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TRANSITION FROM FEE-FOR-SERVICE TO PROSPECTIVE PAYMENT SYSTEM:HOSPITAL SERVICES UNDER NATIONAL HEALTH INSURANCE SYSTEM

by

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ABSTRACT

We investigate the effects of the capitation program with a partially implemented prospective payment system to hospitals under the fee-for-service (FFS) program on the quality and quantity of hospital health care services in Japan. Our results show that there is clear evidence that an introduction of the capitation program to general hospitals under the FFS program reduces the quality of health care. However, the results also suggest the introduction can decrease the health care financial burden on the government.

The difference between managed geriatric hospitals with the capitation fee (CF) and the general geriatric hospitals with the FFS generates higher quality enhancement efforts among the former. The government provides explicit incentives to general geriatric hospitals to select the CF program with higher reimbursement rates.

Under the mixed payment system of the CF and FFS, an expansion of the CF in the geriatric hospitals will raise quality care among them. Thus, transferring the elderly care from the acute-care-oriented general hospitals to less resource-intensive managed geriatric hospitals in the capitation program will be one of the viable options as a cost containment policy by the government.

INTRODUCTION

The Japanese government has maintained the fee-for-service (FFS) payment system for health care services as a retrospective cost-based-reimbursement method. This reimbursement system under the National Health Insurance has substantially raised the national health care expenditures, e.g., a 5 percent per annum. Of hospital care expenditures the elderly aged 65 and over use more than 7 times than people under ages 65 in 1997.

In 1990 the Japanese government implemented a cost containment policy by introducing capitation fee (CF) for geriatric hospital services. Then, the geriatric hospitals with the government's approval of the CF reimbursement are called a managed geriatric hospital; and those, which are not approved by the government, are called a general geriatric hospital with lower FFS reimbursement rates. Despite the importance and urgency of a development of new health care financing system in an aging society like Japan, after nine years of evaluation since the onset of the capitation program there is still no consensus of the effects of the prospective payment system (PPS) on the performance of health care delivery, from both theoretical and empirical perspectives.

Of other industrialized countries, there have been also rapid increases in the costs of health care programs over decades. In those countries do policy debates include controlling health care costs, quality of care and cost-containment programs. For example,

Medicare's PPS in the U.S. has reduced hospital service utilization,[1] and hence has controlled a rapid increase in the health care expenditures (Sloan, Morrisey and Valvona, 1988; Feinglass and Holloway, 1991). It is a common view that the cost containment policy has been effective.

Yet, an ambiguity still remains over the relationship between the level of health care expenditures and quality of health care services. Desharnaia, Kobrinski, Chesney, Long, Ament and Fleming (1987) and Desharnaia, Chesney and Fleming (1988) state that the PPS has reduced hospital utilization without adverse effects on the quality of care. Newhouse and Byrne (1988) claim that the PPS decreases length of stay among Medicare patients. More recently, Hodgkin and McGuire (1994), Dor and Farley (1996) and Kesteloot and Voet (1998) support that the PPS decreases resource-intensity of hospital service.[2]

For the relationship between Medicare and managed care, Baker (1995), Baker and Shankarkumar (1997) and Cutler and Sheiner (1997) analyze that the structural change caused by an increase in a managed care - known as capitation - in the U.S. is negatively associated with decrease in Medicare expenditures. Baker and Brown (1997) and Feldman and Scharfstein (1998) note that managed care patients tend to be treated by lower volume of services than those with cost-based fee-for-service health plan.

In this study of Japanese experience, our purpose is threefold.

First, we will analyze a choice of capitation program by geriatric hospitals. Second, factors causing an increase in health care expenditures will be explored. Finally, we will examine effects of the capitation program on hospital days, units of health care services given to patients and quality of care, and their interactions with each other because the CF may induce geriatric hospitals to save their costs by reducing quality of care and refusing treatments of costly patients.

BACKGROUND

The insurance system for the elderly in Japan consists of five insurers under government supervision. Government-managed Health Insurance covers employees at places of work (mainly small and medium sized enterprises) where no Social-managed Health Insurance is established. Social-managed Health Insurance covers employees at places of work (mainly large enterprises, i.e. enterprises with 300 and more employees) where Social-managed Health Insurance is established. Seamen's Insurance covers seamen, those on ships/boats. Mutual Aid Associations covers national public service employees, local public service employees, and private school teachers and employees. National Health Insurance covers people who are not covered by employee insurance (farmers, the self-employed, carpenters, doctors, employees of small businesses, etc.) and retirees formerly under employees' insurance and their

dependents. About seventy percent of the 11 million elderly belonged to National Health Insurance while seventeen percent were general employees under Government-managed Health Insurance. The remaining thirteen percent belonged to Social-managed Health Insurance, Seamen's Insurance and Mutual Aid Associations.

Medical service providers follow the reimbursement schedules with a point system which is set by the Ministry of Health and Welfare of Japan. The reimbursement price is based on a point system and this unified point system is applied to all medical service providers, regardless of the types of health insurance provided. The role of the point system is to generate enough revenues to cover the costs incurred. Each item of medical service is assigned a certain number of points, and providers are reimbursed a sum of total points multiplied by 10 yen (approximately 10 cents assuming one dollar equals 100 yen).

The point system is classified into thirteen service categories: medication, injection, examination, hospital service, general treatment, radiology, mental treatment, anesthesia, basic consultation, home care, image diagnosis, operation and physiotherapy. Within these groups there are further classifications. For example an initial consultation is 195 points and 450 points with referrals; nursing at hospitals is 318 points; injection ranges from 15 to 150 points, depending on the skill required. As an exception, the point of medication is reimbursed

by 1 point per 15 yen and is the material purchasing price plus the prescription which is 74 points per unit. These changes in points are dependent on whether the patients are children, adults or the elderly, the degree of skill required, the quantity of material needed and the patient's length of treatment. The government reimbursement price consists of these complicated pricing classifications on a fee-for-service basis.

For the elderly, the criteria for government reimbursement slightly differs from the general case. Table 1 shows points by the types of services. The services such as medication, injection, operation, anesthesia, and radiology do not have specific point criteria for the elderly. These consist of so many kinds of services and treatments that the differences between maximum and minimum points are large, e.g., 120~80,000 points for operation, 31~5,100 points for anesthesia, and 80~10,000 points for radiology.

A prospective reimbursement system based on diagnosis-related groups (DRGs) was instituted by the Health Care Financing Administration (HCFA) in 1984 for Medicare inpatient hospital services in the U.S. Unlike the U.S. Medicare system, the Japanese system is partially prospective payment system for hospital services. The general health insurance program under the age of 65 with the FFS and the Elderly Health Insurance Program (EHIP) for the age of 65 and over has two types: the FFS which is a retrospective cost-based method of reimbursement with the point

system and the CF a prospective reimbursement with the same point system.[3]

Hospital services under the capitation program are four categories: medication; injection; examinations; and inpatient care including nursing care, under the name of managed medical treatment of hospitalization. It is called a managed geriatric hospital. A general geriatric hospital is not under the CF. As the capitation program is its early trial stage, all hospital services are not subject to the program. The Japanese government has not fully implemented capitation, and hospital services other than the above four mentioned service categories are still provided under the FFS with the point system.

ANALYTICAL FRAMEWORK

This section briefly addresses an empirical framework in which our estimations are attempted. Suppose that hospital j makes its revenue per period, Z_j:

$$Z_j = \sum_{i=1}^{n} p_i q_i d_i \qquad (1)$$

where i denotes patient i, and p is a reimbursement system $(p = \theta CAP + (1-\theta)FFS)$, $0 \le \theta \le 1$, which is the weighted sum of capitation (CAP) based reimbursement and fee-for-service (FFS) of cost based reimbursement.[4] q and d denote quality of health care (e.g., amount of medical care per day or intensity per day) and length of treatment

(or hospital) days, respectively. Since the CAP reimbursement is made on the basis of lump sum health care per person per day, this will give a geriatiric hospital an incentive not to provide health care beyond the maximum reimbursement per person per day.[5] Therefore, in our framework, intensity, units of service and length of treatment days play important roles. Quality in our analysis is measured by two types of health care intensity: intensity per day and intensity per treatment.

The intensity of services provided by hospital j to patient i is expressed to be a function of reimbursement system and other factors:

$$g_{d,i,j} = f(p_{i,j},\ d_{i,j},\ g_{t,i,j},\ X_{i,j}), \qquad (2\text{-}1)$$

where g_d, and g_t denote intensity per day and intensity per treatment, respectively. X denotes a vector of relevant factors, which include patient characteristics, severity control measures, resource inputs, hospital characteristics, etc.

The quantity of services provided and length of days are expressed to be a function of reimbursement system and other factors:

$$q_{i,j} = h(p_{i,j},\ g_{d,i,j},\ g_{t,i,j},\ X_{i,j}), \qquad (2\text{-}2)$$

and

$$d_{i,j} = k(p_{i,j},\ g_{d,i,j},\ g_{t,i,j},\ X_{i,j}), \qquad (2\text{-}3).$$

Similarly, the intensity per treatment is

$$g_{t,i,j} = m(p_{i,j},\ q_{i,j},\ g_{d,i,j},\ X_{i,j}), \qquad (2\text{-}4).$$

Hospital j makes its decisions on intensity (per day and per treatment), units or quantity of service and length of days to make its revenues be maximized with lower costs. In addition, hospital services decisions may be generated by the factors and production process, that are influenced by decision-making staff. Therefore, intensity in some underlying production function is embodied in services which are expected to be correlated with each other. Thus, the production endogeneity requires an instrumental variable approach (Breyer, 1987). Newhouse (1994) points out the difficulties in measuring output and adjustment for quality in hospital services.

We estimate a simultaneous-equation model with intensity per day (2-1), units of service (2-2), length of days (2-3) and intensity per treatment (2-4) as jointly dependent variables by incorporating quality related factors. We employ two-stage least squares estimations by using instrument variables, which are estimated in the first stage by patient characteristics, insurance types, hospital characteristics and resource inputs. Our instruments are expected to remove biases, which might be created from omitted variables and simultaneity. For identification purpose we exclude units of service from equation (2-1) and (2-3), and length of days from equations (2-2) and (2-4).

To estimate the effect of capitation on hospital services, we consider the regression analogue to equation 2s:

$$\text{Hospital services}_{j,h} = \alpha_0 + \alpha_1 \text{Capitation}_j + \sum_h \beta_h \text{Hospital service}_{j,h} + X_j\gamma + \varepsilon_{j,h} \quad (3).$$

with the procedure subscripts (i) dropped, h denotes intensity per day, units of service, length of days and intensity per treatment by hospital j. $X_j\gamma$ denotes a vector of patient and hospital related variables that may influence intensity, units of service and length of days. ε_j in (3) is a random disturbance, because there are components of intensity per day, units of service, length of days and intensity per treatment that are affected by unmeasurable factors. For h, length of days is not an intensity of care in our analysis (Hodgkin and McGuire, 1994) and we rather employ the number of procedures performed per day for intensity per day and the number of procedures performed per treatment for intensity per treatment.

The focus of the analysis is on influences of the capitation program on hospital services by considering intensity, i.e. quality of care. Given the available data, we group variables: patient characteristics, severity control measure, resource inputs, and hospital characteristics. The patient characteristics are age, sex, insurance types, duration of hospitalization and disease types. In order to adjust quality of hospitals, we include operation types and frequency of equipment usage as a severity control measure; physicians, nurses and technicians as labor inputs; number of equipment types, types of beds and clinical space as capital inputs;

and hospital owner ship types, emergency hospital for medical treatment and other additional special service provided by a hospital, are included in our estimation. Table 2 contains definition of variables.

DATA

In this study, we use three different survey data. The first is the medical facility survey in 1993 (N=9,896 hospitals), i.e., Iryo Shisetsu Jittai Chosa (Statistic Survey of Medical Facility in English). The second is the hospital employee survey in 1993 (N=9,844 hospitals), i.e., Byoin Houkoku Chosa (Survey of Hospital Report in English). The third is the medical services survey in 1994 (N=311,292 patients), i.e., Shakai Iryo Shinryo Koibetsu Chosa (Survey of Medical Treatments).

We merge the above two survey data of hospitals so as to obtain relevant data for this study and examine three types of hospitals: managed geriatric, general geriatric, and general hospitals. Then, we selected the inpatients as well as outpatients in those hospitals, whose age is 65 and more.

EMPIRICAL RESULTS

CHOICE OF CAPITATION (results of logit procedure)

We first present the results of hospital behavior to choose the capitation program in Table 3. The sample of 546 hospitals

consists of managed geriatric and general geriatric hospitals. By holding constant severity of patient, labor and capital inputs, and hospital characteristics, outpatients (LN-IX541) are more likely admitted by the managed geriatric hospitals, while the negative sign of inpatients (LN-IX542) indicates that inpatients are less likely to be admitted to the managed geriatric hospitals. Put it differently, geriatric hospitals have incentives to apply the capitation program in favor of outpatients, while admitting inpatients under the fee-for-service program.

Although it is theoretically possible for geriatric hospitals to change their emphasis either on inpatient based or outpatient based services, the effect of CF (capitation fee) on admission is theoretically ambiguous. The U.S. PPS (prospective payment system) experiences show that the average severity of cases treated on an inpatient basis increases subsequent to the PPS. Less sick patients are treated in non-CF settings, i.e., outpatient as well as inpatient treatments. Outpatient treatment may increase under non-PPS settings. However, under the capitation program in Japan, less inpatients who require intensity make outpatient care to be a more attractive option.

INFLUENCE OF CAPITATION ON OUTPUT

Our next inquiry here is of the effect of capitaion on output of hospitals; doesn't the capitation program provide financial

incentive to geriatric hospitals? It is of interest to examine whether the Japanese capitation program, i.e., a form of partial prospective payment system, discourages hospitals from participating in the program or reduces their financial risks by participation.

Our quasi output function of points per patient per month (SX19) is estimated by the 2SLS procedure. Table 4-1 presents the results of a sample of patients in the managed geriatric and general geriatric hospitals; Table 4-2 presents those of a sample of managed geriatric and general hospitals. The estimated coefficient of CAP (capitation) in Table 4-1 is statistically significant and positive. This implies that the capitation program increases outputs of an additional 2,150 points per patient in a month in the managed geriatric hospitals, compared to the case of a patient in the general geriatric hospitals. For the sample of managed geriatric and general hospitals, the capitation program raises 706 points per patient in the former relative to the case of the latter.

The positive points show there will be some gains for hospitals to participate in the capitation program. The larger gain in the sample of managed geriatric and general geriatric hospitals than in the sample with general hospitals implies more beneficial for general geriatric hospitals to be in the program than the participation by general hospitals. In another way, acute-care oriented general hospitals produce more points than the long-

term-care oriented general geriatric hospitals per patient per month. The number of patients of the FFS (fee-for-service) plan in the general hospitals is much larger than that covered by the FFS plan in the general geriatric hospitals. Hence, the Japanese government provides geriatric hospitals with financial incentives and encourages them to participate in the capitation program by specializing in the treatment of elderly patients as a managed geriatric hospital.[6]

As interesting remarks, the estimated coefficient of intensity per day (SX1918) as a quality measure is 3.96 in the sample of managed geriatric and general geriatric hospitals in Table 4-1. This value is by about 1.0, though small, higher than the estimate in the sample of managed geriatric and general hospitals (2.85 in Table 4-2). Intensity care for the elderly is, therefore, more valued at the geriatric hospitals than at the general hospitals. That is, the government is providing such incentives to treat elderly patients more at the geriatric hospitals than at the general hospitals.

On the other hand, according to the estimated coefficient of units of services, i.e., quantity of treatment per month (SX23), the estimate (208) for the latter sample in Table 4-2 is larger than that in Table 4-1 (196). On a monthly basis, more treatment may be provided to elderly patients at the general hospitals than at the geriatric hospitals and, hence, the points are higher at

the former.[7]

SIMULTANEOUS ESTIMATION

We estimate a simultaneous-equation model with Intensity per Day (SX1918; equation 2-1 in ANALYTICAL FRAMEWORK), Units of Service (SX23; equation 2-2), Length of Days (SX18; equation 2-3) and Intensity per Treatment (SX1923; equation 2-4), all of which are treated as jointly dependent variables in the 2SLS estimation. In Table 5, we present only their estimated coefficients for the evaluation purpose. The results of (II) and (IV) include the product terms of each of the above four variables times the variable of the capitation program (CAP), while those of (I) and (III) are without the product terms of (x CAP). Since our main concern in this analysis is with the capitation program, we focus mainly on those results of (II) and (IV).

For the impacts of CAP on Intensity per Day in (II), the managed geriatric hospitals provide more intensity per day by 378.91 than the general geriatric hospitals do, but less by -996.61 than the general hospitals in (IV). The results show the robustness of our findings in the logit estimation. The managed geriatric hospitals produce more points due to the incentive scheme of the reimbursement by the government than the fee-for-service oriented general geriatric hospitals. The government policy is to develop the capitation program for health care of the elderly in preparing for

the future aging society. Our results imply that transferring the elderly care from the general hospitals, which specialize in acute care, to the managed geriatric hospital, which emphasize less acute care for the elderly, is a cost containment policy option.

The influence of capitation (CAP) on Intensity per Treatment is also observed a clear-cut difference between (II) of 215.51 and (IV) of 883.42. The similar effects but to different degree are also true with Units of Services and Length of Days. Clearly, one of the major effects of the capitation program is to shift the site of the care from the acute care oriented general hospitals to less technologically and qualitatively oriented geriatric hospitals, especially to the managed geriatric hospitals for the cost containment purpose.

Looking at the influences of Intensity per Treatment with capitation (x CAP) on Intensity per Day in (II) and (IV), we find the negative signs, -4.53 and -6.25, respectively. The respective values when CAP=0 are 4.01 in (II) and 5.22 in (IV). Thus, under the capitation program, there exists a strong substitution between the Intensity per Treatment and Intensity per Day. On the contrary, when the capitation program is not implemented, i.e., under the FFS system, hospitals tend to increase both intensity measures, that will result in higher medical costs to the government (and the society). This observation is confirmed also by the effects of Intensity per Day on Intensity per Treatment: 1.41 and -2.13

in (II) and 0.33 and -1.18 in (IV). All of the marginal effects are negative. Thus, hospitals are not able to easily raise their quality of care, e.g., intensity per treatment, through daily base of intensity because the point system restricts their quality efforts through the capitation program.

The similar inverse relationship exists between Length of Days and Intensity per Day. For example, Length of Days has a negative effect on Intensity per Day (-146.37) in (II), while Intensity per Day also has a negative effect on Length of Days (-0.002). It is quite evident that an increase in resource-intensity reduces the length of treatment days with given level of severity of patients. Conversely, an increased (decreased) length of treatment days is usually assumed to be less (more) financial incentive to raise resource intensity per day under the cost-based fee-for-service program (FFS).

To shed further light on the issue of capitation, we computed elasticities of intensity per day, units of service, length of days and intensity of treatment, that are reported in Table 6. The results we present suggest that in general there are substantial decreases in the various hospital services by introducing the capitation program in general hospitals. An introduction of the capitation program clearly depicts changes from the positive (capitation = 0) to negative signs (capitation = 1) in the sample of managed geriatric and general hospitals in (IV).[8]

For example, one percent increase in intensity per day (capitation = 1) will lower the following services by 0.524% of units of services, 0.915% of length of days, and 1.873% of intensity per treatment. Similarly, one percent increase in intensity per treatment will reduce respective services by 0.466% of intensity per day, 0.647% of units of service, and 0.11% of length of days.

If these above results are applied to the general hospitals, a shift in the management from general hospital settings to managed geriatric hospital settings would lead straightforwardly to a significant reduction in the resource-intensity of hospital services, namely quality of care. All these estimates strongly suggest a decrease in medical care expenditures, and in turn the government health care expenditures.

SUMMARY and POLICY IMPLICATIONS

This research paper investigates the role of the capitation program in a partial transition from the cost-based fee-for-service payment to the prospective payment under the point system of the national health insurance. In particular, the Japanese government have recommended general geriatric hospitals using a fee-for-service payment (FFS) system to become a managed geriatric hospital using a capitation fee (CF) system by providing higher reimbursement levels to the latter. Higher reimbursement levels by the capitation program are expected to encourage an increase

in resource-intensity, namely quality of services, in geriatric hospitals and at the same time to provide more revenue through change in the hospital management from the FFS to the CF.

Understanding hospital behavior is especially important at the current health care financing stage so as to implement a capitation program for the elderly care in Japan. A partial implementation of the capitation program in the transition from the retrospective payment to the prospective payment system anticipates reductions in the hospital health care expenditures of the government, by shifting the elderly care from the acute-care-oriented general hospitals to less equipped but staffed and resource-intensive geriatric hospitals. Our findings in this study show an evidence to reduce inpatient admissions, but to raise outpatient admissions in the non-CF setting of geriatric hospitals.

Because the FFS setting of inpatient treatment provides little financial incentives to the general geriatric hospitals, the government rather generates financial incentives in the CF-setting managed geriatric hospitals. Thus, the capitation program stimulates general geriatric hospitals to become a managed geriatric hospital.

Under the FFS, acute-care-oriented general hospitals favor admitting inpatients. The general hospitals are, however, utilized as a substitute for geriatric hospitals in Japan, which leads to higher health care expenditures. Our finding shows that the current

mixed reimbursement system of the FFS and the CF generates high quality enhancement efforts for the elderly care among managed geriatric hospitals in Japan. In response to the higher level of prospective payment to the managed geriatric hospitals relative to general geriatric hospitals, the former are encouraged to improve their quality of care.

Finally, our results also indicate that the capitation program leads to a substantial decrease in health care services in acute-care general hospitals. Hence, an expansion of the program from the current partial prospective to full prospective payment creates less quality improvement efforts among general hospitals.

An expansion of the capitation program among geriatric hospitals and transferring the elderly care from acute-care-oriented general hospitals to less resource-intensive managed geriatric hospitals will be the viable options for the government cost containment policy.

FOOTNOTES

1 The studies are Desharnaia, Kobrinski, Chesney, Long, Ament and Fleming, 1987; Desharnaia, Chesney and Fleming, 1988; Newhouse and Byrne, 1988; Sloan, Morrisey and Valvona, 1988; Hodgkin and McGuire, 1994; Dor and Farley, 1996; and Kesteloot and Voet, 1998.

2 According to Steinwald and Dummit (1989), the onset of a PPS tends to have an effect on an increase in a case-mix index. A higher value for the index leads to a greater degree of complexity, which is in turn higher medical expenditures per patient with greater input resources.

3 Abe (1983) intensively discusses a lack of strict internal controls by medical service providers, who fail to perform efficiently under the Japanese point system.

4 when $\theta=1$, all medical care provided to patient is subject to the capitation based reimbursement; if $0<\theta<1$, this is called a partial capitation based reimbursement; and if $\theta=0$, then the reimbursement is the FFS. The Japanese capitation program is a form of partial prospective payment system, since not all health care services are subject to the capitation fee even at managed geriatric hospitals.

5 While the capitation based reimbursement is a lump sum payment, the Japanese government gives hansome reimbursement rates to the geriatric hospitals with the capitation program. On the other hand, other geriatric hospitals are to accept low rates of reimbursement because this group does not meet the government requirements on the number of medical staffs as well as facilities.

6 Managed geriatric hospitals are required to meet the regulatory standard of medical law by staffing three physicians per 100 inpatients, one nurse per 6 inpatients and one nursing assistant per 8 inpatients. The requirements at a general hospital are six physicians per 100 inpatients and one nurse per 4 inpatients.

7 The variable of length of days (SX18) is not included as another policy factor in addition to SX23 and SX1918 in the SX19 equation, because of the identity problem.

8 There is one exception of the influence of length of days on intensity per day; the effects are -1.744 (cap=0) and 0.966 (cap=1).

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Table 1
Point System for the Elderly (Health and Medical Care Services)

Type of Service	Points
1. Consultation	
First hospital visit	195
Hospital visit more than once	43
2. Home Care (per month)	2,200
3. * Medication	
Preparation (a/)	1~4
Prescription	24
4. Injection (b/)	15~250
5. Physiotherapy (per day)	
Equals or less than 6 months since the first consultation	
Complicated physiotherapy	500
Simple physiotherapy	170
More than 6 months since the first consultation	
Complicated physiotherapy	460
Simple physiotherapy	150
6. Image diagnosis	
Simple computer tomogram	
Head	800
Body	1,100
Limbs	800
Computer tomogram for cerebral functions	2,300
7. Examination	
Basic examination	
when an admission to a hospital (per month)	60
8. Treatment (per day)	12
9. * Operation	120~80,000
10. * Anesthesia	31~5,100
11. * Radiology	80~10,000
12. Hospital day (per day)	
Basic nursing care	
Less than 6 months since the first consultation	318
More than 6 months since the first consultation	308

Note: * follows the same criteria as one for all other ages.
a/ 1 for a haustus and 4 for an internal medicine.
b/ for example, 15 for hypodermical injection, 120 for a venous injection and 250 for spinal injection.
Source: Department of Insurance, and Department of Health Insurance and Welfare of the Elderly, *Tensu Hyo no Kaishaku 1993* (Interpretation of points table 1993), Tokyo, the Ministry of Health and Welfare, 1993.

Table 2
Definition of Variables

Policy Factors	
CAP	geriatric hospitals with capitation (i.e., managed geriatric hospitals) = 1, otherwise = 0; individuals in managed geriatric hospitals = 1, otherwise = 0.
SX18	length of days: total hospital days per month.
SX19	total points for a patient per month.
SX23	units of service: total number of treatments per month.
SX1918	intensity per day: total points of a patient/hospital days per month.
SX1923	intensity per treatment: total points of a patient/treatments per month.
Patient Characteristics	
IX541	the number of outpatient admissions per month.
IX542	the number of inpatient admissions per month.
SX15D1	sex of patient: male = 1, female = 0.
SX16	age of patient.
IX201D1	general occupational insurance (i.e., employee's health insurance, seamen's insurance, and mutual aid associations insurance) = 1, otherwise = 0.
IX203D1	employee's accident compensation insurance = 1, otherwise = 0.
SX4D2	geriatric medical care = 1, otherwise = 0.
SX6D1	inpatient = 1, otherwise = 0.
SX26D1	length of stay: days between less than a week and a month.
D2	days between more than month and less than three months.
D3	days between more than three months and less than six months.
D4	days between more than six months and less than one year.
D5	days between more than one year and less than one year and a half.
D6	days between more than one year and a half.
CIRCUL	diseases of the circulatory system = 1, otherwise = 0.
MUSCUL	diseases of the musculoskeletal system and connective tissue = 1, otherwise = 0.
DIGEST	diseases of the digestive system = 1, otherwise = 0.
NERVOU	diseases of the nervous system and sense organs = 1, otherwise = 0.
Severity Control Measure	
XX5301	the average number of patients per bed in intensive care unit (ICU) per month.
XX5306	the average number of patients per bed in radiotherapeutics unit per month.
IX4701	the number of general anesthesia per month.
IX4710	the number of operations of os femoris per month.
IX4711	the number of operations of percutaneous transluminal coronary angioplasy per month.
XK4901	the frequency of usage per fiberscope of (upper) digestive tract per week.

(Table 2 continued)

XK4904	the frequency of usage per digital radiography per week.
XK4906	the frequency of usage per general computed tomograph (X-ray CT) per week.
XK4908	the frequency of usage per nuclear magnetic resonator-tomograph (NMR-CT or MRI) per week.
XK4910	the frequency of usage per bone-salt measuring apparatus (or Equipment) per week.
XK4917	the frequency of usage per medical high-energy radiograph (or radiographic equipment) per week.

Labor Inputs

ZX1301	the number of full-time physicians.
ZX1303	the number of pharmacists.
ZX1306	the number of nurses.
ZX1308	the number of associate nurses.
ZX1310	the number of nursing assistants.
ZX1317	the number of radiology technicians.
ZX1319	the number of clinical laboratory technicians.
ZX1322	the number of nutritionists.
ZX1325	the number of clerks.

Capital Inputs

IK4901	the number of fiberscope of (upper) digestive tract.
IK4917	the number of medical high-energy radiograph (or radiographic equipment).
IK4924	the number of renographic dialyzator.
IX131	the number of general beds.
IX141	the number of geriatric beds.
IX222	size of ward in square meters.
IX224	size of clinical section in square meters.
IX225	size of clerical section in square meters.

Hospital Characteristics

IX10D2	hospitals run by prefectural government.
IX10D3	hospitals run by municipal government.
1X10D4	hospitals run by non-profit organization (insurance, union, etc.).
IX10D23	hospitals run by private individual.
IX332D1	emergency hospital for medical care treatment system = 1, otherwise=0.
IX411D1	meal preparation for patients (by outside providers) = 1, otherwise = 0.
IX415D1	cleaning hospitals (by outside providers) = 1, otherwise = 0.

Nursing Care and Other Services

IX5308	the number of patients treated in ergotherapy unit per month.

(Table 2 continued)

IX5309	the number of patients treated in psychiatric ergotherapy unit per month.
IX5311	the number of patients treated in geriatric day-care unit per month.
IX514D1	hospitals practicing vaccination.
IX362	the number of prescriptions issued per week.
Regional Dummy	
IX3D1	district dummy = 1 (Hokkaido and Touhoku), otherwise = 0.
IX3D2	district dummy = 1 (North Kantou), otherwise = 0.
IX3D3	omitted district (East Kantou where includes Tokyo).
IX3D4	district dummy = 1 (Hokuriku), otherwise = 0.
IX3D5	district dummy = 1 (Tokai), otherwise = 0.
IX3D6	district dummy = 1 (Kinki), otherwise = 0.
IX3D7	district dummy = 1 (Chugoku), otherwise = 0.
IX3D8	district dummy = 1 (Shikoku), otherwise = 0.
IX3D9	district dummy = 1 (Kyushu and Okinawa), otherwise = 0.

Table 3
Logit Model of Capitation: Managed Geriatric and General Geriatric Hospitals
Dependent Variable: CAP (Capitation)

Independent Variables	Estimated Coefficients	t-statistic	P-value	$\partial CAP/\partial X$
C	2.126	1.090	[.276]	0.316
Patient Characteristics				
LN-IX541	.2209	1.833	[.067]	0.032
LN-IX542	-1.243	-3.022	[.003]	-0.185
Severity Control				
LN-XX5301	.0677	.3868	[.699]	0.010
LN-IX4701	.9163	2.628	[.009]	0.136
LN-IX4710	-.5007	-.7486	[.454]	-0.074
LN-XK4901	-.2218	-1.459	[.144]	-0.033
LN-XK4904	-.2083	-.7892	[.430]	-0.031
LN-XK4906	-.1271	-1.260	[.208]	-0.018
LN-XK4908	-.1096	-.5475	[.584]	-0.016
LN-XK4910	-.6491	-1.797	[.072]	-0.096
LN-XK4917	-.1841	-.7774	[.437]	-0.027
Labor Inputs				
LN-ZX1301	-.8743	-1.744	[.081]	-0.130
LN-ZX1303	-1.193	-3.765	[.000]	-0.177
LN-ZX1306	1.432	6.052	[.000]	0.213
LN-ZX1308	1.439	3.389	[.001]	0.214
LN-ZX1310	1.834	6.647	[.000]	0.272
LN-ZX1317	-.1144	-.2922	[.770]	-0.017
LN-ZX1319	-.4085	-.9830	[.326]	-0.060
LN-ZX1322	.0621	.1616	[.872]	0.009
LN-ZX1325	.2235	.6925	[.489]	0.033
Capital Inputs				
LN-IK4901	-.6410	-1.883	[.060]	-0.095
LN-IK4917	-1.272	-.9829	[.326]	-0.189
LN-IK4924	-.5825	-2.757	[.006]	-0.086
LN-IX131	.4171	1.297	[.194]	0.062
LN-IX141	-.2715	-1.801	[.072]	-0.040
LN-IX222	-.9622	-2.947	[.003]	-0.143
LN-IX224	.0783	.4232	[.672]	0.011
LN-IX225	-.3273	-2.042	[.041]	-0.048
Hospital Characteristics				
IX10D23	-.3052	-1.171	[.241]	-0.045
IX332D1	.1854	.6224	[.534]	0.027
Nursing Care and Other Services				
LN-IX5308	.0998	1.462	[.144]	0.014
LN-IX5309	.2779	1.894	[.058]	0.041
LN-IX5311	.3959	2.223	[.026]	0.058

LN-IX362	.0444	.6337	[.526]	0.006
Regional Dummies				
IX3D1	.4248	.9742	[.330]	0.063
IX3D2	1.103	1.793	[.073]	0.164
IX3D4	1.017	1.810	[.070]	0.151
IX3D5	.1434	.2961	[.767]	0.021
IX3D6	.8956	2.116	[.034]	0.133
IX3D7	.7008	1.221	[.222]	0.104
IX3D8	1.715	3.144	[.002]	0.255
IX3D9	.6679	1.720	[.085]	0.099

Number of observations = 546
R-squared = .388326
Log likelihood = -249.069
Fraction of Correct Predictions = 0.798535

Note: $\partial CAP/\partial X$ is the marginal effect of independent variable on the dependent variable. LN indicates natural logarithm.

Table 4-1
Two-Stage Least Squares of Points for Patient (SX19):
Managed Geriatric and General Geriatric Hospitals
Dependent Variable: SX19

Independent Variables	Estimated Coefficients	t-statistic	P-value
C	-8026.87	-1.060	[.289]
Policy Factors			
CAP	2150.13	7.418	[.000]
SX23	196.653	3.718	[.000]
SX1918	3.96828	3.651	[.000]
Patient's Characteristics			
SX15D1	9.60492	.0714	[.943]
SX16	-11.2959	-1.163	[.245]
IX201D1	943.591	.6731	[.501]
IX203D1	-201.084	-1.367	[.172]
SX4D2	83.4726	.4372	[.662]
SX6D1	30309.2	4.215	[.000]
SX26D1	2814.37	.3871	[.699]
D2	-17182.4	-15.60	[.000]
D3	1912.36	2.361	[.018]
D4	2803.09	3.475	[.001]
D5	2392.78	3.008	[.003]
D6	3095.30	3.842	[.000]
CIRCUL	352.937	2.519	[.012]
MUSCUL	881.558	3.310	[.001]
DIGEST	145.495	.5634	[.573]
NERVOU	886.275	1.881	[.060]
Severity Control			
XX5301	-13.3843	-1.233	[.217]
IX4701	-18.0271	-1.439	[.150]
IX4710	-34.3375	-.4270	[.669]
IX4711	1477.27	2.146	[.032]
XK4901	-44.0454	-3.233	[.001]
XK4904	-1.96163	-1.070	[.284]
XK4906	5.37186	1.307	[.191]
XK4908	-4.85328	-.5920	[.554]
XK4910	22.1602	1.018	[.308]
XK4917	17.2421	2.980	[.003]
Labor Inputs			
ZX1301	-60.2768	-1.674	[.094]
ZX1303	-3.76024	-.0665	[.947]
ZX1306	48.2786	7.183	[.000]
ZX1308	-15.2641	-1.863	[.062]
ZX1310	26.4927	4.965	[.000]

ZX1317	154.306	1.922	[.055]
ZX1319	-201.873	-4.365	[.000]
ZX1322	79.8457	2.142	[.032]
ZX1325	-38.4582	-2.769	[.006]
Capital Inputs			
IK4901	-171.221	-2.134	[.033]
IK4917	-316.195	-.9179	[.359]
IK4924	8.67803	.6122	[.540]
IX131	4.20721	2.060	[.039]
IX141	-2.66319	-1.547	[.122]
IX222	-.264405	-4.268	[.000]
IX224	-.058870	-.4429	[.658]
IX225	.840E-02	.1159	[.908]
Hospital Characteristics			
IX10D2	838.545	.9431	[.346]
D3	1690.96	2.579	[.010]
D4	-542.234	-1.453	[.146]
IX332D1	234.512	1.768	[.077]
Nursing Care and Other Services			
IX5308	.032587	.2183	[.827]
IX5309	-.940749	-2.028	[.042]
IX5311	1.13512	3.394	[.001]
IX362	1.00328	2.789	[.005]

Number of observations: 16970
R-squared = .833646
Adjusted R-squared = .833115
Std. error of regression = 7107.33

Note: SX23 and SX1918 are endogenous variables. The exogenous variables, which are excluded from the above equation but are included in the first stage equation, are: IX411D1 IX415D1 IX514D1 XX5306 IX3D1 IX3D2 IX3D4 IX3D5 IX3D6 IX3D7 IX3D8 and IX3D9.

Table 4-2
Two-Stage Least Squares of Points for Patient (SX19):
Managed Geriatric and General Hospitals
Dependent Variable: SX19

Independent Variables	Estimated Coefficients	t-statistic	P-value
C	3098.78	.884	[.377]
Policy Factors			
CAP	706.628	3.143	[.002]
SX23	208.959	2.166	[.030]
SX1918	2.85315	2.518	[.012]
Patient's Characteristics			
SX15D1	5.09174	.0351	[.972]
SX16	-15.9828	-1.746	[.081]
IX201D1	1254.69	1.555	[.120]
IX203D1	-268.434	-1.381	[.167]
SX4D2	39.6638	.2493	[.803]
SX6D1	21085.3	10.277	[.000]
SX26D1	-6492.93	-2.243	[.025]
D2	-12055.4	-6.531	[.000]
D3	5471.65	6.744	[.000]
D4	5567.62	6.962	[.000]
D5	4065.51	4.580	[.000]
D6	6072.55	4.792	[.000]
CIRCUL	193.821	1.112	[.266]
MUSCUL	544.687	1.564	[.118]
DIGEST	-556.238	-2.321	[.020]
NERVOU	637.735	1.301	[.193]
Severity Control			
XX5301	-2.27115	-.4165	[.677]
IX4701	-4.42757	-1.622	[.105]
IX4710	-16.4852	-.6592	[.510]
IX4711	1.06867	.0333	[.973]
XK4901	-17.4141	-2.344	[.019]
XK4904	1.20743	1.188	[.235]
XK4906	3.84148	2.255	[.024]
XK4908	-.977509	-.7760	[.438]
XK4910	3.62993	.2221	[.824]
XK4917	-9.10354	-5.138	[.000]
Labor Inputs			
ZX1301	7.79683	2.003	[.045]
ZX1303	-35.0205	-1.107	[.268]
ZX1306	6.42118	2.643	[.008]
ZX1308	-3.61372	-.9942	[.320]
ZX1310	-6.61582	-1.288	[.198]

ZX1317	39.9880	1.061	[.288]
ZX1319	-26.6757	-1.267	[.205]
ZX1322	4.71315	.1798	[.857]
ZX1325	-.407374	-.0655	[.948]
Capital Inputs			
IK4901	-55.5533	-2.867	[.004]
IK4917	346.610	1.507	[.132]
IK4924	22.1655	3.533	[.000]
IX131	.558713	.5475	[.584]
IX141	2.82309	2.418	[.016]
IX222	-.2948E-02	-.0735	[.941]
IX224	.058706	1.929	[.054]
IX225	-.058524	-2.286	[.022]
Hospital Characteristics			
IX10D2	76.1635	.2442	[.807]
D3	-233.696	-1.363	[.173]
D4	363.094	1.843	[.065]
IX332D1	-174.949	-1.484	[.138]
Nursing Care and Other Services			
IX5308	.096482	.7759	[.438]
IX5309	-.966834	-2.948	[.003]
IX5311	1.08592	2.365	[.018]
IX362	.096293	1.178	[.239]

Number of observations: 45643
R-squared = .702739
Adjusted R-squared = .702386
Std. error of regression = 9886.46

Note: SX23 and SX1918 are endogenous variables. The exogenous variables, which are excluded from the above equation but are included in the first stage equation, are: IX411D1 IX415D1 IX514D1 XX5306 IX3D1 IX3D2 IX3D4 IX3D5 IX3D6 IX3D7 IX3D8 and IX3D9.

Table 5
Regression Results: Capitation, Intensity per Day, Units of Service, Length of Days and Intensity per Treatment*

Dependent Variable	Intensity per Day	Units of Service	Length of Days	Intensity per Treatment
(I) Managed geriatric hospitals and General geriatric hospitals				
· Capitation (CAP)	117.79[a]	-1.15[b]	-0.07	299.86[a]
· Intensity per day	---	0.01[a]	-0.001[c]	0.36[c]
· Units of service	---	---	---	-46.82[a]
· Length of days	-27.39[c]	---	---	---
· Intensity per treatment	-0.11[c]	-0.006[a]	0.47E-04	---
(II) Managed geriatric hospitals and General geriatric hospitals				
· Capitation (CAP)	378.91	6.44[c]	0.61	215.51
· Intensity per day	---	0.017[a]	-0.002[c]	1.41[a]
· Units of service	---	---	---	-119.99[a]
· Length of days	-146.37[a]	---	---	---
· Intensity per treatment	4.01[a]	-0.018	0.006	---
· Intensity per day x CAP	---	-0.012[b]	0.001	-2.13[a]
· Units of service x CAP	---	---	---	143.28[b]
· Length of days x CAP	189.63[a]	---	---	---
· Intensity per treatment x CAP	-4.53[a]	0.01	-0.005	---
(III) Managed geriatric hospitals and General hospitals				
· Capitation (CAP)	50.12	1.07[c]	0.11	207.41[a]
· Intensity per day	---	0.004[a]	-0.001[a]	0.004
· Units of service	---	---	---	-19.79[b]
· Length of days	-76.21[b]	---	---	---
· Intensity per treatment	-0.43	-0.01[a]	0.98E-03	---
(IV) Managed geriatric hospitals and General hospitals				
· Capitation (CAP)	-996.61[b]	25.85[a]	9.17[a]	883.42
· Intensity per day	---	0.008[a]	0.9E-04	0.33[c]
· Units of service	---	---	---	-47.37
· Length of days	-311.67[a]	---	---	---
· Intensity per treatment	5.22[a]	0.002	0.006[b]	---
· Intensity per day x CAP	---	-0.01[b]	-0.005[a]	-1.18[c]
· Units of service x CAP	---	---	---	41.03
· Length of days x CAP	484.34[a]	---	---	---
· Intensity per treatment x CAP	-6.25[a]	-0.01[c]	-0.007[a]	---

Note: a, b and c represent statistically significant levels of coefficients as follows: 99% level(a), 95% level(b) and 90% level(c) for a two-tailed test.
* The entire results of the regressions are available upon request.

Table 6
Elasticities: Effects of Capitation
Intensity per Day, Units of Service, Length of Days and
Intensity per Treatment*

Dependent Variable	Intensity per Day	Units of Service	Length of Days	Intensity per Treatment
(II) Managed geriatric hospitals and General geriatric hospitals				
Elasticity with Capitation =0				
· Intensity per day	---	1.230[a]	-0.188[c]	1.579[a]
· Units of service	---	---	---	-1.907[a]
· Length of days	1.624[a]	---	---	---
· Intensity per treatment	3.589[a]	-1.137	0.493	---
Elasticity with Capitation =1				
· Intensity per day	---	0.380[b]	-0.039	-0.811[a]
· Units of service	---	---	---	0.370[b]
· Length of days	0.480[a]	---	---	---
· Intensity per treatment	-0.463[a]	-0.496	0.038	---
(IV) Managed geriatric hospitals and General hospitals				
Elasticity with Capitation =0				
· Intensity per day	---	0.765[a]	0.017	0.747[c]
· Units of service	---	---	---	-1.24
· Length of days	-1.744[a]	---	---	---
· Intensity per treatment	2.354[a]	0.088	0.503[b]	---
Elasticity with Capitation =1				
· Intensity per day	---	-0.524[b]	-0.915[a]	-1.873[c]
· Units of service	---	---	---	-0.163
· Length of days	0.966[a]	---	---	---
· Intensity per treatment	-0.466[a]	-0.647[c]	-0.110[a]	---

Note: a, b and c represent statistically significant levels of coefficients as follows: 99% level(a), 95% level(b) and 90% level(c) for a two-tailed test.
* Elasticities are based on the regression results from groups II and IV in Table 5.