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Analysis of the Effectiveness of Medical Aid Case Management Program

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Chapter

01

Introduction

Chapter 1

Introduction

A government medical aid insurance program was instituted for low income citizens in 1977 when South Korea introduced mandatory social health insurance for industrial workers, and the program has provided medical services needed for maintaining a healthy life. While a medical aid program provided institutional support for the low-income bracket of the population to receive minimum medical services at the right time, the level of satisfaction of beneficiaries with the services and their health level are still assumed to be low. Also, the program has made contributions to meeting the medical needs of the poor, but financial burden to the government's health budget due to excessive use of medical care by some clients has become a social issue.

To tackle such problems, the Korean government puts in place the medical aid manager program, which provides health helpers for clients in 2003. Case management is mainly intended to help recipients suffering multiple problems such as disease and poverty improve their self-care competency through consultation with case managers. The program also aims to induce recipients who seek excessive medical care to properly use medical services through consultation.

Therefore, it is necessary to analyze the program whether it is being implemented as it was intended after a certain period of time and find better ways to develop the program in the

future based on the analysis.

This paper aims to measure the effectiveness of medical aid case manager program from both macroscopic and microscopic point of view in terms of improvement of health, financial expenditure, and proper use of medical care.

Chapter

02

Content and Method of Research

Chapter 2

Content and Method of Research

This paper studied general theories of effectiveness evaluation in order to measure the effectiveness of case management program.

Based on the theoretical review, macroscopic analysis was conducted to find out what impacts case management program has on medical aid budget. Then, from microscopic point of view, behavior of the clients of case management before and after intervention was analyzed in relation to the purpose of the program.

Methods of research used for this study included reviews of related domestic and international literature, and collection of opinions from a task force composed of experts in medical aid and health insurance, government officials and employees, the National Health Insurance Corporation, the Health Insurance Review & Assessment Service, medical organizations, civic groups, and medical aid case managers.

Chapter

03

Theoretical Study of Effectiveness Evaluation

Chapter 3

Theoretical Study of Effectiveness Evaluation

1. Measurement of effectiveness using logic model

Basic principle for identifying effectiveness analysis indicators for any project is to enhance values in the future and the details can be summarized as follows: First, effectiveness analysis indicators should be related to the goal of organization; Second, they should reflect major activities of the members of organization; Third, issues that are not related to the operations of organization should be excluded; Fourth, effectiveness analysis indicators should be reasonable and objective; Fifth, indicators can be easily understood by the members of organization, which means that indicators should be quantifiable; Sixth, indicators should not be conflicted, which means that correlated indicators should be excluded; Seventh, indicators can be reflected in performance evaluation and compensation, which emphasizes that indicators for effectiveness analysis should be reflected in preformance evaluation in principle; Eighth, a set of indicators should balance long-term and short-term aspects of effectiveness.

With these principles in mind, this study will apply two types of models that are relevant to effectiveness analysis and indicator development to examine major indicators for each process. First

model for designing indicators is logic model. Input-process-output-performance of this model is summarized in <Table 3-1>. When the elements of case management program is divided into categories, input, activities and results, and performance. Major indicators for consideration are as follows:

〈Table 3-1〉 Effectiveness Evaluation Indicators Using Logic Model

Category	Variable		Specific indicator
Input	Manpower		· Labor cost of medical aid case managers
	Budget		· Operational cost of program
Activity and output	Number of counseling		· Number of counseling per case manager
	Number of recipients of case management		· Number of recipients of case management compared to annual target
Performance	Cost	Stabilization of medical aid finance (excessive use of medical care)	· Year-on-year variation in medical expenses
			· Emergency visit rate compared to pre-case management
			· Hospitalization rate compared to pre-case management
			· Variation in medication cost compared to pre-case management
			· Rehospitalization rate within 30 days after being discharged
			· Rate of outpatient visits compared to pre-case management
			· Variation in the number of medical care shoppers
	Quality of service	Encouragement of rational use of medical care	· Selection rate of family doctor
			· Selection rate of regular pharmacist
			· Decrease rate of medical institution usage
			· Variation in duplicate use of same ingredient drugs
			· Variation in use of medicines that are not advised to take together
		Clinical effectiveness	· Rate of controlling HbA1C (diabetic patient) blood sugar
			· Rate of controlling blood pressure (hypertension patient)
		Improvement of self-care competency	· Improvement rate of subjective health status
			· Improvement rate of activity in daily living

Category	Variable		Specific indicator
			· Decrease rate of pain
			· Decrease rate of depression
			· Rate of controlling symptoms and condition
			· Drinking rate
			· Smoking rate
			· Rate of physical exercise
			· Rate of regular blood pressure check (hypertension patient)
			· Regular blood sugar check (diabetic patient)
		Improvement of health quality of life	· Rate of improvement in quality of life
		Building support system	· Utilization rate of social resource
		Satisfaction rate	· Satisfaction rate of case management
	Accessibility	Proper use of medical care (deficient use of medical care)	· Appropriate rate of outpatient visit (apply after setting appropriate number of days of outpatient visit)
			· Appropriate rate of number of days of medication (apply after setting the appropriate number of days of medication)

2. Measurement of effectiveness using BSC model

The other model is BSC (Balanced Score Card). This model asserted that financial indicators of the existing accounting systems focused mainly on profit and cost of the current term and failed to reflect long-term aspects of organizations. The characteristic of BSC is the presentation of a mixture of financial and non-financial measures that utilize customer, internal business process (internal innovation), and learning and growth for developing indicators. Major indicators derived from BSC model are categorized into finance, customer, internal process, and

learning & growth as in <Table 3-2>.

〈Table 3-2〉 Effectiveness Evaluation Indicators Using BCS Model

Finance	Customer	Internal process	Learning & growth
· Year-on-year variation in medical expenses · Rate of emergency visits compared to pre-case management · Hospitalization rate compared to pre-case management · Variation in medication cost compared to pre-case management · Rehospitalization rate within 30 days after being discharged · Rate of outpatient visits compared to pre-case management · Variation in the number of medical care shoppers	· Selection rate of family doctor · Selection rate of regular pharmacist · Decrease in rate of use of medical institution · Variation in duplicate use of same ingredient drugs · Variations in use of medicines that are not advised to take together · Rate of controlling HbA1C (diabetic patient) blood sugar · Rate of controlling hypertension (hypertension patient) · Improvement rate of subjective health status · Improvement rate in activity for daily living · Decrease rate of pain · Decrease rate of depression · Rate of controlling symptom and condition · Drinking rate · Smoking rate · Rate of physical exercise · Rate of regular blood pressure check (hypertension patient) · Rate of regular blood sugar check (diabetic patient) · Improvement in rate of quality of life · Utilization rate of social resources	· Number of counseling per case manager · Number of recipients of case management compared to annual target	· Improvement of awareness of recipient of case management · Satisfaction rate of case management

Chapter

04

Measuring the Effectiveness of Medical Aid Case Management

Chapter 4

Measuring the Effectiveness of Medical Aid Case Management

Logic model and BSC model have each their merits. Logic model specifies major components of a program and performance measures for meeting the goals of medical aid case management program such as improvement in quality of service, quality of service, and accessibility, while BSC model focuses on financial performance and also shows performance indicators for realizing satisfaction of beneficiaries from customer's point of view, for improving the performance of medical aid case managers from the perspective of internal process, and for ensuring future growth and survival from the perspective of learning and growth. However, BSC model lacks performance measurement indicators that need to be managed in the future from the perspective of learning and growth.

Theoretical review showed that short-term, mid-term, and long-term performance can be taken into account for designing effectiveness measurement indicators. In addition, short-term performance identifies change of awareness rather than final outcome, mid-term shows change of behavior derived from change of awareness, and long-term suggests ultimate goals that should be met through a project. Most effectiveness measurement indicators, however, do not clearly divide short-term and long-term performance and have difficulty measuring effectiveness.

This paper focuses on long-term effectiveness measurement, thus sets the ultimate goals of medical aid case management as improvement of health, efficient management of fiscal expenditure, encouragement of proper use of medical care, and improvement of customer satisfaction. Macroscopic budget impact analysis was conducted on the introduction of medical aid case management first. And then, available indicators for each category in relation to the aforementioned 4 ultimate goals were used to analyze how the behavior of the recipient of case management from the microscopic point of view.

1. Macroscopic budget impact analysis

(1) Overview and method of analysis

Budget impact analysis was conducted on medical aid case management, co-payments, and designation of primary clinic in medical aid program. First of all, in order to analyze financial effects of the introduction of case management program, medical expenditure was estimated on the assumption that the program was not in place, which was in fact put into effect in May 2003. Second step was to compare the estimated amount with the actual expenditure for analyzing what impact the case management program has had on the financial expenditure of Korea's medical aid up until 2010. Third, the same method of analysis was applied to the budget impact of co-payments and designation of primary clinic, which were introduced in July 2007. Medical expenditure was estimated on the assumption that designation of primary

clinic was not in place, which was in fact introduced in July 2007 and the estimation was compared with the actual expenditure. Lastly, estimated financial expenditures of case management program, co-payments, and designation of primary clinic before and after the introduction of the programs were compared so that the difference was translated as cost reduction effect.

For a more detailed budget impact analysis, the number of recipients and medical cost by class was used to calculate the average monthly medical cost per medical aid recipient as follows:

Total monthly medical cost of medical aid = Number of monthly beneficiaries by class × Monthly medical cost by class per person

The calculated average monthly medical cost per person was used to estimate monthly medical cost per person until December 2010 when the change in system has not been in effect yet. As for case management program, data from January 2001 to April 2003 was applied to estimate monthly medical cost per person until December 2010 and data from January 2001 to June 2007 was used to calculate monthly medical cost per person until December 2010 for designation of primary clinic. In addition, for analysis of cost reduction effect of case management program, estimated medical cost for 2010 based on data from January 2001 to April 2003 was compared with that from January 2001 to June 2007.

(2) Designing model

As mentioned in overview and method of analysis, estimation was classified into class 1 and 2 beneficiaries, and recipients of other benefit in order to accurately reflect change in medical cost by class, and potential welfare recipients who lost medical aid eligibility and was transferred to health insurance system until December 2010 were excluded.

Applied estimation model was the ARIMA (Integrated Autoregressive Moving Average) analysis model, which is used to explain the statistical characteristics of the movement of time series variables on the assumption that a current value is dependent on the past values of the same variable for forecasting the future values of the variable. In order to verify the stationarity of time series data, Dickey-Fuller unit root test was carried out. Unit root test on the medical cost of class 1 & 2 medical aid beneficiaries and recipients of other benefit showed evidence of non-stationarity, so an initial differencing step was applied to remove the non-stationarity.

$$(1-\phi_1 L-\cdots \phi_p L^p)(1-L)^d Y_t = (1+\theta_1 L+\cdots+\theta_q L^q)\epsilon_t$$

Then, to find the best ARMA(p, q) of Y_t, the BOX-Jenkins methodology, which uses sample autocorrelation (AC) and sample partial autocorrelation (PAC) function, Akaike (AIC), and Schwartz (SBC) were applied as in <Table 4-1>:

〈Table 4-1〉 Selection of ARIMA(p,d,q)

	AR(p)	MA(q)	I(d)	ARIMA
Class 1 (after introduction of case management program)	1	0	1	(1,1,0)
Class 1 (after introduction of designation of primary clinic)	1	0	1	(1,1,0)
Class 2 (after introduction of case management program)	1	0	1	(1,1,0)
Class 2 (after introduction of designation of primary clinic)	2	0	1	(2,1,0)
Other laws (after introduction of case management program)	2	0	1	(2,1,0)
Other laws (after introduction of designation of primary clinic)	2	0	1	(2,1,0)

(3) Result of analysis

As mentioned above, medical expenditures were estimated on the assumption that case management program, co-payments, and designation of primary clinic were not in place for any class of recipients. The results of estimation for recipients of class 1 & 2 medical aid and other benefit proved that new programs had impact on cost reduction except for effect of designation of primary clinic in 2009 as in <Table 4-2> below. Cost reduction effect of case management program was not so remarkable at first, but was gradually improved to reach the highest point in 2007 and 2008. The figure decreased a little bit in 2009 and

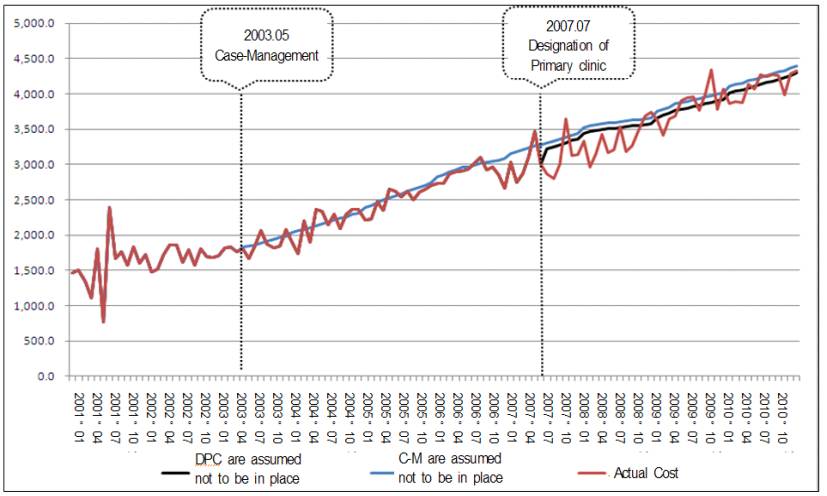
stood at about 140 billion won in 2010. Effect of designation of primary clinic and co-payments, which were introduced in 2007, was remarkable in the early days as predicted but the cost savings decreased gradually and have been very slight after 2009. If we set the cost reduction impact of case management program apart from the others, the program was estimated to save about 120 billion won after 2010, proving that its outcome was very positive.

〈Table 4-2〉 Estimated Medical Expenditures for Total Recipients

(Unit: 100 million Won)

	Actual data(①)	Case management not in place(②)	Designation of primary clinic not in place(③)	Effects of case management program ②-①	Effects of designation of primary clinic ③-①
2001	18,829	18,829	18,829	-	-
2002	20,312	20,312	20,312	-	-
2003	22,149	22,352	22,149	203	-
2004	26,004	26,059	26,004	55	-
2005	30,162	30,824	30,162	662	-
2006	34,592	35,661	34,592	1,069	-
2007	36,807	39,560	38,003	2,753	1,197
2008	40,165	43,210	42,217	3,045	2,052
2009	46,143	46,765	45,673	622	-470
2010	49,496	50,967	49,757	1,471	261

〔Figure 4-1〕 Comparison between Estimated Monthly Medical Cost (case management and designation of primary clinic are assumed not to be in place) and Actual Cost



Note: DPC is designation of primary clinic. C-M is case management.

2. Microscopic budget impact analysis

Recipients of medical aid are selected through certain criteria, so they may show specific sociodemographic characteristics and behavior of using medical aid. That is why it is difficult to set similar independent groups. If we set independent groups without taking such characteristics into consideration, this may lead to over-estimation of increase rate of medical expenditure as compared to that of other independent groups.

In order to verify the effectiveness of medical aid case management program, time-series design was utilized to analyze actual payments for medical aid (number of days covered by

medical aid). Time-series design model is a semi-experimental model that measures a sequence of data points at successive time instants for identifying trends and changes, and compares trends before and after input of a program to determine its effectiveness. Also, what is good about the model is that it is possible to adjust time points of intervention and set independent internal groups by dividing experiment groups.

Data from the National Health Insurance Corporation from 2007 to 2010 was used for analysis. This includes about 40 million cases of payments for recipients of case management in 2010. Recipients were grouped into those who had been covered by case management program from 2009 and those who entered into the program in 2010, and change before and after the intervention of medical aid case management program.

Change of the average quarterly medical aid expenditure per person for the users of medical aid case management from 2009 is as follows:

In the 4th quarter of 2007, the average per capita medical aid cost increased about 6.9% to reach 1,191,877 won compared to the previous quarter. The figure steadily increased until the second quarter of 2009, but the rate of increase slowed down after the 3rd quarter when 6 months passed after the introduction of medical aid case management. However, medical aid expenditure started to decline in the 4th quarter of 2009. Average per capita medical aid expenditure slightly increased in the 2nd quarter of 2010, but it decreased in the next quarter. When compared with the trend of recipients of case management in 2010, such trend clearly proves the effectiveness of the program.

While the average per capita medical aid expenditure of the users of case management from 2009 had been on the decrease, that of the users from 2010 was on the rise. After intervention of the program in 2010, increase rate of the 2nd quarter dropped slightly from 14.8% to 8.5%, and quarter-to-quarter medical aid expenditure declined in the 3rd quarter. The differences in average per capita expenditure between time points and groups were statistically meaningful.

Trends in the quarterly expenditures of the recipients of medical aid case management are given in [Figure 4-2] below:

〈Table 4-3〉 Variations in Average Quarterly Medical Aid Expenditure per Person

(Unit: Won, rate)

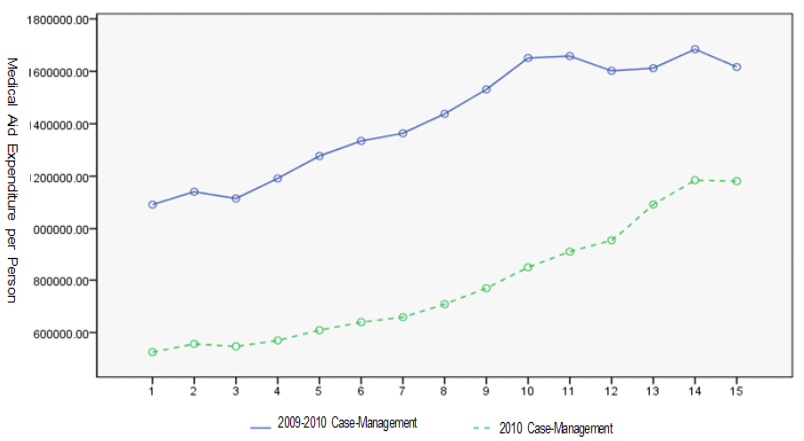
	2009 - 2010 recipients of case management		2010 recipients of case management		Total	
	Mean(SD)	Change	Mean(SD)	Change	Mean(SD)	Change
1Q 2007	1,091,819.9 (1,664,639.7)	-	525,489.0 (1,213,588.9)	-	623,854.3 (1,320,720.6)	-
2Q 2007	1,140,810.0 (1,564,857.0)	4.5	556,661.2 (1,265,207.7)	5.9	658,121.3 (1,340,523.8)	5.5 3Q
3Q 2007	1,115,167.5 (1,685,450.3)	-2.2	547,094.1 (1,305,224.6)	-1.7	645,762.1 (1,395,499.4)	-1.9
4Q 2007	1,191,877.8 (1,696,374.6)	6.9	570,155.9 (1,314,196.1)	4.2	678,142.1 (1,407,982.5)	5.0
1Q 2008	1,277,150.9 (1,837,689.9)	7.2	609,110.2 (1,491,247.6)	6.8	725,141.4 (1,577,391.7)	6.9
2Q 2008	1,334,620.3 (1,910,904.2)	4.5	639,757.5 (1,511,827.5)	5.0	760,447.4 (1,610,014.7)	4.9
3Q 2008	1,363,860.4 (1,792,566.3)	2.2	658,696.4 (1,471,308.8)	3.0	781,175.5 (1,555,062.6)	2.7
4Q 2008	1,437,834.2 (1,894,030.6)	5.4	708,314.4 (1,553,149.5)	7.5	835,023.9 (1,640,955.3)	6.9
1Q 2009	1,531,091.2 (1,884,865.8)	6.5	769,171.5 (1,639,247.9)	8.6	901,508.4 (1,709,027.3)	8.0

	2009 - 2010 recipients of case management		2010 recipients of case management		Total	
	Mean(SD)	Change	Mean(SD)	Change	Mean(SD)	Change
2Q 2009	1,650,736.9 (2,182,727.6)	7.8	848,948.7 (1,773,062.3)	10.4	988,210.4 (1,875,489.4)	9.6
3Q 2009	1,658,111.5 (2,204,692.4)	0.4	908,548.7 (1,919,431.2)	7.0	1,038,739.4 (1,992,275.8)	5.1
4Q 2009	1,601,936.1 (2,230,309.3)	-3.4	951,868.5 (1,968,004.9)	4.8	1,064,778.0 (2,030,994.5)	2.5
1Q 2010	1,611,957.8 (2,193,756.0)	0.6	1,092,396.5 (3,388,623.4)	14.8	1,182,638.5 (3,219,151.6)	11.1
2Q 2010	1,684,200.0 (2,302,821.5)	4.5	1,184,725.4 (2,579,260.6)	8.5	1,271,478.6 (2,540,462.2)	7.5
3Q 2010	1,616,378.0 (2,204,250.8)	-4.0	1,181,077.7 (2,536,046.4)	-0.3	1,256,684.5 (2,487,070.1)	-1.2
# of case	30,180		143,579		173,759	

Note: 1: F value between time points: 1913.143***, F value between groups: 7810.988***

2: * <.05, **<.01 ***<.001

〔Figure 4-2〕 Variations in Average Quarterly Medical Aid Expenditure per Person



Note 1: Q 1: 1Q of 2007 Q 5: 1Q of 2008 Q9: 1Q of 2009 Q15: 3Q of 2010

2: 2009~2010 means case management users for the 2 years. 2010 means case management users for 1 year.

Trends in the average quarterly number of days per person covered by medical aid for the 2009 users of case management are similar to that of their average per capita medical aid expenditure. The number of case management users had been on the steady increase from the 4th quarter of 2007, but the increase rate dropped from the 3rd quarter of 2009 when the medical aid case management came into effect. The number of days covered by medical aid decreased compared to the previous quarter from the 4th quarter of 2009. The number of days covered by medical aid of the 2010 users of case management had been increased steadily from the 4th quarter of 2007. The increase rate was somewhat decreased in the 4th quarter of 2009 and the 1st quarter of 2010, but the rate rose again from the 2nd quarter. When the 2009 users are compared to the 2010 users, quarter-to-quarter number of days covered by medical aid for the 2009 users decreased in the 1st quarter of 2010 while that for the 2010 users increased slightly. The figure increased higher for the 2010 users than for the 2009 users. Difference in average per capita number of days covered by medical aid by time point and group was statistically meaningful.

Trends in quarterly number of days covered by medical aid case management are shown in [Figure 4-3].

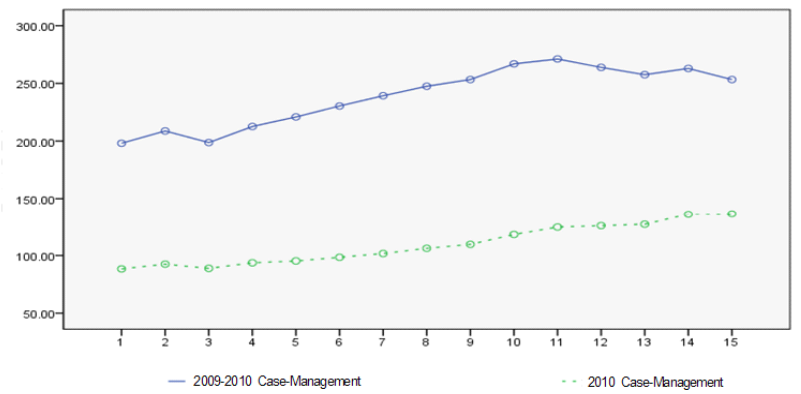
〈Table 4-4〉 Variations in Average Quarterly Number of Days Covered by Medical Aid per Person (days of hospitalization&outpatient visits+days of medication)

(Unit: day, rate)

	2009 - 2010 recipient of case management		2010 recipient of case management		Total	
	Mean(SD)	Change	Mean(SD)	Change	Mean(SD)	Change
1Q 2007	198.1 (143.8)	-	88.4 (98.7)	-	107.4 (115.6)	-
2Q 2007	208.7 (147.2)	5.4	92.5 (101.6)	4.7	112.7 (119.3)	4.9
3Q 2007기	198.7 (129.6)	-4.8	88.8 (95.6)	-4.0	107.9 (110.5)	-4.2
4Q 2007	212.6 (138.6)	7.0	93.7 (98.8)	5.5	114.3 (115.9)	6.0
1Q 2008	220.9 (139.0)	3.9	95.2 (98.4)	1.7	117.1 (116.7)	2.4
2Q 2008	230.4 (139.2)	4.3	98.4 (101.0)	3.3	121.3 (119.5)	3.6
3Q 2008	239.3 (142.8)	3.9	101.7 (103.9)	3.3	125.6 (123.2)	3.5
4Q 2008	247.5 (144.8)	3.4	106.2 (107.1)	4.4	130.7 (126.4)	4.1
1Q 2009	253.3 (143.0)	2.4	109.7 (110.4)	3.3	134.6 (128.8)	3.0
2Q 2009	266.9 (147.2)	5.4	118.3 (117.2)	7.9	144.1 (135.2)	7.0
3Q 2009	271.1 (148.8)	1.6	124.7 (122.8)	5.4	150.1 (139.2)	4.2
4Q 2009	263.9 (146.2)	-2.7	125.9 (120.7)	1.0	149.9 (136.0)	-0.2
1Q 2010	257.5 (146.1)	-2.4	127.2 (118.7)	1.0	149.8 (133.4)	-0.1
2Q 2010	262.9 (148.6)	2.1	136.0 (121.7)	7.0	158.1 (135.6)	5.5
3Q 2010	253.3 (145.9)	-3.6	136.5 (119.7)	0.3	156.8 (132.3)	-0.8
# of case	30,180		143,579		173,759	

Note: 1: F value between time points: 10753.98 ***, F value between groups: 42868.578***
2: * <.05, **<.01 ***<.001

[Figure 4-3] Changes in Average Quarterly Number of Days Covered by Medical Aid per Person (number of outpatient visits+number of days of medication)



Note: 1: Vertical axis represents number of days covered by medical aid (days of hospitalization & outpatient visits+days of medication),
2: Horizontal axis Q 1: 1Q 2007~ Q 5: 1Q 2008 Q 9: 1Q 2009 ~ Q 15: 3Q 2010
3: 2009~2010 means case management users for the 2 years. 2010 means case management users for 1 year.

Variations in medical aid expenditure for case management users were divided into each class. The average per capita medical aid expenditure for the 2009 case management users for class 1 had steadily risen since the 4th quarter of 2007, but the figure increased a mere 0.4% from the previous quarter in the 3rd quarter 2009 when case management program was applied, and dropped 3.5% in the 4th quarter. The same was true for class 2 recipients. Their increase rate started to fall from the 3rd quarter of 2009 and the average per capita medical aid expenditure also decreased. The effectiveness of case management can be verified

when the figures are compared with those of the 2010 users. The average per capita medical aid expenditure of the 2010 class 1 recipients rose 6.7% and 4.4% for the 3rd quarter and 4th quarter of 2009 respectively. While that of the class 2 recipients increased 9.3% and 7.4% respectively, that of the 2009 users 1 fell 3.5% for class 1 and 2% for class 2 in the 4th quarter of 2009. The figures changed more rapidly in the 1st quarter of 2010. The 2009 users showed a 0.9% increase for class 1 and a 2.1% decrease for class 2 while the 2010 users represented a 15.2% and 12.3% increase. But quarter-to-quarter medical aid expenditure of the 2010 users slightly fell from the 3rd quarter when the effects of case management program can be felt. Difference in average per capita medical cost by time point, type of medical aid, and group was statistically meaningful.

Variation in average quarterly per capita medical expenditure by type of medical aid is in [Figure 4-4].

〈Table 4-5〉 Variations in Average Quarterly Per Capita Medical Expenditure by Type of Medical Aid

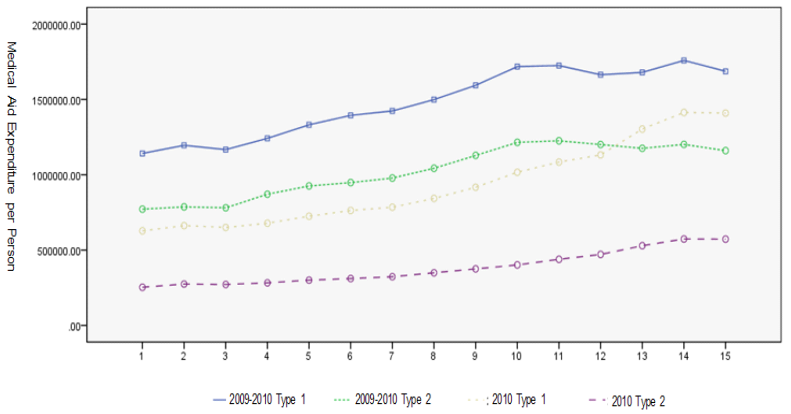
(Unit: won, rate)

	2009 - 2010 recipient of case management - Class 1		2010 recipient of case management - Class 1		2009 - 2010 recipient of case management - Class 2		2010 recipient of case management- Class		Total	
	Mean (SD)	Change	Mean (SD)	Class	Mean (SD)	Class	Mean (SD)	Class	Mean (SD)	Class
1Q 2007	1,141,270.0 (1,715,666.8)	-	627,491.1 (1,332,832.7)	-	771,520.1 (1,239,212.2)	-	252,869.9 (748,070.6)	-	623,877.2 (1,320,793.9)	-
2Q 2007	1,195,471.9 (1,611,659.4)	4.7	662,334.7 (1,382,346.4)	5.6	786,712.5 (1,158,023.1)	2.0	274,283.3 (814,251.0)	8.5	658,157.4 (1,340,605.7)	5.5
3Q 2007	1,166,852.9 (1,743,281.2)	-2.4	650,088.6 (1,424,094.9)	-1.8	780,619.6 (1,194,554.6)	-0.8	271,634.0 (854,015.1)	-1.0	645,748.6 (1,395,296.1)	-1.9

	2009 - 2010 recipient of case management - Class 1		2010 recipient of case management - Class 1		2009 - 2010 recipient of case management - Class 2		2010 recipient of case management- Class		Total	
	Mean (SD)	Change	Mean (SD)	Class	Mean (SD)	Class	Mean (SD)	Class	Mean (SD)	Class
4Q 2007	1,241,481.2 (1,735,943.3)	6.4	677,931.6 (1,443,585.7)	4.3	870,777.6 (1,371,052.2)	11.5	282,333.5 (812,771.2)	3.9	678,221.4 (1,408,092.2)	5.0
1Q 2008	1,331,460.6 (1,889,161.9)	7.2	724,775.3 (1,651,270.9)	6.9	925,511.8 (1,411,528.8)	6.3	300,264.5 (866,225.8)	6.4	725,235.7 (1,577,535.7)	6.9
2Q 2008	1,394,173.5 (1,976,631.8)	4.7	762,874.1 (1,628,194.4)	5.3	947,871.3 (1,348,943.5)	2.4	310,856.8 (1,077,951.1)	3.5	760,485.6 (1,610,120.7)	4.9
3Q 2008	1,423,481.2 (1,838,557.4)	2.1	784,395.2 (1,607,889.6)	2.8	978,007.3 (1,400,022.4)	3.2	322,920.0 (941,821.5)	3.9	781,250.5 (1,555,179.5)	2.7
4Q 2008	1,498,839.9 (1,949,108.3)	5.3	842,807.4 (1,661,749.2)	7.4	1,042,869.8 (1,426,931.4)	6.6	349,112.4 (1,141,651.0)	8.1	835,113.7 (1,641,089.5)	6.9
1Q 2009	1,593,344.1 (1,926,064.9)	6.3	916,795.7 (1,783,710.8)	8.8	1,128,242.2 (1,532,713.7)	8.2	374,978.1 (1,074,246.7)	7.4	901,626.4 (1,709,186.4)	8.0
2Q 2009	1,718,058.3 (2,227,786.9)	7.8	1,016,568.4 (1,946,850.3)	10.9	1,214,965.7 (1,805,444.8)	7.7	401,277.5 (1,068,965.1)	7.0	988,319.3 (1,875,653.9)	9.6
3Q 2009	1,724,691.5 (2,269,194.4)	0.4	1,084,310.6 (2,077,912.5)	6.7	1,225,324.9 (1,664,937.9)	0.9	438,665.8 (1,299,398.2)	9.3	1,038,703.1 (1,992,312.1)	5.1
4Q 2009	1,663,876.6 (2,303,153.5)	-3.5	1,131,767.0 (2,120,780.0)	4.4	1,200,648.1 (1,627,793.4)	-2.0	470,977.7 (1,371,506.6)	7.4	1,064,782.0 (2,030,760.1)	2.5
1Q 2010	1,679,347.8 (2,265,689.3)	0.9	1,303,298.0 (3,827,483.1)	15.2	1,175,492.6 (1,585,758.5)	-2.1	528,929.7 (1,609,803.6)	12.3	1,182,706.8 (3,219,427.4)	11.1
2Q 2010	1,758,614.4 (2,375,688.7)	4.7	1,413,658.8 (2,816,262.9)	8.5	1,201,327.6 (1,680,060.6)	2.2	573,331.0 (1,651,075.8)	8.4	1,271,586.5 (2,540,663.5)	7.5
3Q 2010	1,686,537.8 (2,280,190.2)	-4.1	1,408,981.0 (2,784,973.3)	-0.3	1,159,982.6 (1,546,795.7)	-3.4	572,358.2 (1,545,156.1)	-0.2	1,256,747.0 (2,487,209.9)	-1.2
# of case	26,148		104,450		4,027		39,085		173,710	

Note: 1: F value between time points :822.298***, F value between groups: 5238.184***
2: * <.05, **<.01 ***<.001

〔Figure 4-4〕 Variations in Average Quarterly Medical Aid Expenditure Per Person by Type of Medical Aid



Note: 1 Q 1: 1Q 2007~ Q 5: 1Q 2008 Q 9: 1Q 2009 ~ Q 15: 3Q 2010
2 2009~2010 means case management users for the 2 years. 2010 means case management users for 1 year.
3 On the basis of 1Q of 2007, from top to bottom 2009 - 2010 class 1, 2009 - 2010 class 2, 2010 class 1, 2010 class 2

The average per capita number of days covered by medical aid for the 2009 class 1 users stood at 205.1 days in the 1st quarter of 2007. The figure slightly reduced in the 3rd quarter of 2009 and rose again to peak at 278 days in the 3rd quarter of 2009. After being entered in the case management program in 2009, their increase rate somewhat decreased to reach 270, a 2.7% quarter-to-quarter decrease in the 4th quarter and fell further to record 260 in the 3rd quarter of 2010. That for class 2 recipients also had steadily risen from the 3rd quarter of 2007, but increase rate started to slow down in the 3rd quarter of 2009. The figure decreased compared to the previous quarter in the 4Q 2009 and 1Q 2010. Positive effects of the program

is clear when the figures are compared with those of the 2010 users. Increase rate of the 2010 users in 3Q 2009 was 5.2% and 6.4% for class 1 and 2 respectively while that of the 2009 users was relatively low at 1.5%, 2.0% for class 1 and 2 and even decreased in 1Q 2010. With regards to the 2010 users, increase rate for 2Q was 6.6% and 9.2% for class 1 and 2 respectively, but the rate has slowed down. Variations in average quarterly per capita number of days covered by medical aid by type of medical aid are shown in [Figure 4-5].

〈Table 4-6〉 Variations in Average Quarterly Per Capita Number of Days Covered by Medical Aid by Type of Medical Aid (days of hospitalization & outpatient visits+days of medication)

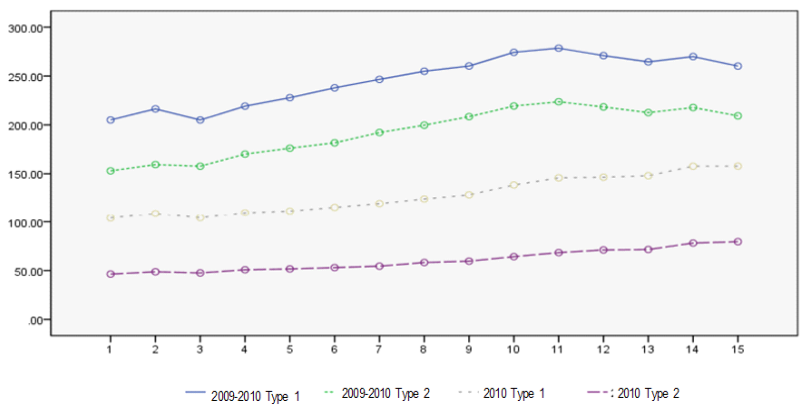
(Unit: day, rate)

	2009 - 2010 recipient of case management - Class 1		2010 recipient of case management - Class 1		2009 - 2010 recipient of case management - Class 2		2010 recipient of case management - Class 2		Total	
	Mean (SD)	Change	Mean (SD)	Change	Mean (SD)	Change	Mean (SD)	Change	Mean (SD)	Change
1Q 2007	205.1 (136.5)	-	104.1 (102.6)	-	152.9 (177.7)	-	46.4 (72.5)	-	107.4 (115.7)	-
2Q 2007	216.4 (142.2)	5.5	108.9 (105.2)	4.6	159.4 (168.2)	4.2	48.7 (75.5)	5.1	112.7 (119.3)	4.9
3Q 2007	205.0 (126.3)	-5.2	104.3 (98.5)	-4.2	157.7 (142.5)	-1.0	47.6 (73.2)	-2.4	107.9 (110.5)	-4.2
4Q 2007	219.2 (131.4)	6.9	109.8 (101.4)	5.3	170.1 (172.8)	7.8	50.8 (76.5)	6.7	114.4 (115.9)	6.0
1Q 2008	227.8 (135.3)	4.0	111.6 (100.3)	1.7	176.1 (153.6)	3.6	51.6 (77.8)	1.7	117.1 (116.7)	2.4
2Q 2008	237.9 (136.8)	4.4	115.4 (102.6)	3.4	181.7 (144.5)	3.1	53.0 (80.2)	2.7	121.3 (119.5)	3.6
3Q 2008	246.6 (141.0)	3.6	119.4 (105.7)	3.4	192.2 (145.3)	5.8	54.5 (81.7)	2.8	125.6 (123.2)	3.5
4Q 2008	254.9 (142.9)	3.4	124.1 (108.9)	4.0	199.7 (148.0)	3.9	58.2 (84.9)	6.8	130.7 (126.4)	4.1
1Q 2009	260.3 (140.6)	2.1	128.4 (112.1)	3.4	208.5 (149.9)	4.4	59.6 (88.3)	2.4	134.6 (128.8)	3.0

	2009 - 2010 recipient of case management - Class 1		2010 recipient of case management - Class 1		2009 - 2010 recipient of case management - Class 2		2010 recipient of case management - Class 2		Total	
	Mean (SD)	Change	Mean (SD)	Change	Mean (SD)	Change	Mean (SD)	Change	Mean (SD)	Change
2Q 2009	274.2 (144.9)	5.4	138.5 (119.0)	7.9	219.4 (153.3)	5.2	64.2 (93.0)	7.7	144.1 (135.3)	7.0
3Q 2009	278.5 (146.6)	1.5	145.8 (124.2)	5.2	223.7 (154.2)	2.0	68.4 (98.9)	6.4	150.1 (139.2)	4.2
4Q 2009	270.9 (143.9)	-2.7	146.5 (122.2)	0.5	218.4 (152.8)	-2.4	71.1 (97.5)	4.0	149.9 (136.0)	-0.2
1Q 2010	264.5 (143.6)	-2.4	148.0 (119.0)	1.0	212.6 (153.5)	-2.7	71.5 (98.3)	0.6	149.8 (133.4)	-0.1
2Q 2010	269.9 (146.7)	2.1	157.7 (121.7)	6.6	217.8 (153.2)	2.5	78.1 (100.9)	9.2	158.1 (135.6)	5.5
3Q 2010	260.1 (144.1)	-3.6	157.8 (119.2)	0.0	209.3 (149.3)	-3.9	79.5 (100.9)	1.8	156.8 (132.3)	-0.8
# of case	26,148		104,450		4,027		39,085		173,710	

Note: 1: F value between time points: 4859.716***, F value between groups: 20814.364***
2: * <.05, **<.01 ***<.001

[Figure 4-5] Average Quarterly Number of Days Covered by Medical Aid by Type of Medical Aid



Note: 1: Vertical axis - number of days covered by medical aid (hospitalization & outpatient visits+medication), Horizontal axis Q 1: 1Q 2007~ Q 5: 1Q 2008 Q 9: 1Q 2009 ~ Q 15: 3Q 2010
2: 2009~2010 means case management users for the 2 years. 2010 means case management users for 1 year.
3: On the basis of 2007, from top to bottom 2009~2010 class 1, 2009~2010 class 2, 2010 class 1, 2010 class 2

In conclusion, the comparison of the average per capita medical cost and number of days covered by medical aid from 2007 to 3Q 2010 between the 2009 users and 2010 users proved positive effects of case management program. For both the 2009 users and 2010 users, average medical aid expenditure and number of days covered by medical aid decreased or their increase rate slowed down from 3 to 6 months after the program was in force. The results were also statistically meaningful.

3. Analysis of behavior change

To validate the effectiveness of medical aid case management program, evaluation scores by category from internal assessment report[1] were used. The last time point was applied to redundant case management recipients, and all time points in the performance record were used for analysis of the performance of case management. For analysis of microscopic behavior change, general characteristics and performance of management of the 2010 case management recipients were reviewed and also internal assessment reports for 2009 and 2010 were examined to identify the trend of evaluation scores by category. Lastly, changes in the use of medical aid of the case management recipients (medical

1) Preliminary assessment was conducted to identify demands of the beneficiaries of medical aid case management for understanding of the program, reasonable medical care utilization, health status, level of self-care, support resource, environmental health and set targets based on the assessment. Also it was done to measure the change of recipients and the effectiveness of intervention after the end of case management. High-risk group and prevention group were evaluated before and after intervention.

aid expenditure, days covered by medical aid) from 2007 to 2010 were analyzed.

Out of the 2010 case management recipients, redundant ones who also benefited from case management in 20009 were picked out for analysis of the effectiveness of case management. Time points were pre- and post-2009 and post-2010.

Generally, paired t-test is conducted for statistical validation of the effectiveness of a program, but the test method is likely to cause research reactivity error because it is done in a short period of time. Given that the purpose of case management program is to change the lifestyle of its beneficiaries in the long term, t-test before and after intervention may have difficulty in validating effectiveness. Therefore, we need to take a long-term approach to analysis of the effectiveness of the program. To this end, trend for 2 years from 2009 and 2010 was examined. Also, recipients were divided into high-risk group and prevention group. A total of 18,701 users were sampled for analysis, including 1,235 for prevention group and 17,466 for high-risk group.

GLM (General Linear Model) was adopted for analysis and management group and period of case management were also taken into consideration.

a) Self-care competency

Self-care competency is classified into six categories: disease status, understanding of medical aid program, control symptoms and condition, medication, lifestyle management, and hygiene & prevention.

A higher score for disease status means the recipient better understands his/her disease status. Disease status score of the prevention group has been on the steady rise from 2.73 for pre-2009 to 3.05 for post-2009 and to 3.10 for post-2010. The same was true for the high-risk group. The figure has increased from 2.84 for pre-2009 to 3.11 for post-2009 and to 3.15 for post-2010. Differences between time points were statistically meaningful.

〈Table 4-7〉 Disease status

(Unit: Point)

	Pre-2009		Post-2009		Post-2010	
	Mean	SD	Mean	SD	Mean	SD
Prevention group	2.73	0.71	3.05	0.63	3.10	0.63
High-risk group	2.84	0.69	3.12	0.60	3.15	0.59
Total	2.83	0.69	3.11	0.60	3.15	0.59

Tests of Within-Subjects Effects		Tests of Within-Subjects Contrasts		Tests of Between-Subjects Effects	
Time point	71.693***	Time point	96.068***	Constant	23032.875***
Time point * Mgt period	1.194	Time point * Mgt period	.505	Mgt period	.241
Time point * managed group	3.281*	Time point * managed group	3.895*	Managed group	18.229***

Note: * <.05, **<.01 ***<.001

A higher score for control symptom and condition means symptom is better managed and the distribution of assessment scores is as follows:

Prevention group recorded 2.82 for pre-2009. The score improved to reach 3.12 for post-2009 and was maintained at 3.12 for post-2010. That of high-risk group has steadily risen from 2.83 for pre-2009 to 3.12 for post-2009 and to 3.17 for post-2010. Changes in scores between time points were statistically meaningful, and managed groups showed statistically

meaningful trends of changes.

〈Table 4-8〉 Control symptom and condition

(Unit: Point)

	Pre-2009		Post-2009		Post-2010	
	Mean	SD	Mean	SD	Mean	SD
Prevention group	2.82	0.72	3.12	0.64	3.12	0.64
High-risk group	2.83	0.69	3.12	0.62	3.17	0.62
Total	2.83	0.7	3.12	0.62	3.17	0.62

Tests of Within-Subjects Effects		Tests of Within-Subjects Contrasts		Tests of Between-Subjects Effects	
Time point	30.886***	Time point	31.247***	Constant	24168.113***
Time point * mgt period	13.825***	Time point * mgt period	20.790***	Mgt period	22.101***
Time point * managed group	1.072	Time point * managed group	.438	Managed group	8.464**

Note: * <.05, **<.01 ***<.001

A higher medication score means more proper intake of medicines. Prevention group scored 3.00 for pre-2009 and 3.33 for post-2009, but the score slightly fell in the post-2010 assessment to 3.32. The same trend was observed in the high-risk group. The figure rose from 3.28 fro pre-2009 to 3.53 for post-2009 and fell to 3.52 for post-2010. Medication scores have generally improved compared to those of pre-2009, and variations between time points were statistically meaningful.

〈Table 4-9〉 Medication

(Unit: Point)

	Pre-2009		Post-2009		Post-2010	
	Mean	SD	Mean	SD	Mean	SD
Prevention group	3.00	0.87	3.33	0.75	3.32	0.76
High-risk group	3.28	0.84	3.53	0.71	3.52	0.71
Total	3.27	0.85	3.52	0.71	3.51	0.71

Tests of Within-Subjects Effects		Tests of Within-Subjects Contrasts		Tests of Between-Subjects Effects	
Time point	44.296***	Time point	55.836***	Constant	19362.800***
Time point * mgt period	2.278	Time point * mgt period	.049	Mgt period	12.243***
Time point * managed period	5.058**	Time point * managed group	4.209***	Managed group	120.088***

Note: * <.05, **<.01 ***<.001

A higher lifestyle management score means lifestyle is better managed. That of prevention group stood at 2.84 for pre-2009, 3.03 for post-2009, and 3.11 for post-2010, meaning lifestyle has changed for the better. That of high-risk group has steadily improved from 2.86 for pre-2009 to 3.04 for post-2009 and to 3.18 for post-2010. Differences in scores between time points were statistically meaningful and difference between management periods and managed groups was also meaningful.

〈Table 4-10〉 Lifestyle Management

(Unit: Point)

	Pre-2009		Post-2009		Post-2010	
	Mean	SD	Mean	SD	Mean	SD
Prevention group	2.84	0.66	3.03	0.67	3.11	0.64
High-risk group	2.86	0.68	3.04	0.69	3.18	0.61
Total	2.86	0.68	3.04	0.69	3.18	0.61

Tests of Within-Subjects Effects		Tests of Within-Subjects Contrasts		Tests of Between-Subjects Effects	
Time point	29.614***	Time point	43.352***	Constant	20914.209***
Time point * mgt period	3.679*	Time point * mgt period	5.619*	Mgt period	17.080***
Time point * managed group	1.906	Time point * managed group	.298	Managed group	10.454**

Note: * <.05, **<.01 ***<.001

A higher point in hygiene & prevention means the activity for hygiene and prevention is better managed. Pre- and post-2009 score was 2.83, but the figure surged to 3.17 for post-2010 assessment. That of high-risk group has gradually increased from 2.93 for pre-2009 to 3.19 and 3.25. Increases in scores between time points have been observed in high-risk group but this was not statistically meaningful.

〈Table 4-11〉 Hygiene and prevention

(Unit: Point)

	Pre-2009		Post-2009		Post-2010	
	Mean	SD	Mean	SD	Mean	SD
Prevention group	2.83	0.72	2.83	0.72	3.17	0.39
High-risk group	2.93	0.53	3.19	0.57	3.25	0.58
Total	2.92	0.54	3.17	0.58	3.24	0.57

Tests of Within-Subjects Effects		Tests of Within-Subjects Contrasts		Tests of Between-Subjects Effects	
Time point	1.790	Time point	.208	Constant	342.337***
Time point * mgt period	2.100	Time point * mgt period	.698	Mgt period	1.945
Time point * managed group	.401	Time point * managed group	.140	Managed group	.677

Note: * <.05, **<.01 ***<.001

Distribution of the total scores of self-care competency categories (disease status, understanding of medical aid program, control symptom and condition, medication, lifestyle management, hygiene & prevention) is as follows:

The score of prevention group was 12.82 for pre-2009 and has risen to 17.33 and again to 18.69. That of high-risk group has also steadily increased from 13.75 for pre-2009 to 18.05 for post-2009 and 19.29 for post-2010. Differences in the trend of changes between time points were statistically meaningful and the same was true between management periods and managed groups.

〈Table 4-12〉 Total Self-Care Competency Categories

(Unit: Point)

	Pre-2009		Post-2009		Post-2010	
	Mean	SD	Mean	SD	Mean	SD
Prevention group	12.82	3.79	17.33	4.79	18.69	3.37
High-risk group	13.75	3.50	18.05	4.32	19.29	3.04
Total	13.70	3.52	18.01	4.35	19.26	3.06

Tests of Within-Subjects Effects		Tests of Within-Subjects Contrasts		Tests of Between-Subjects Effects	
Time point	1080.891***	Time point	1964.626***	Constant	20031.37***
Time point * mgt period	69.283***	Time point * mgt period	79.798***	Mgt period	51.609***
Time point * managed group	5.095*	Time point * managed group	1.339	Managed group	17.762***

Note: * <.05, **<.01 ***<.001

All the categories except for medication (disease status, understanding of medical aid program, control symptom and condition, lifestyle management, hygiene & prevention) showed a steady increase for pre- and post-2009 and post-2010 assessments. Medication also improved in the post-2010 evaluation compared to pre-2009. Case management program was proven to be effective in the category of hygiene & prevention.

b) Reasonable medical care utilization

Reasonable medical care utilization is divided into proper use of medical care, medical care shopping, level of service used by clients, medical institution used by clients, and level of

prescription duplication.

A higher score in proper use of medical care means recipients use medical service more properly. Score of prevention group in the category stood at 5.55 for pre-2009 and rose to 6.18 in post-2009, but fell to 5.99 for post-2010. The same trend was found in high-risk group. The figure rose to 5.58 in post-2009 from 4.70 in pre-2009, but decreased to 5.48 in post-2010. Differences in the evaluation scores of time points were statistically meaningful, and trend in change was different by management period and managed group.

〈Table 4-13〉 Proper Use of Medical Care

(Unit: Point)

	Pre-2009		Post-2009		Post-2010	
	Mean	SD	Mean	SD	Mean	SD
Prevention group	5.55	1.77	6.18	1.70	5.99	1.87
High-risk group	4.70	1.57	5.58	1.54	5.48	1.74
Total	4.75	1.59	5.61	1.56	5.51	1.75

Tests of Within-Subjects Effects		Tests of Within-Subjects Contrasts		Tests of Between-Subjects Effects	
Time point	6.969**	Time point	1.852	Constant	14456.288***
Time * mgt period	41.599***	Time * mgt period	46.318***	Mgt period	220.463***
Time * managed group	2.443	Time * managed group	3.573	Managed group	58.124***

Note: * <.05, **<.01 ***<.001

A higher score in medical care shopping means the beneficiary uses medical service less wastefully. Score of prevention group was 3.49 for pre-2009 and improved to 3.71 for post-2009 and

to 3.81 for post-2010. The same was true for high-risk group. The figure was 2.70 for pre-2009, 3.13 for post-2009, and 3.23 for post-2010. Differences in scores between time points were statistically meaningful and trends in evaluation score were also different between managed groups and management periods.

〈Table 4-14〉 Medical Care Shopping

(Unit: Point)

	Pre-2009		Post-2009		Post-2010	
	Mean	SD	Mean	SD	Mean	SD
Prevention group	3.49	0.89	3.71	0.75	3.81	0.78
High-risk group	2.65	0.82	3.09	0.73	3.19	0.73
Total	2.70	0.84	3.13	0.74	3.23	0.74

Tests of aEffects		Tests of Within-Subjects Contrasts		Tests of Between-Subjects Effects	
Time point	14.011***	Time point	21.398***	Constant	23418.594***
Time point * mgt period	42.262***	Time point * mgt period	51.328***	Mgt period	186.517***
Time point * managed group	9.872***	Time point * managed group	10.317**	managed group	640.287***

Note: * <.05, **<.01 ***<.001

A higher point in level of service used by clients means the client uses medical institution more reasonably. Score of prevention group was 3.43 for pew-2009, 3.60 for post-2009, and 3.64 for post-2010. That of high-risk group was 2.95 for pre-2009, 3.20 for post-2009, and 3.27 for post-2010. Differences in scores between time points were statistically meaningful and trends in changes were different by management period and managed group.

〈Table 4-15〉 Level of Service Used by Clients

(Unit: Point)

	Pre-2009		Post-2009		Post-2010	
	Mean	SD	Mean	SD	Mean	SD
Prevention group	3.43	0.76	3.60	0.69	3.64	0.72
High-risk group	2.95	0.68	3.20	0.60	3.24	0.61
Total	2.97	0.69	3.22	0.62	3.27	0.62

Tests of Within-Subjects Effects		Tests of Within-Subjects Contrasts		Tests of Between-Subjects Effects	
Time point	13.826***	Time point	19.372***	Constant	31583.368***
Time point * mgt period	10.998***	Time point * mgt period	12.730***	Mgt period	57.117***
Time point * managed group	1.708***	Time point * managed group	2.080	Managed group	396.774***

Note: * <.05, **<.01 ***<.001

A higher score in number of medical institution used by clients means the number is more appropriate. That of prevention group was 3.45 for pre-2009, 3.64 for post-2009, and 3.83 for post-2010. That of high-risk group was 2.69 for pre-2009, 2.97 for post-2009, and 3.34 for post-2010. Differences in scores between time points were statistically meaningful and trends in changes were different by management period and managed group.

〈Table 4-16〉 Number of Medical Institution Used by Clients

(Unit: Point)

	Pre-2009		Post-2009		Post-2010	
	Mean	SD	Mean	SD	Mean	SD
Prevention group	3.45	0.88	3.64	0.81	3.83	0.76
High-risk group	2.69	0.80	2.97	0.78	3.34	0.71
Total	2.73	0.82	3.00	0.79	3.37	0.72

Tests of Within-Subjects Effects		Tests of Within-Subjects Contrasts		Tests of Between-Subjects Effects	
Time point	60.842***	Time point	91.040***	Constant	22370.071***
Time point * mgt period	13.339***	Time point * mgt period	18.959***	Mgt period	203.051***
Time point * managed group	23.039***	Time point * managed group	31.474***	Managed group	491.214***

Note: * <.05, **<.01 ***<.001

A higher score in level of prescription duplication means prescription is less redundant. That of prevention group was 3.55 for pre-2009, 3.74 for post-2009, and 3.80 for post-2010. That of high-risk group has also improved from 2.78 for pre-2009 to 3.20 for post-2009 and to 3.28 for post-2010. Differences in scores between time points were statistically meaningful and trends in changes were different by management period and managed group. Changes between time points with managed groups and management periods into consideration are shown in [Figure 6-19].

〈Table 4-17〉 Level of Prescription Duplication

(Unit: Point)

	Pre-2009		Post-2009		Post-2010	
	Mean	SD	Mean	SD	Mean	SD
Prevention group	3.55	0.86	3.74	0.75	3.80	0.77
High-risk group	2.78	0.79	3.17	0.70	3.25	0.73
Total	2.82	0.82	3.20	0.71	3.28	0.74

Tests of Within-Subjects Effects		Tests of Within-Subjects Contrasts		Tests of Between-Subjects Effects	
Time point	4.941*	Time point	6.903*	Constant	26220.973***
Time point * mgt period	41.796***	Time point * mgt period	55.097***	Mgt period	244.392***
Time point * managed group	8.188*	Time point * managed group	9.285*	Managed group	531.978***

Note: * <.05, **<.01 ***<.001

Trend in the total score of reasonable use of medical care (proper use of medical care, medical care shopping, level of service used by clients, and level of prescription duplication) is as follows:

Total score of prevention group has steadily increased from 19.33 for pre-2009 to 20.37 for post-2009, and to 20.74 for post-2010. The same was found in high-risk group. Its score has improved from 15.67 for pre-2009, 17.82 for post-2009, and 8.44 for post-2010. Differences in scores between time points were statistically meaningful and trends in changes were different by management period and managed group.

〈Table 4-18〉 Reasonable Use of Medical Care

(Unit: Point)

	Pre-2009		Post-2009		Post-2010	
	Mean	SD	Mean	SD	Mean	SD
Prevention group	19.33	4.48	20.37	4.64	20.74	4.27
High-risk group	15.67	3.84	17.67	3.90	18.31	3.80
Total	15.87	3.96	17.82	3.99	18.44	3.86

Tests of Within-Subjects Effects		Tests of Within-Subjects Contrasts		Tests of Between-Subjects Effects	
Time point	13.032***	Time point	19.143***	Constant	28587.754***
Time point * mgt period	35.270***	Time point * mgt period	53.282***	Mgt period	269.221***
Time point * managed group	12.959***	Time point * managed group	18.394***	Managed group	371.449***

Note: * <.05, **<.01 ***<.001

Of reasonable use of medical care, the category of proper use of medical care improved in post-2010 in comparison with pre-2009, but had slightly fallen in the post-2009 evaluation. The other categories (medical care shopping, level of service used by clients, and level of prescription duplication), however, have recorded a steady increase from pre-2009 to post-2010. Such results proved the effectiveness of case management program in the indicator.

c) Building support system

Building support system was categorized into social isolation and resource network. A higher score in social isolation means recipients are less isolated in society. Score of prevention group

was 2.89 for pre-2009 and 3.16 for post-2009, and 3.50 for post-2010. That of high-risk group was 2.89 for pre-2009, 3.07 for post-2009, and 3.43 for post-2010. Differences in scores between time points were statistically meaningful and trends in changes were different by management period.

〈Table 4-19〉 Social isolation

(Unit: Point)

	Pre-2009		Post-2009		Post-2010	
	Mean	SD	Mean	SD	Mean	SD
Prevention group	2.89	1.30	3.16	0.91	3.50	1.20
High-risk group	2.89	1.37	3.07	0.94	3.43	1.20
Total	2.89	1.37	3.08	0.94	3.43	1.20

Tests of Within-Subjects Effects		Tests of Within-Subjects Contrasts		Tests of Between-Subjects Effects	
Time point	61.886***	Time point	103.384***	Constant	6218.821***
Time point * mgt period	3.611*	Time point * mgt period	5.568*	Mgt period	14.824**
Time point * managed group	.977	Time point * mgt period	.074	Managed group	.009

Note: * <.05, **<.01 ***<.001

A higher score in resource network means resource network is better operated. Prevention group scored 2.95 for pre-2009, 3.11 for post-2009, and 3.17 for post-2010. The figure for high-risk group has also increased steadily from 3.01 for pre-2009 to 3.13 for post-2009 and to 3.19 for post-2010. Differences in scores between time points were statistically meaningful and trends in changes were different by managed group.

〈Table 4-20〉 Resource network

(Unit: Point)

	Pre-2009		Post-2009		Post-2010	
	Mean	SD	Mean	SD	Mean	SD
Prevention	2.95	0.58	3.11	0.58	3.17	0.58
High-risk	3.01	0.58	3.13	0.55	3.19	0.57
Total	3.00	0.58	3.13	0.55	3.19	0.57

Tests of Within-Subjects Effects		Tests of Within-Subjects Contrasts		Tests of Between-Subjects Effects	
Time point	14.466***	Time point	21.330***	Constant	26618.621***
Time point * mgt period	4.935*	Time point * mgt period	4.803*	Mgt period	1.424
Time point * managed group	3.144*	Time point * managed group	4.021*	Managed group	4.773*

Note: * <.05, **<.01 ***<.001

Total score of prevention group in building support system has improved from 5.22 for pre-2009 to 5.94 for post-2009 and to 6.35 for post-2010. The same trend was observed for high-risk group. The figure has risen from 5.20 for pre-2009 to 5.89 for post-2009 and to 6.34 for post-2010. Differences in scores between time points were statistically meaningful and trends in changes were different by management period.

〈Table 4-21〉 Building Support System

(Unit: Point)

	Pre-2009		Post-2009		Post-2010	
	Mean	SD	Mean	SD	Mean	SD
Prevention	5.22	1.98	5.94	1.49	6.35	1.74
High-risk	5.20	1.97	5.89	1.41	6.34	1.65
Total	5.20	1.97	5.90	1.41	6.34	1.65

Tests of Within-Subjects Effects		Tests of Within-Subjects Contrasts		Tests of Between-Subjects Effects	
Time point	121.766***	Time point	191.359***	Constant	12451.085***
Time point * mgt period	1.463	Time point * mgt period	1.414	Mgt period	5.680*
Time point * managed group	.182	Time point * managed group	.297	Managed group	.126

Note: * <.05, **<.01 ***<.001

Of the indicator of building support system, social isolation and resource network have recorded a steady increase from the pre-2009 assessment. In particular, the category of social isolation has shown a remarkable growth.

d) Health quality of life

Health quality of life is composed of health status, activity of daily living, pain, depression, health concern, and environmental health.

A higher score in health status evaluation means health status gets better. Score of prevention group had improved from 2.63 for pre-2009 to 3.22 for post-2009, but slightly fell to 3.16 for post-2010. That of high-risk group has been on the steady increase from 2.39 for pre-2009 to 3.34 for post-2009 to 3.36 for post-2010. Differences in scores between time points were statistically meaningful and trends in changes were different by managed group.

〈Table 4-22〉 Health Status

(Unit: Point)

	Pre-2009		Post-2009		Post-2010	
	Mean	SD	Mean	SD	Mean	SD
Prevention	2.63	0.60	3.22	0.59	3.16	0.59
High-risk	2.39	0.58	3.34	0.60	3.36	0.60
Total	2.40	0.58	3.34	0.60	3.35	0.60

Tests of Within-Subjects Effects		Tests of Within-Subjects Contrasts		Tests of Between-Subjects Effects	
Time point	221.021***	Time point	316.596***	Constant	39228.425***
Time point * mgt period	26.300***	Time point * mgt period	22.394***	Mgt period	1.502
Time point * managed group	79.908***	Time point * managed group	132.817***	Managed group	4.451*

Note: * <.05, **<.01 ***<.001

In activity of daily living, prevention group scored 3.55 points for pre-2009, 3.62 for post-2009, and 3.65 for post-2010. The score of high-risk group has also increased steadily from 3.30 for pre-2009 to 3.35 for post-2009 and 3.37 for post-2010. Differences in scores between time points were statistically meaningful and trends in changes were different by managed group.

〈Table 4-23〉 Activity of Daily Living

(Unit: Point)

	Pre-2009		Post-2009		Post-2010	
	Mean	SD	Mean	SD	Mean	SD
Prevention	3.55	0.83	3.62	0.84	3.65	0.79
High-risk	3.30	0.76	3.35	0.76	3.37	0.73
Total	3.31	0.77	3.36	0.77	3.38	0.74

Tests of Within-Subjects Effects		Tests of Within-Subjects Contrasts		Tests of Between-Subjects Effects	
Time point	10.163***	Time point	14.450***	Constant	18150.827***
Time point * mgt period	1.891	Time point * mgt period	2.324	Mgt period	1.059
Time point * managed group	.128	Time point * managed group	.135	Managed group	103.329***

Note: * <.05, **<.01 ***<.001

A higher score in pain means the recipient feels less pain. Prevention group scored 3.12 for pre-2009, 3.26 for post-2009, and 3.45 for post-2010. High-risk group recorded 2.75 for pre-2009, 2.86 for post-2009, and 3.05 for post-2010. Differences in scores between time points were statistically meaningful and trends in changes were different by management period and managed group.

〈Table 4-24〉 Pain

(Unit: Point)

	Pre-2009		Post-2009		Post-2010	
	Mean	SD	Mean	SD	Mean	SD
Prevention	3.12	0.83	3.26	0.83	3.45	0.74
High-risk	2.75	0.71	2.86	0.71	3.05	0.69
Total	2.77	0.72	2.88	0.72	3.07	0.70

Tests of Within-Subjects Effects		Tests of Within-Subjects Contrasts		Tests of Between-Subjects Effects	
Time point	49.324***	Time point	69.429***	Constant	19610.266***
Time point * mgt period	.648	Time point * mgt period	.610	Mgt period	75.568***
Time point * managed group	1.051	Time point * managed group	.769	Managed group	198.361***

Note: * <.05, **<.01 ***<.001

A higher score in depression means the recipient is less depressed. Prevention group scored 2.91 for pre-2009, 3.03 for post-2009, and 3.20 for post-2010. High-risk group scored 2.73 for pre-2009, 2.85 for post-2009, and 3.07 for post-2010, meaning depression level has decreased. Differences in scores between time points were statistically meaningful and trends in changes were different by management period and managed group.

〈Total 4-25〉 Depression

(Unit: Point)

	Pre-2009		Post-2009		Post-2010	
	Mean	SD	Mean	SD	Mean	SD
Prevention	2.91	0.66	3.03	0.69	3.20	0.62
High-risk	2.73	0.63	2.85	0.64	3.07	0.60
Total	2.74	0.64	2.86	0.64	3.08	0.60

Tests of Within-Subjects Effects		Tests of Within-Subjects Contrasts		Tests of Between-Subjects Effects	
Time point	41.143***	Time point	60.692***	Constant	23092.600***
Time point * mgt period	3.367	Time point * mgt period	4.829*	Mgt period	20.216***
Time point * managed group	1.070	Time point * managed group	.704	Managed group	46.690***

Note: * <.05, **<.01 ***<.001

A higher score in health concern means the recipient are more concerned with his/her health. Prevention group recorded 2.98 for pre-2009, 2.78 for post-2009, and 3.00 for post-2010. High-risk group scored 3.17 for pre-2009, 2.57 for post-2009, and the figure slightly increased in the post-2010 assessment. Differences in scores between time points were statistically meaningful and trends in changes were different by management period and managed group.

〈Table 4-26〉 Health Concern

(Unit: Point)

	Pre-2009		Post-2009		Post-2010	
	Mean	SD	Mean	SD	Mean	SD
Prevention	2.98	0.68	2.78	0.68	3.00	0.61
High-risk	3.17	0.67	2.56	0.64	2.75	0.61
Total	3.16	0.67	2.57	0.64	2.76	0.61

Tests of Within-Subjects Effects		Tests of Within-Subjects Contrasts		Tests of Between-Subjects Effects	
Time point	34.876***	Time point	2.204	Constant	31856.664***
Time point * mgt period	12.539***	Time point * mgt period	19.400*	Mgt period	7.700*
Time point * managed group	76.463***	Time point * managed group	109.827***	Managed group	24.420***

Note: * <.05, **<.01 ***<.001

A higher environmental health score means the beneficiary lives in a more agreeable residential environment. That of prevention group was 3.92 for pre-2009, 3.93 for post-2009, and 4.04 for post-2010. That of high-risk group has also increased steadily from 3.87 for pre-2009 to 3.91 for post-2009 and to 4.04 for post-2010. Differences in scores between time points were statistically meaningful and trends in changes were different by management period.

〈Table 4-27〉 Environmental Health

(Unit: Point)

	Pre-2009		Post-2009		Post-2010	
	Mean	SD	Mean	SD	Mean	SD
Prevention	3.92	1.24	3.93	1.23	4.04	1.14
High-risk	3.87	1.27	3.91	1.25	4.04	1.13
Total	3.87	1.27	3.91	1.25	4.04	1.13

Tests of Within-Subjects Effects		Tests of Within-Subjects Contrasts		Tests of Between-Subjects Effects	
Time point	20.564***	Time point	24.108***	Constant	6183.480***
Time point * mgt period	6.072*	Time point* mgt period	6.769*	Mgt period	11.397**
Time point * managed group	2.341	Time point * managed group	3.012	Managed group	3.078

Note: * <.05, **<.01 ***<.001

Total scores in the area of health & quality of life are as follows:

Score of prevention group was 17.64 for pre-2009, 18.01 for post-2009, and 19.38 for post-2010. That of high-risk group stood at 17.16 for pre-2009, 17.57 for post-2009, and 18.91 for post-2010. Differences in scores between time points were statistically meaningful and trends in changes were different by management period and managed group.

〈Table 4-28〉 Health & Quality of Life

(Unit: Point)

	Pre-2009		Post-2009		Post-2010	
	Mean	SD	Mean	SD	Mean	SD
Prevention group	17.64	4.19	18.01	4.50	19.38	4.03
High-risk group	17.16	3.63	17.57	3.83	18.91	3.28
Total	17.19	3.66	17.60	3.88	18.93	3.33

Tests of Within-Subjects Effects		Tests of Within-Subjects Contrasts		Tests of Between-Subjects Effects	
Time point	177.243***	Time point	259.382***	Constant	24929.837***
Time point * mgt period	27.449***	Time point * mgt period	40.522***	Mgt period	12.165***
Time point * managed group	3.506*	Time point * managed group	5.481*	Managed group	30.792***

Note: * <.05, **<.01 ***<.001

For health quality of life, the categories health status, activity of daily living, pain, depression, and environmental health have been on the steady rise ever since the pre-2009 assessment. Such result can be interpreted to support the effectiveness of case management program.

Chapter

05

Conclusion

Chapter 5

Conclusion

This paper intended to analyze the effectiveness of medical aid case management program. First, theoretical study was conducted on indicators of effectiveness analysis which are generally used for such analysis both at home and abroad. The study found out that effectiveness verification in other nations is categorized into short-term, mid-term, and long-term and various indicators are utilized to analyze different time periods.

While other counties have taken various approaches to analyzing the effectiveness of a program, South Korea's analyses on effectiveness aimed only on the behavioral changes in use of medical care before and after the introduction of case management program in 2003, failing to analyze the program in terms of its ultimate goals.

With that in mind, this paper set the goals of medical aid case management program as 1) efficient management of financial expenditures, 2) enhancement of health, 3) encouragement of proper use of medical care, 4) improvement of customer satisfaction. We have analyzed effectiveness as to whether the program met the four goals. Analysis was done from both macroscopic and microscopic perspectives. For macroanalysis, time series data from the National Health Insurance Corporation was used to estimate the trend of expenditures on the assumption that medical aid case management program and co-payments

and designation of primary clinic are not in place. The estimated figures were compared with the actual expenditures to identify the change in financial expenditures after the introduction of the program.

Also, to accurately reflect the trend in medical expenditures by class of medical aid, estimation was categorized into class 1, class 2, and recipients of other benefits. Those who lost medical aid eligibility and was moved to health insurance program from January 2001 to December 2010 were excluded from the analysis. Applied estimation model was ARIMA (Integrated Autoregressive Moving Average) analysis model that is used to explain the statistical characteristics of the movement of time series variables on the assumption that a current value is dependent on the past values of the same variable for forecasting the future values of that variable. If we suppose cost reduction after the introduction of case management in 2010 arises only from the effects of the program, it is estimated to save about 120 billion won.

As part of microanalysis, data from the Korea Health and Welfare Information Service and the National Health Insurance Corporation to analyze effectiveness associated with the purpose of case management. Data from the Korea Health and Welfare Information Service was reports that are filled out by case managers when they interview recipients of the program in relation to the purpose of the intervention of case management. Data was composed of investigation before and after intervention in 2009 and 2010. Pre and post-2009 interviews and post-2010 interviews were utilized for analysis. Results showed that case management have positive impact on overall categories including

reasonable use of medical care, and health quality of life. They were also statistically meaningful.

Next, data from the National Health Insurance Corporation was divided into two groups: recipients covered by case management from 2009 to 2010 and those who entered the program in 2010. This was to assess the short-term effectiveness of the program and to analyze whether the effectiveness would be more positive if the program continues. Average quarterly per capita medical aid expenditure was used in the analysis. It was evaluated that the program had partial impact on enhancement of cost effectiveness even for the newly entered group and the effects were clearer for those who were managed for 2 years. The same was true for analyses on the basis of the number of days of hospitalization and outpatient visits and risk group, which was statistically meaningful. This also implies that the effects of case management program will be more positive from mid-to-long-term perspective than from short-term point of view.

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