology, it could be found 56689 out-patient services patients of department of obstetrics and gynecology and 3878 admission services patients of department of obstetrics and gynecology in this database.

The mandatory NHI program covers >99% (~23 million) of the Taiwanese population. Beneficiaries are free to choose among health care providers contracted with the NHI and receive comprehensive benefits that include inpatient care, ambulatory care, dental care, and prescription drugs.

4. Result

There are 262 clinic institutions with out-patient services and 172 clinic institutions with admission services in this study (as Table 1).

The descriptive statistics of the data of out-patient services are as Table 2. There are 262 clinic institutions with out-patient services in this study.

The descriptive statistics of the data of out-patient services are as Table 3. There are 172 clinics institutions with Out-patient services in this study.

Table 1. The Number of 5 Types of Hospital

	Out-patient services	Admission services
Public Hospitals	53	32
University Hospitals	12	10
Army Hospitals	13	9
Private Hospitals	174	114
Religious Hospitals	10	7
Total	262	172

Table 2. The Descriptive Statistics of The Data of Out-patient Services

	Examination Fee	Drugs Fee	The Number of Dosing Days	Treatment
N	262	262	262	262
Minimum	0	0	0	1
Maximum	405347	619303	17726	3255
Average	5140.33	30883.87	1797.78	368.73
S. E.	60503.581	29299.604	2367.592	464.699

Table 3. The Descriptive Statistics of The Data of Admission Services

	Examination Fee	Drugs Fee	Days of Hospitalization	Treatment
N	172	172	172	172
Minimum	681	35	1	1
Maximum	399458	863581	1065	135639.007
Average	28770.08	48552.18	84.35	132.233
S. E.	48085.331	135639.007	19.66	27.007

For checking the input items and output items follow the rule of isotonicity, this study check the input items and output items with Pearson relation analysis. The rule of isotonicity is more inputs with more outputs. It could be found that input items and output items are positively correlated. The result of correlation analysis of out-patient services is as Table 4, and the result of correlation analysis of admission services is as Table 5.

4.1. Efficiency Measuring

4.1.1. The Efficiency Measuring of Out-patient Services

The efficiency measuring model of out-patient services is as Figure 1. The inputs are examination fee, drugs fee, and the number of dosing days. The outputs is treatment. The 262 clinic institutions with out-patient services, 11 hospitals are efficiency hospital in department of obstetrics and gynecology. One efficiency hospital is public hospitals, and ten efficiency hospitals are private hospitals. (Table 6) The efficiency score is be measured with BCC output-oriented model.

The descriptive statistics of efficiency scores of

department of obstetrics and gynecology are as Table 7. The average of efficiency score of university hospitals (0.59) is better than others, and the average of efficiency score of army hospitals (0.33) is the last one.

4.1.2. The Efficiency Measuring of Admission Services

The efficiency measuring model of admission services is as Figure 2. The inputs are examination fee, drugs fee, and days of hospitalization. The output is treatment. The 172 clinic institutions with out-patient services, 15 hospitals are efficiency hospital in department of obstetrics and gynecology. One efficiency hospital is public hospitals, one efficiency hospital is university hospitals, one efficiency hospital is army hospitals, and twelve efficiency hospitals are private hospitals. (Table 8)

The descriptive statistics of efficiency scores of department of obstetrics and gynecology are as Table 9. The average of efficiency score of university hospitals (0.76) is better than others, and the average of efficiency score of army hospitals (0.59) is the last one.

Table 4. Correlation Analysis of Out-patient Services

	Examination Fee	Drugs Fee	The Number of Dosing Days	Treatment
Examination Fee	1	.685*	.850*	.979*
Drugs Fee		1	.811*	.685*
The Number of Dosing Days			1	.871*
Treatment				1

Note: * $\alpha \leq 0.05$

Table 5. Correlation Analysis of Admission Services

	Examination Fee	Drugs fee	Days of Hospitalization	Treatment
Examination fee	1	.819*	.996*	.971*
Drugs fee		1	.805*	.759*
Days of Hospitalization			1	.966*
Treatment				1

Note: * $\alpha \leq 0.05$

Table 6. The Efficiency and Inefficiency of Department of Obstetrics and Gynecology

	Public Hospitals	University Hospitals	Army Hospitals	Private Hospitals	Religious Hospitals
Efficiency	1	0	0	10	0
Inefficiency	52	12	13	164	10
Total	53	12	13	174	10

Table 7. The Descriptive Statistics of Efficiency Scores of Department of Obstetrics and Gynecology

	N	Minimum	Maximum	Average	S.E.
Public Hospital	53	0.06	1.00	0.35	0.03
University Hospital	12	0.23	0.82	0.59	0.05
Army Hospitals	13	0.19	0.60	0.33	0.03
Private Hospitals	174	0.04	1.00	0.47	0.02
Religious Hospitals	10	0.15	0.82	0.45	0.07

Table 8. The Efficiency and Inefficiency of Department of Obstetrics and Gynecology

	Public Hospitals	University Hospitals	Army Hospitals	Private Hospitals	Religious Hospitals
Efficiency	1	1	1	12	0
Inefficiency	31	9	8	102	7
Total	32	10	9	114	7

Table 9. The Descriptive Statistics of Efficiency scores of Department of Obstetrics and Gynecology

	N	Minimum	Maximum	Average	S.E.
Public Hospitals	32	0.26	1.00	0.64	0.03
University Hospitals	10	0.59	1.00	0.76	0.04
Army Hospitals	9	0.21	1.00	0.59	0.07
Private Hospitals	114	0.30	1.00	0.72	0.02
Religious Hospitals	7	0.58	0.94	0.70	0.05

Table 10. The Benchmark of Out-patient Services

ID	Type	Exam. Fee	Drugs Fee	Dosing Days	Treatment	Reference Times
BO01	Public H.	405347	234816	14987	3186	0
BO02	Private H.	321951	194115	10586	2652	85
BO03	Private H.	115891	37097	2726	1092	49
BO04	Private H.	144295	48551	2807	1221	21
BO05	Private H.	17454	7353	353	484	232
BO06	Private H.	337682	376439	17726	3255	71
BO07	Private H.	166992	29232	2153	1176	18
BO08	Private H.	133545	23543	1976	1020	28
BO09	Private H.	77722	9989	930	674	41
BO10	Private H.	274344	62076	4506	1834	10
BO11	Private H.	120220	74308	5337	1177	99

Table 11. The Benchmark of Admission Services

ID	Type	Exam. Fee	Drugs Fee	Days of Hosp.	Treatment	Reference Times
BA01	Private H.	23608	4303	78	26	16
BA02	Private H.	399458	851845	1065	232	21
BA03	Public H.	100720	34369	297	68	11
BA04	Private H.	7945	838	28	7	3
BA05	Private H.	6356	2321	19	9	103
BA06	University H.	804	233	1	1	14
BA07	Private H.	2043	421	6	3	48
BA08	Army H.	681	140	2	1	6
BA09	Private H.	908	35	3	1	3
BA10	Private H.	110331	475703	287	83	17
BA11	Private H.	35185	13409	113	43	99
BA12	Private H.	681	87	2	1	12
BA13	Private H.	227831	229029	620	134	17
BA14	Private H.	681	107	3	1	2
BA15	Private H.	32688	4483	110	34	16

Table 12. The Kruskal-Wallis Test Between Five Types of Hospitals

	The type of hospital					x ² -Value	P-Value
	Public Hospitals	University Hospitals	Army Hospitals	Private Hospitals	Religious Hospitals		
Out-patient services	53	12	13	174	10	15.64*	0.004
Admission service	32	10	9	114	7	12.27*	0.015

Note: * $\alpha \leq 0.05$

4.2. The Benchmark of Hospital with Department of Obstetrics and Gynecology

4.2.1. The Benchmark of Out-patient Services

The benchmark of hospital with department of obstetrics and gynecology are as Table 10, and their efficiency score are 1. The reference times of BO05 is maximum. It means most of hospital's efficiency score is generated by comparing with BO05, and most of inefficiency hospital can learn from it for more efficiency.

Based on these efficiency hospitals, it could be find the ideal examination fee is between 405347 and 17454, the ideal drugs fee is between 376439 and 7353, and the ideal number of dosing days is between 17726 and 353.

4.2.2. The Benchmark of Admission Services

The benchmark of hospital of admission services with department of obstetrics and gynecology are as Table 11, and their efficiency scores are 1. The reference times of BA05 is maximum. It means most of hospital's efficiency score is generated by comparing with BA05, and most of inefficiency hospital can learn from it for more efficiency.

Based on these efficiency hospitals, it could be find the ideal examination fee is between 399458 and 681, the ideal drugs fee is between 851845 and 35, and the ideal days of hospitalization is between 1065 and 1.

4.3. The type of Hospital and Efficiency Score

This study check relationship of the type of hospital and the efficiency score by the nonparametric tests of Kruskal-Wallis test. The efficiency score between different types of hospital are significantly different. (Table 12)

5. Discussion and Conclusions

The object of this study is detecting the optimum range of clinic charges with efficiency hospitals. The conclusion of this study can be provided the government and healthcare organization manager as the decision-making.

No matter out-patient services or admission services of the department of obstetrics and gynecology, the average of efficiency score of university hospitals are all better than other type of hospital (Table 7). University hospitals always play an important role in obstetrics and gynecology in Taiwan. The average of efficiency score of army hospitals are not as good as other type of hospital. The object of army hospital is the healthcare of soldiers, and the department of obstetrics and gynecology is not an important department for them.

The benchmark hospitals with department of obstetrics and gynecology are almost private hospitals. Those inefficiency hospitals can learn from these efficiency private hospitals in department of obstetrics and gynecology. Based on these efficiency hospitals, it could be find the ideal examination fee is fewer than 405347, the ideal drugs fee is

fewer than 376439, and the ideal number of dosing days is fewer than 17726. Based on these efficiency hospitals, it could be find the ideal examination fee is fewer than 399458, the ideal drugs fee is fewer than 851845, and the ideal days of hospitalization is fewer than 1065.

The efficiency scores of department of obstetrics and gynecology are significantly different in different types of hospital. For different type of hospitals' object, and the healthcare government should build different police for improve their efficiency. The operation of private hospitals are efficiency for more profit, it could be find that most benchmarks are private hospitals in out-patient services and admission services in this study. No matter public hospital or army hospital, they all poor in efficiency than other type of hospitals, and their owners all are government. The government should improve their efficiency with some strategy, such as Build, Operate, Transfer (BOT) or hire a private hospital managers as a consultant.

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