Study of In-Patient Cost Analysis using Hospital Database in Korea

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Abstract

This study is to figure out Influence factors on Admission costs, based on In-Patient Cost Analysis. The study reviewed German Cost Analysis Method, drew Cost analysis Method applicable to Korean hospitals, and then conducted Analysis of Variance (ANOVA) and Multiple Regression, to analyze what factors influenced Admission Costs. The empirical analysis has shown that the cost recovery level was influenced by 'Hospital visit days', 'Examination costs' and 'Physician costs' Especially the cost recovery level had a positive relationship with Examination cost rate and a negative relationship with Physician cost rate, which directly affected surgical units and medical units thus caused the imbalance of Cost recovery level between both units. In other words, surgical units cost recovery level was low, however medical units was relatively high. Therefore the improvement of Cost recovery system, based on the exact cost information is needed to solve the imbalance of cost recovery level.

Keywords: Hospital Cost; Cost Accounting System; Admission Cost; Cost Center

1. Introduction

The cost recovery method of Korean National Health Insurance for Physicians medical service basically stands on Fee for Services, and has gone through three big changes. When introducing Medical Insurance for the first time in 1977, it adopted Point System but it was changed to Amount System which is the system announcing each service cost, in 1981. And in 2001, Resource based Relative Value Scale (RBRVS) on the basis of Point for services and Conversion Factor was introduced, and has been continued until now.

Medical Insurance Fee system used when introducing was lack of objective bases, because it referred already customized or other countries fee. Moreover, it had been criticized that each service input cost was imbalanced.

Relative Value Scale (RBRVS) is based on Resource use for services. It is the way which can seek not only the differential of resources relative value but also the suitability of insurance fee, and it has a strong point to be able to guarantee more objective bases than the existing systems such as the Amount System, when measuring the value of service [1]. Korean Relative Value Scale accounts Resource use for services, on the basis of Physician workload, Medical service costs (Labor costs for Medical staffs, Material costs, Equipment costs, and risk grade.

Now it is under the circumstance that hospitals targeted cost analysis is very rare, even though Medical service suppliers are expressing their economic difficulties, caused by low recovery rate for insured Medical service costs. That's why this study is to review German cost accounting method, to produce Patient Cost Accounting Method with ABC cost analysis system applied, and then to present the difference between Patient cost and Cost recovery level, and Influence factors on Cost recovery level.

2. Theoretical Consideration

Generally speaking, Cost is the amount measuring tangible or intangible value which is given up spontaneously or by force, for the acquisition or the creation of economic value. And hospital cost is to express economic value of goods and services, consumed in the process of medical service for patients. The economic value includes not only direct medical service costs but also Assistant and Maintenance costs for supporting direct medical services. That is, Cost is the flow of economic value, used in the process of Hospital Management and Cost Accounting is to classify and to account Labor costs, Material costs and Maintenance costs and *etc..* by Cost unit, and then to sum up them by place occurred.

The reasons why Cost Accounting is needed in hospitals are as follows. First, it is to develop the reasonable fee for Health Insurance Policy. At the moment, Korean Fee is decided by 'RBRVS' and 'Conversion Factor' and is benchmarking SGR (Sustainable Growth Rate) of USA for its adjustment. However SGR model considers only the inflation rate for next year, compared to the base year on several macroeconomic indicators, and doesn't care about medical service needed resources. So the medical service suppliers are complaining about that the cost recovery doesn't work properly, and are continuously asking the reorganization of medical fee system. Second, it can improve the efficiency of hospital management by collecting cost information. It is possible to figure out resource input versus consumption by systematic cost accounting, furthermore to confirm detailed element status. These information will be very useful to allocate or reassign resources.

But for hospital cost accounting, it is difficult to choose the objects of cost, and even if it can choose, it is very difficult to apply them collectively because resource input kinds are various by object and the volume is not fixable [2]. In other words, not only hospital cost's allocation process is complicated, but also it's not easy to divide 'Common expenses' into each service. From the reason, studies of 'Hospital cost' are not many, moreover patient cost analysis with which this study is to deal, has not been studied at all.

European countries where hospital cost analysis is being studied lively, have tried to enhance the accuracy of cost accounting to maximize the merits of DRG [3]. They thought that the exact understanding of cost must be considered above all, for serving the effective and fair medical services. Under this understanding, many countries such as England, France, Germany and *etc..* have chosen standard hospitals, have collected Cost information regularly and have developed DRG system based on them.

In theory, Cost has to be allocated to all patients who are homogeneous medically and in cost-related [4-5]. In case of German where Patient cost accounting system is relatively well built up, all hospitals account Cost by cost-center depending on hospital accounting standards, which has been conducted initiatively by InEK (Institute for the Hospital Remuneration System). German's DRG Cost Matrix System structurizes cost items (Labor costs, Material costs and Infrastructure costs), cost-center group, and allocation scheme, being utilized for patient cost accounting [6].

Many european countries are using Cost data to develop DRG system. Among those countries, all hospitals of England, Portugal and Netherlands are building up mandatory cost-accounting system and annually reporting data from it to their governments. And some countries like Germany, France, Ireland and Sweden which don't take the system are in accordance with National costing guidelines. If taking a look into Cost allocation method of these countries, common expenses are allocated to each medical department by Direct cost allocation to patients (England, Estonia, Finland, Netherlands and Sweden), or Indirect cost allocation to patients (France and Germany). Those expenses which are allocated to each medical department are again allocated to each patient. And many countries except for Austria apply weighting statistics to Micro-costing accounting [7].

The first verification of Cost data is up to hospitals. The central government in case of England, Estonia and Netherlands, and local authorities in Austria and France do the second. Finland is exceptional. In Finland, Cost data is not supervised by the central government or local authority systematically, so hospitals take all responsibilities [8].

3. Analysis Method

3.1. Objects of Study

This study analyzed cost with German cost structure applied. The basic cost allocation method adopted complete cost allocation method which allocates total expenses for each in-patient who got service in cost-center. The basic data for Cost analysis are from 2010 data of a general hospital which manages with 'Activity-based cost analysis system' and the final Cost recovery rate was calculated by connecting 'Patient cost' to Health Insurance Medical Service cost data.

Also to calculate Patient cost, each expense data of Labor costs(doctors and medical staff costs differentiated) by cost-center group, Material costs, Equipment costs and Management costs was collected. Cost-center consisted of 136 units, and each cost-center included all occurred medical record data, regardless of the kinds of Insurer(National health insurance, Medicaid, Auto insurance, Worker's compensation insurance and General patients). As the result, 24,646 Patients medical fees were analyzed with excluding unstable data <Table 1>.

Table 1. Characteristics of the Objects of Analysis

Classification		Frequency(N)	Ratio(%)
Age	0	976	4.0
	Age 1-10	2,860	11.6
	Age 11-20	1,026	4.2
	Age 21-30	1,334	5.4
	Age 31-40	2,246	9.1
	Age 41-50	3,110	12.6
	Age 51-60	3,140	12.7
	Age 61-70	4,616	18.7
	More than 70	5,338	21.7
Gender	Male	12,514	50.8
	Female	12,132	49.2
Hospital visit days	1-15 days	21,012	85.3
	16-30 days	2,455	10.0
	31-45 days	560	2.3
	46-60 days	261	1.1
	61-75 days	191	0.8
	More than 75	167	0.7
Medical departments	Internal Medicine	8,957	36.3
	Neurology	879	3.6
	Psychiatrics	783	3.2
	General Surgery	1,462	5.9
	Orthopedics	2,386	9.7
	Neurosurgery	999	4.1
	Cardiothoracic Surgery	532	2.2
	Plastic Surgery	201	0.8
	Ob & Gy	795	3.2
	Pediatrics	3,590	14.6
	Ophthalmology	235	1.0

	Otolaryngology	957	3.9
	Urology	891	3.6
	Rehabilitation	298	1.2
	Family Medicine	973	3.9
	Emergency Medicine	574	2.3
	Other Assistant departments	134	0.5
Operation	Non-operation	19,016	77.2
	Operation	5,630	22.8
Emergency room visit	Non-use	15,971	64.8
	Use	8,675	35.2
Classification of DRG	Simple DRG	3,818	15.5
	General DRG	16,738	67.9
	Special DRG	4,090	16.6
Total Medical Costs (Korean Won)	Less than 510,000	5,658	23.0
	510,000-1,000,000	6,787	27.5
	1,010,000-1,500,000	3,439	14.0
	1,510,000-2,000,000	2,173	8.8
	2,010,000-2,500,000	1,286	5.2
	2,510,000-5,000,000	2,909	11.8
	More than 5,000,000	2,394	9.7
Total		24,646	100.0

4. The Process of Cost Analysis

4.1. Cost-center Setting

Cost center is the first aggregation unit of the occurred cost, and there's no consistent theory of Cost center setting method. Generally speaking, Cost center is decided by the scale, characteristics and the structure of an organization, and the more they are subdivided, the higher the efficiency of cost analysis goes. But the more expenses are also needed [9]. If cost centers are not many on the contrary, it is likely that inhomogeneous items are possible to be considered as one [10]. Expecting that the enough experience is able to cover such different views, this study derived Cost analysis model applicable to Korean circumstance, based on German cost analysis model.

4.2. The Classification of Cost Units

Cost units consist of 'Labor costs', 'Material costs' and 'Maintenance costs'. 'Labor costs' are related to the labor, required in the process of medical profit creation and cover all kinds of wage paid to all members. The most part of Hospital labor costs is paid to Physicians who give medical services and clinical human resources(medical technicians and *etc.*.). This study subdivided labor costs into Physicians, clinical human resources and their assistants.

'Material costs' are divided into separate compensation provided material costs(the costs which can be charged to insurer) and non-separate compensation provided material costs(the costs which can't be charged to insurer on account of that the cost is already included in medical service). Patient cost was aggregated when a separate compensation was done because the compensation was done on a basis of market price. For non-separate compensation provided material costs on the other hand, the total occurred amount for a year was allocated per Patient, by allocation scheme.

'Maintenance costs' include all expenses except for Labor costs and 'Material costs' among expenditures for Hospital's medical profit creation activity. 'Maintenance costs' were allocated by each cost center unit activity. However depreciation costs for medical

devices and Maintenance costs were treated as Direct costs, owing to their direct cost-like characteristics in this study.

4.3. In-Patient Cost Allocation

German cost accounting method was referred for In-patient cost allocation. 'In-patient room' costs were calculated by dividing total expenses from In-patients wards into the sum of all patients admission days(one patient cost), next by multiplying the sum and each patient's admission days.

For 'Operating rooms' and 'Anesthesia rooms', it applied Expenses per minute to a patient's operation time and anesthesia time. In case of 'Psycho theraphy rooms', 'Physical theraphy rooms' and 'Laboratories', the input resources depended on what kind of examinations were done, so the total Relative value scores(Relative value score $\times$ Annual examination numbers) by Examination were applied to Point cost accounting. And about Extracorporeal Shock Wave Liythoripsy(ESWL) rooms, the numbers of ESWL were accounted and the weight was applied; 100% for 1 time, 50% for 2-5 and 25% for over 6. 'Hemodialysis' rooms were calculated with Dialysis costs per minute, using the total dialysis time.

The In-patient cost unit allocation model is as <Table 2>. When setting up such an allocation scheme, The National Health Insurance data were used subsidiarily in case there were no direct data. The data such as Delivery numbers, Intensive Care Unit(ICU) Using days and the accumulated patient numbers for Emergency room were input as proxy variables, related to Delivery wards, Intensive Care Units and Emergency rooms. Besides, 80% of anesthesia time was accounted in case of non-accountable operation time, and Relative Value Score for ESWL rooms and the numbers of dialysis for Hemodialysis rooms were used as Scheme data.

Table 2. Model of Hospital Inpatient Cost Matrix

Cost Center Group	Cost Category	Labor costs		Material costs		Drugs costs	Equipment costs	Maintenance costs
		Physicians	Medical staff	Separate compensation	Include services			
Ward	Delivery ward	Actual time			Actual time		Actual time	Actual time
	Intensive care unit	Actual time			Actual time		Actual time	Actual time
	General Ward	Care days			Care days		Care days	Care days
	Emergency room	Actual time			Actual time		Actual time	Actual time
Operating rooms	Operating rooms	Operation time			Operation time		Operation time	Operation time
	Anesthesia (for operation)	Anesthesia time			Anesthesia time		Anesthesia time	Anesthesia time
Anesthesia (for treatment)		RBRVS Score			RBRVS Score		RBRVS Score	RBRVS Score
Radiology	SPECT, MRI, CT, X-Ray *etc.*	RBRVS Score		Actual usage cost	RBRVS Score	Actual usage cost	RBRVS Score	RBRVS Score
Sample Laboratories	Blood, Urine, Microorganism *etc.*	RBRVS Score			RBRVS Score		RBRVS Score	RBRVS Score
Functional Laboratories	Endoscope, ECG, EEG, Respiratory function *etc.*	RBRVS Score			RBRVS Score		RBRVS Score	RBRVS Score
Physical Theraphy / Psycho Theraphy		RBRVS Score			RBRVS Score		RBRVS Score	RBRVS Score
ESWL(Extracor-poreal Shock Wave Liythoripsy)		Number of ESWL			Number of ESWL		Number of ESWL	Number of ESWL
Hemodialysis		Hemodialysis time			Hemodialysis time		Hemodialysis time	Hemodialysis time
Pharmacy		RBRVS Score			RBRVS Score		RBRVS Score	RBRVS Score

5. The Results of Patient Cost Analysis

5.1. Cost per Unit

First of all, the allocation scheme score per cost unit was set up. Table 3 is the scheme for all patients no matter who the patients (National health insurance, Worker's compensation insurance, Medicaid and *etc.*) are and no matter what kind of services (Inpatient and Outpatient) are. For instance, 829,440 minutes of 'Operating room' include the operation time not only of National health insurance patients but also of Worker's compensation insurance and Medicaid patients, which accumulate all medical service time for In-patients and Out-patients. In addition to that, 204 scores of 'Laboratories' mean the total Relative Value scores of all examination services which Inpatients and

Outpatients were served for an year. But the data were excluded, if the separate compensation was done or the patient paid 100% of Medical material costs and Pharmaceutical costs.

Table 3. Allocation Scheme per Cost Unit

Cost Unit		Allocation Scheme	Total Costs (Korean Won)	Allocation Scheme Score
Ward	Delivery ward	Spontaneous Delivery Number	326,538,370	503 cases
	Emergency room	Accumulated Emergency Room Patient Number	5,425,116,136	18,191 Inpatients
	General Ward	Inpatient Days	22,317,986,183	285,555 days
	Intensive care unit	Intensive care unit Inpatient Days	5,138,447,775	18,628 days
Operating Rooms	Operating rooms	Operation Time	7,688,729,699	829,440 minutes
	Anesthesia(for operation)	Anesthesia Time	2,317,353,235	1,036,800 minutes
Anesthesia Rooms(For treatment)		RBRVS Score	310,031,385	3,169,751 points
Laboratories	Specimen/Function test	RBRVS Score	11,030,892,492	204,420,665 points
Radiology	Imaging test	RBRVS Score	10,209,681,745	154,486,358 points
Physical/Psycho Theraphy	Physical/Psycho Theraphy	RBRVS Score	2,355,732,091	34,486,403 points
ESWL(Extracor-poreal Shock Wave Liythoripsy)	ESWL	RBRVS Score	127,366,580	2,041,452 points
Hemodialysis	Hemodialysis	Hemodialysis Number	2,048,464,239	26,250 cases
Pharmacy	Medication preparation	RBRVS Score	3,075,921,969	12,777,902 points

5.2. The Difference between Cost Recovery Level (Medical Service Costs), Cost Level and Cost Recovery Rate

Table 4 shows In-patient characteristics difference between Cost recovery level and Cost level. Though both Cost recovery level and Cost level tended to increase as 'Age' went higher, Cost level was higher than Cost recovery level in all ages. The difference of Cost recovery level was most in 21~30 and gradually decreased from over 30. The highest Cost recovery rate group was the aged over 70.

The absolute Cost recovery level for women was lower than for men, but Cost level was higher on the contrary. Cost recovery rate was higher for men and the difference between two was meaningful statistically. As 'Admission days' got longer, the difference between Medical service costs and Cost level gradually increased except for 31-45 days. Cost recovery was highest for 31-45 days and lowest for 64-75 days.

For Medical departments, Cost recovery rate of Internal Medicine(99.8) and Family Medicine(103.8%) was satisfactory. Cost recovery level of all departments except for Family Medicine was below Cost level. Otolaryngology(69.8%), Emergency Medicine(72.1%) and Ob/Gy(73.2%) was especially low.

Related to 'Operation', the difference between Cost recovery level and Cost level was big when operating. The Operated group's Cost recovery rate was only 70%, while Non-Operated group'was over 93%. The Cost recovery rate when visiting Emergency room was a bit lower than when not visiting, this was meaningful statistically.

For Diagnosis related group(DRG), Cost recovery level and Cost level of Special DRG were absolutely high, compared to other DRGs(Simple DRG and General DRG). Cost recovery rate also was fine in Special DRG(94.3) than other DRGs(Simple DRG:82.5%, General DRG:87.7%). The severity of DRG was similar to DRG classification. The group with high severity had higher Cost recovery rate than the group with low. Especially the Cost recovery was 100% achieved in the group with grade 3 of severity.

It turned out that the more Medical service costs were, the bigger the difference between total Medical service costs and Cost level was, within 5,000,000 Korean Won of total Medical costs. The Cost recovery rate was more satisfactory as total Medical costs increased.

Table 4. Comparison between Medical Costs by Characteristics and Costs

Classification		Number of Patients	Mean (Korean Won)			Cost recovery rate (Mean±Standard deviation)	Statistic
			Medical costs(A)	Costs(B)	Difference (B-A)		
Age	0	976	610,419	761,289	150,870	80.1±13.4	F=281.29**
	1-10	2,860	668,863	799,069	130,207	81.8±18.1	
	11-20	1,026	1,153,071	1,424,177	271,106	80.3±21.8	
	21-30	1,334	1,193,442	1,543,225	349,783	78.7±22.9	
	31-40	2,246	1,487,182	1,809,901	322,719	81.5±26.6	
	41-50	3,110	1,927,975	2,223,434	295,459	84.9±21.8	
	51-60	3,140	2,231,995	2,474,775	242,781	89.2±20.8	
	61-70	4,616	2,696,897	2,892,350	195,453	92.8±19.2	
	More than 70	5,338	2,861,146	2,936,380	75,234	96.1±18.5	
Gender	Male	12,514	2,015,263	2,195,588	180,325	88.5±21.4	T=17.14**
	Female	12,132	1,989,051	2,213,059	224,008	87.4±21.1	
Hospital visit days	1-15 days	21,012	1,265,206	1,441,083	175,877	86.9±21.5	F=81.53**
	16-30 days	2,455	4,795,767	5,117,791	322,024	94.3±17.8	
	31-45 days	560	6,827,734	6,996,767	169,032	96.9±16.4	
	46-60 days	261	8,842,756	9,178,523	335,766	94.6±18.7	
	61-75 days	191	9,753,833	10,608,577	854,744	86.2±29.3	
	More than 75 days	167	17,949,532	18,803,504	853,972	92.3±23.4	
Medical departments	Internal Medicine	8,957	2,298,155	2,209,715	△88,441	99.8±15.2	F=591.94**
	Neurology	879	2,371,328	2,411,408	40,080	94.2±12.8	
	psychiatrics	783	1,972,069	2,230,084	258,014	87.6±13.7	
	General Surgery	1,462	2,123,656	2,588,742	465,086	78.7±16.9	
	Orthopedics	2,386	3,094,224	3,789,289	695,064	76.2±16.4	
	Neurosurgery	999	3,953,971	4,714,336	760,365	82.8±13.6	
	Cardiothoracic Surgery	532	1,769,876	2,099,688	329,812	79.2±29.2	
	Plastic Surgery	201	1,092,740	1,740,558	647,818	55.2±23.5	
	Ob&Gy	795	928,504	1,381,955	453,451	73.2±31.3	
	Pediatrics	3,590	577,182	680,004	102,822	83.6±15.5	

	ophthalmology	235	1,096,738	1,540,325	443,587	81.5±50.0	
	otolaryngology	957	992,482	1,556,298	563,816	69.8±29.1	
	Urology	891	1,306,660	1,867,429	560,769	74.5±20.3	
	Rehabilitation	298	6,098,281	6,952,146	853,865	84.8±24.3	
	Family Medicine	973	2,138,059	2,051,413	△86,646	103.8±4.3	
	Emergency Medicine	574	561,555	708,295	146,740	72.1±18.0	
Operation	Non-operation	19,016	1,690,166	1,720,076	29,911	93.0±19.5	T=5,646.85**
	Operation	5,630	3,056,834	3,839,334	782,500	71.1±18.1	
Emergency room visit	None visit	15,971	1,938,687	2,185,613	246,927	89.1±22.6	T=122.42**
	Visit	8,675	2,119,585	2,238,385	118,800	85.9±18.5	
Classification of DRG	Simple DRG	3,818	843,322	1,054,517	211,195	82.5±22.3	F=316.77**
	General DRG	16,738	2,026,467	2,236,780	210,313	87.7±21.4	
	Special DRG	4,090	2,985,663	3,144,022	158,359	94.3±18.2	
Total Medical costs (Korean Won)	Less than 510,000	5,658	366,559	534,078	167,519	77.2±23.2	F=528.01**
	510,000-1,000,000	6,787	724,788	904,132	179,344	85.8±20.5	
	1,010,000-1,500,000	3,439	1,230,652	1,423,338	192,686	90.6±18.7	
	1,510,000-2,000,000	2,173	1,745,122	1,985,258	240,136	92.7±19.2	
	2,010,000-2,5000,000	1,286	2,248,346	2,514,577	266,232	93.5±18.3	
	2,510,000-5,000,000	2,909	3,591,342	3,873,826	282,484	96.2±18.5	
	More than 5,000,000	2,394	8,769,460	8,961,876	192,417	98.7±15.7	
Total		24,646	2,002,360	2,204,188	201,828	88.0±21.3	

1) The reason why Medical costs and Costs of Rehabilitation is high is that Average Care days of Rehabilitation patients(51.4 days) are much more than those of other departments(9.0 days)

2) * p < 0.05, ** P < 0.01

5.3. Influence Factors on Cost Recovery Rate

To find out the influence factors on Cost recovery rate, the study executed multiple regression analysis, taking Cost recovery rate into Dependent variable, and taking In-patients Characteristics variables such as Gender, Age, Care days, Medical departments, Operation, Emergency room visit, DRG and the severity of DRG into Independent variables.

Medical departments were dummied on the basis of Psychiatry of which Cost recovery rate was most likely to approach the average Cost recovery rate of all Medical departments, and Emergency rooms and Operating rooms also were dummied by whether they were used or not. Moreover, The rate of 'Examination costs' and 'Physicians labor costs' was added because they were expected to influence much to Cost recovery rate.

As a consequence of multiple regression analysis, Cost recovery rate was influenced by Gender, Age, Medical departments, Emergency room visit, DRG, the severity of DRG, and the rate of Examination costs and Physicians labor costs. Among them, the rate of Examination costs and Physicians labor costs was most influential, and the Cost recovery rate went higher as Examination cost rate was high, and it went lower as Physicians labor cost rate was high<Table 5>.

Table 5. Influence Factor on Cost Recovery Rate

Independent variables	Non-standardized		Standardized regression coefficient	t-value	Significance probability
	Regression coefficient	Standard error			
gender (0=male)	0.006	0.002	0.012	2.620	0.009
Age	0.000	0.000	0.015	2.016	0.044
Hospital visit days§	0.076	0.002	0.261	47.889	0.000
Medical department (0=Psychiatry)					
Internal medicine	0.055	0.007	0.098	7.329	0.000
Neurology	-0.011	0.010	-0.008	-1.147	0.251
General Surgery	0.003	0.009	0.003	0.377	0.706
Orthopedics	0.018	0.009	0.019	2.044	0.041
Neurosurgery	-0.065	0.009	-0.048	-6.905	0.000
Cardiothoracic Surgery	0.084	0.012	0.041	7.279	0.000
Plastic Surgery	-0.129	0.019	-0.033	-6.811	0.000
Ob&Gy	-0.116	0.010	-0.077	-11.921	0.000
Pediatrics	0.009	0.008	0.012	1.123	0.262
ophthalmology	0.185	0.017	0.056	11.086	0.000
otolaryngology	0.021	0.010	0.013	2.099	0.036
Urology	-0.013	0.010	-0.009	-1.310	0.190
Rehabilitation	-0.132	0.013	-0.053	-10.060	0.000
Family Medicine	0.054	0.009	0.040	5.798	0.000
Emergency Medicine	-0.062	0.011	-0.035	-5.558	0.000
Other departments	0.073	0.018	0.020	4.117	0.000
Emergency room visit(0=None visit)	-0.056	0.004	-0.100	-15.561	0.000
Operation (0=None operation)	-0.002	0.006	-0.003	-0.374	0.708
DRG	0.012	0.002	0.025	4.831	0.000
Examination cost rate§	0.107	0.002	0.406	53.056	0.000
Physician cost rate§	-0.192	0.006	-0.277	-30.097	0.000
(constant)	-0.461	0.017		-27.756	0.000

1) F=1,087.50, df=23,837, p=0.000, R^2=53.3%

2) §: Hospital visit days and the rate of Examination costs and Physician costs are log converted values.

6. Consideration and Conclusion

This study analyzed In-patient costs in order to figure out Influence factors on Admission costs. The methods of resource use measurement can be classified into Bottom-up or Top-down, and Macro-costing or Micro-costing. That which method will be used is decided by the accuracy and the effectiveness of Cost accounting [11-13].

This study referred GDRG Cost analysis method which German InEK is carrying out, to calculate the accurate and efficient 'Patient cost'. Cost-centers were consisted of 10 and each cost-center was classified with Physician costs, Medical staff costs, Material costs, Equipment costs and Maintenance costs.

When taking a look at Cost recovery rate by In-patient characteristics, it was high in the aged and for women. Also the longer admission days were, the lower Cost recovery rate got, which means that hospital benefits can be decreased if admission days go longer.

Cost recovery rate was finer when DRG and its severity were in more serious situation. Cost recovery of special DRG or the group with high severity was carried out better comparing to opposite groups, so it is expected that the possibility to reduce Medical service for the patients with high severity is low. However, the opposite interpretation is also possible. Provided that the patients are in General group or with low severity, it is possible for hospitals to decrease their services appealing their difficulties of benefit conservation. It may cause low Medical service quality and unintended health inequality.

Related to Medical departments, Cost recovery rate was low for Surgical units and high for Medical units. The problem was that Surgical units had high physician cost rate but Medical units had high examination cost rate. Also it can't be separated from social problems such as poor management due to the excessive physicians' labor costs, or such as the increasing examination cost abuse to cover up the insufficient medical benefit. This was confirmed in regression analysis in which the influence factors on Cost recovery rate were reviewed. The analysis showed that admission days, and the rate of examination costs and physicians'labor costs were very important influence factors on Cost recovery level. By the result of actual proof analysis, the cost recovery rate had a positive relationship with Examination costs and a negative relationship with physician costs.

This study is meaningful because it is an analysis connecting Health insurance claim data with Cost data for the first time in Korea. But it also has a few limits. First, the data for Cost analysis came from not many medical centers but a general hospital. Especially, the analysis input patients were only 24,646 who occupied only 0.87% of total general hospitals'health insurance admission numbers in 2010. For the reason, it is difficult for Patient costs built up in this study to have representativeness.

Second, it didn't include the costs of special wards(Isolation ward, Sterile treatment room and Neonatal unit) which take up the most part among admission costs, when setting up Cost-center unit. But there are the same limits in Germany where Cost analysis is very developed. Germany also calculates costs for only 3 units; General wards, Intensive care units and Delivery wards, and has been trying to improve Patient cost analysis method to make up for such a kind of problem for a long time.

Third, an hospital's uninsured benefits were not included in Cost recovery rate analysis, though 21.0% of Korea's total medical expenditure was uninsured in 2010[14]. That's because it's possible to calculate the total uninsured medical expenditures, but still difficult to calculate each patient's. If the data of uninsured medical expenditure is included, it is expected that the cost recovery rate will go up considerably.

It will help build up the reasonable medical insurance fee system, if Cost analysis for Out-patients is done, with making up for such limits. Moreover, plans for the objective data securing, well organized Cost analysis system and the accumulated data building up, based on advanced countries' experiences should be completed. Especially the government ought to set up the supporting system for medical service suppliers to intend to do those things.

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