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EFFECTIVENESS OF GOVERNMENT POLICY: AN EXPERIENCE FROM A NATIONAL HEALTH CARE SYSTEM

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ABSTRACT

This paper examines the trade-off between the length of treatment days and the units of service provided per day for elderly patients in the context of the initiative taken by the Ministry of Health and Welfare of Japan to discourage lengthy hospital treatment and/or stay by elderly patients. By using three leading diseases among the elderly in Japan (cancer, heart related disease and mental illness) and separating care utilization into an episode by types of treatment, our results suggest that the government measures function but they do not effectively work to reduce increases in medical expenditures by the elderly under the fee-for-service basis. The evidence shows the interdependency between days and quantity of services, and the larger impact of services on days than days on services. Providers are more able to raise their revenue by additional services, than by additional treatment days, under the government's current cost containment policy toward the elderly care. For the so-called skilled type of treatment services (injection, general treatment, consultation and operation), the results on all elderly ages 65 and over without disease classification show some statistically significant positive impact on length of treatment in days and quantity of services provided per day. For the so-called material type of service (medication and examination), medical service providers are likely to prescribe more drugs as the price of drugs falls under the current strict drug price control by the Japanese government.

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I Introduction

At present, the United States and Japan along with most other industrialized countries are facing an aging society. The percentage of Japanese aged 65 and over is currently 13 percent and is expected to reach 17 percent by the year 2000 and 25 percent by 2025. A recent increase in the aging population significantly affects national medical care expenditures in Japan. Medical care expenditures for the elderly have increased faster than national medical expenditures, and the ratio of these expenditures for the elderly to national medical care expenditures have been constantly rising (Table 1). Elderly receiving medical care services increased 4.0 percent per year on average since the early 1980s.

The rapid increase in medical care expenditures attracts researchers to focus on cost containment strategies (Butler, 1991; Garrison, 1991; Newhouse, 1993). Traditional cost analysis typically focuses on the institutional sector, rather than on episode (Custer, Moser, Musacchio and Willke, 1990; Wedig 1993). It suppresses information on the intensity of utilization of service treatment within an episode. Medical service treatment within an episode can better depict a central measure of cost than in an institutional setting on a sector-by-sector basis. However, an episode of treatment is often defined conceptually as a bundle of services given during a period of continuous contact. In this paper, by separating care utilization into episodes by types of treatment, we will analyze variation of treatments and information, and deduce important policy implications. Furthermore this paper

sheds light on the elderly's medical cost (i.e., medical expenditures) on disease structures with various types of treatments in the national health insurance framework, rather than in an institutional setting at the market sector level. Thus, by controlling for type of episode, the analysis can generate more precise estimates of the cost structures in the aging society.

The objective of this paper is to find a relationship between medical service provisions for the elderly and related national policy. We will assess whether the intention of the Ministry of Health and Welfare, by lowering the reimbursement for the medical care, discourages lengthy hospital stays by elderly people and constrains the quantity of services under the National Health Insurance system in Japan. Thus, we will examine the trade off between length of treatment, and quantity of services provided by medical service providers. In addition, we will also analyze the linkage between the change in the government reimbursement price for types of services, and the so-called skilled types of services (injection, general treatment, consultation and operation) and the material type of services (medication and examination) under Japanese medical pricing system with a fee-for-service basis. The paper analyzes three leading diseases among the elderly: cancer, heart related diseases and mental illness.[1] Cancer and heart related diseases cause the highest rate of death and hospitalization among the elderly in Japan. Mental illness has recently been increasing as life expectancy of elderly people rises and has gradually increased its share of medical expenditures in

Table 2. Medical expenditures on cancer and heart related disease dominate, with expenditures on mental disease being third, along with other diseases such as musculoskeletal and digestive organic diseases for elderly age 65 and over.

The organization of the paper is as follows. Section II presents a brief summary of the historical background of the Japanese medical care system for the elderly. Section III describes the conceptual framework and methodology. The empirical results are presented in Section IV and are followed by the conclusion in Section V.

II Historical Background of Medical Care System for the Elderly

In 1963 the Welfare Law for the Elderly was established to provide physical examinations for elderly people. The Medical Care Expenditure Payment System was enacted in 1973. Its free care system, in which copayments of the elderly were paid by the government, resulted in too frequent medical treatment and caused quick expansion in government expenditures on medical services for the elderly. The average annual percentage change in medical care expenditures was 18 percent until the Health Service System for the Elderly was established in 1983. The previous system also created an imbalance in the burden between the elderly who were covered by Employees' Health Insurance and the Community Based National Insurance. However, the previous system enabled elderly people to have access to medical care services, and provided needed medical care service for them. The present cost-sharing system, health

service system, for the elderly, still presents the imbalance of the burden shared among different health insurers. The present system could reduce the skyrocketing increase in medical expenditures of the elderly experienced since 1983. Currently the elderly bear certain minimal portion of cost with the remaining costs jointly paid by the national (20%), state (5%) and local (5%) governments and the insurers of medical care insurance systems (70%).

The insurance system for the elderly consists of five insurers under government supervision. Government-managed Health Insurance covers employees at place of work (mainly small and medium size enterprises) where no social-managed Health Insurance is established. Social-managed Health Insurance covers employees at places of work (mainly large enterprises and employees in enterprises 300 and over) where Social-managed Health Insurance is established. Seamen's Insurance covers seamen, those on defined vessels. Mutual Aid Associations are national public service employees, local public service employees, and private school teachers and employees. National Insurance covers people who are not covered by employees insurance (farmers, self-employed, carpenters, doctors, employees of small businesses, etc.) and retirees formerly under employees' insurance plus dependents. In 1991 about seventy percent of 15.582 million elderly belonged to National Insurance and eighteen percent of them were general employees under Government-managed Health Insurance. The remaining twelve percent belonged to Social-managed Health Insurance,

Seamen's Insurance and Mutual Aid Associations. Table 3 shows these insurers' recent share of medical care expenditures by the elderly.

Medical service providers follow the reimbursement scheme by the point system which is set by the Ministry of Health and Welfare of Japan. The unified point system is applied to all medical service providers, regardless of the types of health insurance. The role of the point system is to generate enough revenue to cover 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 9 cents assuming one dollar equals 102 yen) under the fee-for-service system. The services consist of thirteen types of treatments: medication, injection, examination, hospital service, general treatment, radiology, mental treatment, anesthesia, basic consultation, home care, image diagnosis, operation and physiotherapy. Table 4 presents the relative importance of different types of service for the elderly in total amount of reimbursement to medical service providers per claim. The share pattern is different for the three types of leading diseases. There is no systematic differences in treatment cost. Hospital services are remarkably important for mental illness patients, followed by heart related disease and cancer. In cancer, injection and hospital services dominate the share. For medication, mental illness and heart related disease have a relatively larger share than cancer. Regarding the reimbursement for skilled type of treatment services (injection,

general treatment, consultation and operation), general treatment and consultation are higher for heart related disease than in the case of cancer, while operation is higher for cancer than heart related disease. In mental illness, skilled types of treatment services (operation and consultation) play a smaller role than general treatment.

Japanese reimbursement price is based on the point system which 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. In these groups there are further classifications. For example an initial consultation is 195 points (1 point=10 yen) and 450 points with referrals; nursing at hospital is 318 points; injection ranges from 15 to 150 points, depending on skill required; medication is 1 point per 15 yen purchasing material price plus prescription which is 74 points per unit. These changes in points are dependent on whether the patients are children, adult or elderly, degree of skill required, quantity of material and patient's length of treatment. The government reimbursement price consists of these complicated pricing classifications on a fee-for-service basis. Abe (1983) intensively analyzes the Japanese point system and discusses a lack of strict internal control by medical service providers who create a failure to perform efficiently. In this study we use a price of each type of service in thirteen classifications of types of services.

III Analytical Framework

For utilization of treatments, medical service providers have dual roles. They act as if they were not only the patient's advisors but also as income optimizers for their own interest. In the latter role, suppose that medical service providers have an incentive for optimizing their target revenue under a fee-for-service basis in a national health insurance system.[2] If they target a certain revenue, there exists a trade off between a length of treatment in days and quantity of services per day within a given target revenue, and they reveal characteristics of treatment within an episode. We note that service utilization not only rises rapidly near the terminal period but also the last days of physician and hospital services have less resource utilization than the first days. It is plausible that a fall in the average length of treatments by the government containment policy may increase the resource intensity per day under the fee-for-service basis. A rise in the amount of reimbursement per day, namely medical care expenditures, depends on the average utilization of services per day and the last day's marginal change in the resource intensity. Thus, we will examine this trade off between treatment days and quantity of services provided and look at different treatments for cancer, heart related disease and mental illness for the elderly. We evaluate how the government reimbursement price affects the length of treatment for a disease and quantity of services provided by hospitals for the elderly, especially the difference between skilled and material services.

A disease requires different types of treatment services within an episode. A cost of each treatment service is reimbursed by the government. In this section we try to conceptualize a relationship between a reimbursement price by the government and medical service providers in a generalized framework.[3] Suppose that a reimbursement price by the government to medical care service providers: P_r, is expressed as,

1 $\quad P_r = P_m \cdot s + P_m \qquad 0 < s < 1,$

where P_m denotes a market price under the competitive market among the health and medical service providers, "s" stands for a subsidy rate by the government, $Pm \cdot s$ is government subsidy through medical service providers. The government subsidy with a fee-for-service system tends to induce medical service providers to provide more medical services to patients and create induced demand for medical service: Q, not quantity demanded (Feldstein, 1993). A choice of medical service is determined by providers, not patients. Providers will be guided by their efficiency and treatment prices which affect their revenue. Under the existing national health care system, current demand curve for health and medical services already stays on the right side of a demand curve, D^{**}, compared to D_0 which is without government involvement in Figure 1. Thus, a one unit increase in demand for health and medical service results in an increase in a price which depends on the slope of supply curve. Each percentage increase in Q that raises the market price of medical service, resulting in a net change in price due to a one unit increase in medical care is expressed as

2 $\partial P_m/\partial Q = 1/Q \cdot P_m \cdot 1/\epsilon$.

An absolute rise in the price ($\partial P_m/\partial Q$) is equal to a medical price per service multiplied by $1/\epsilon$ which is an inverse of an elasticity of supply of medical service. Then, the total price is expressed as, $\partial P_m/\partial Q + P_m$. Japan's point system is itemized pricing with fee-for-service and providers may be encouraged or may generate revenue to cover the total cost. It provides more individualized care and requires different resources for treatment. Thus, the intention of the government's point system is to encourage efficient use of medical resources and it depends on the optimal size of government subsidy which in turn influences revenue of medical service providers. An equilibrium subsidy rate, given a supply of medical service curve, is derived from equations 1 and 2. We obtain

3 $s = (\partial P_m/\partial Q)(1/P_m)$,

where the subsidy rate is a rate of change in P_m with respect to Q. The subsidy rate:s, is e_1e_3/e_3Q_1 with the government subsidy of national health care system in Figure 1. A demand curve D_0 represents the original demand curve without the national health care system, while D^{**} is the current demand curve with the national health care system. The equilibrium point moves from e to e_1. The population currently enjoys a higher level of consumption of medical services at Q_1. The national health care system provides comprehensive health and medical services for the population. It improves health status of people, and in turn extends the amount of time of available to people for daily activities because a decrease in the number of sick days will increase the time available for

socio-economic activities such as work, leisure and others. Thus, the system raises the economic value of human resources and permeates benefits to others through a provision of health and medical services in the society (Grossman 1972a and 1972b). Therefore, the external benefits to others in the society emerges. This quasi-society's benefit is expressed by marginal social benefit curve: MSB, which is marginal social benefits ($MSB=\partial P_m/\partial Q=P_m \cdot s$) in Figure 1.

A government subsidy largely depends on a slope of supply of medical services curve. The current supply curve, namely a marginal cost curve, depends on and is determined by efficient use of medical input resources. Given the government reimbursement price, suppose that a medical service provider has a target at a certain revenue. Let's consider a representative medical service provider whose preferences are generated by the utility function (Wedig, 1993), as

4 $U = U(R), \quad U' > 0$ and $U'' < 0$.

U is the utility derived from a medical service revenue, R. Revenue is an additively separable revenue function and is defined as

5 $R = P_r \cdot Q(Q_1, Q_s)$,

where Q_1 and Q_s are a length of treatment and quantity of services provided, respectively. This separation is theoretically proved by Coyte (1985), and he explicitly discusses medical service providers as utility maximizers. For a dual role assumption, providers act according to a patient's financial and medical interests as decision makers, and also act as their own utility maximizers who

target an optimization of total revenue. A provider's optimized revenue is obtained by differentiating the total revenue with respect to both types of care provided,[4] and we obtain as,

6 $MR = AR_l[\ 1 + (1/\epsilon_{PrQl})] + AR_s[\ 1 + (1/\epsilon_{PrQs})],\ MR \geq 0$

where MR is a marginal revenue, AR is an average revenue of a length of stay:l, and of a quantity of service:s, and ϵ is a government reimbursement price elasticity of a length of stay:ϵ_{PrQl}, and of a quantity of service:ϵ_{PrQs}. Japan's point system, i.e. the government reimbursement price, has an important role for the medical service providers and influences on quantitative decision of medical services. Especially the fee-for-service system induces the providers to perform a dual role. We will analyze the role of the government reimbursement price and its influence on the medical service providers with Japan's point system under the national health insurance framework.

Let's suppose T is a target-revenue margin per unit as mark-ups over cost. It is expressed as follows

7 $T = (P_r - MC)/P_r,$

where MC is the marginal cost of medical service provided, and P_r is the government reimbursement price. A smaller gap between P_r and MC represent a more competitive market (Hoerger, 1990). Therefore T tends to be small. Under an optimal condition from equations 6 and 7, we obtain as,

8 $P_r = AR_l\{[1+(1/\epsilon_{PrQl})]/[1-T]\} + AR_s\{[1+(1/\epsilon_{PrQs})]/[1-T]\}$, and

9 $MSB = \partial P_m/\partial Q = AR_l\{[1+(1/\epsilon_{PrQl})]/[1-T]\} + AR_s\{[1+(1/\epsilon_{PrQs})]/[1-T]\} - P_m.$

The derivation of above approach is in conformity with the

theoretical framework of optimization (Pauly, 1987). Equation 9 presents the following interesting implications in a provision of medical service under the current national health care system. Given an equilibrium quantity of medical services,

(1) An inelastic ϵ_{PrQl} and/or ϵ_{PrQs} means large $1/\epsilon = s \cdot Q$ at the equilibrium level of medical service. It implies that a large subsidy relative to a market price (namely a subsidy rate: s) will be required with an inelastic steep curve. It is shown by e_1e_3/e_3Q_1 with a relatively steep marginal curve: MC^{**} in Figure 1. Hence a medical service provider targets a high level of T because of an increase in the level of P_r with given level of P_m and quantity of medical service. An inelastic MC^{**} requires the government to spend a relatively large amount of subsidy: e_1e_3, to maintain national medical services at Q_1 level, while an elastic marginal cost curve: MC^{*}, requires a lower amount of the government subsidy: e_2e_3 in Figure 1. Put differently, the government reimbursement price is proportionally higher than the market price which does not involve the government in provisions for medical care services. Thus efficiency in producing medical service by providers is important to achieving cost containment policy.

(2) A more elastic MC^{*} of medical service in Figure 1, is implied a small $1/\epsilon = sQ^{*}$ at the equilibrium level of medical service. A small subsidy rate: s, induces medical service providers to target a low rate of T because of a little change in P_r. In this case the reimbursement price is small proportionally and relatively to a market price, in turn the government spending on health and medical

service declines.

(3) A situation of a small gap between T and P_r may force to medical service providers to lower marginal cost:MC, namely more efficient production of medical service.

We have discussed the implication of the government reimbursement price on behavior of targeting revenue by medical service providers. Our concern is that the objective of medical service providers as optimizers is to target a certain level of total revenue under the fee-for-service system. In this case a change in the government reimbursement price affects medical service providers who control quantity of medical care services such as a length of treatment in days and/or number of units of service per day. An assumption of our target revenue hypothesis is that medical service providers maintain their actual total revenue. The following equations derived from equation 8 allows us to analyze precisely how different service treatment affects length of treatment in days and quantity of service provided.

10-1 $\quad Q_l = \theta^{-1}{}_l / Z_{PrQl} - Q_s \phi_{ls} (Z_{PrQs} / Z_{PrQl})$, and

10-2 $\quad Q_s = \theta^{-1}{}_s / Z_{PrQs} - Q_l \phi_{ls} (Z_{PrQl} / Z_{PrQs})$,

where Z_{PrQl} is $[1+(1/\epsilon_{PrQl})]/[1-T]$, Z_{PrQs} is $[1+(1/\epsilon_{PrQs})]/[1-T]$. $\theta^{-1}{}_l$ and $\theta^{-1}{}_s$ are an inversed proportion of a government reimbursement price to revenue from length of stay and to revenue from services respectively, and ϕ_{ls} is a ratio of revenue from length of stays to services. Equations 10s show that Q_l and Q_s are a function of both a length of treatment and a quantity of services, and the government reimbursement price, and Q_l and Q_s are also

simultaneously determined.

To understand the relationship between medical service provision for the elderly and the government's point of view of health care needs among different treatments within an episode, we will investigate the impacts of reimbursement price of various treatment services on length of treatment in days and number of units of service, and examine these relationships regarding an existence of trade off between treatment in days and quantity of services provided per day within an episode. The length of treatment in days and number of units of service treated per day employed within the context of this paper are estimated as,

(A) $DAY = f(SERVICE, PRICE) + \omega_1$,

and

(B) $SERVICE = f(DAY, PRICE) + \omega_2$,

where DAY is length of treatment in days for treatment, SERVICE is number of units of service provided per day, and PRICE which is prices of various treatment received by medical service providers through the health care system represents a unit price for a type of service. The ω in (A) and (B) are stochastic error terms, because there are components of length of treatment in days for treatment and number of units of service per day that are affected by unmeasured factors. To test interdependency between a length of treatment days and quantity of services per day we employ a system of simultaneous equations by a two-stage-least-squares estimation procedure.

IV Empirical results

The data used to estimate the models A and B is based on the Shakai Iryo Shiryo Koibetsu Chosa Houkoku 1989-1991 which is based on aggregated monthly financial report in June for each year and is compiled by the Ministry of Health and Welfare. This aggregate data contains thirteen disease classifications, for which we choose the three leading types of diseases (48 observations for cancer, 54 for heart related disease and 48 for mental illness) and all elderly people without disease classification (120 observations). The data contains thirteen types of treatment services with number of claims, services and the amount of government reimbursement. The data does not classify male and female difference regarding length of treatment in days and units of service provided. We integrate two important health insurances (Government-managed Health Insurance and National Insurance) and age classification of 65-69 and 70- into the estimation of all elderly people without disease classification. But we are not able to integrate these variables for the estimation of each disease (cancer, heart relate disease and mental illness) because of inadequate data regarding disease classification among the elderly in this publicly open data. Thus, the study on all elderly people examines the effect of the National Insurance and the Government-managed Health Insurance on medical service providers' behavior for the care of elderly by using a dummy variable along with an age dummy variable without disease classification. The data does not contain information about providers' and patients' characteristics. Thus, we await the

availability of micro-level data to the public to get further insight.

Table 5 presents the definition of variables. Means and standard deviation are reported in Tables 6 (three leading diseases among the elderly) and 7 (all elderly people aged 65 and over without disease classification). Tables 8 (three leading diseases among the elderly) and 9 (all elderly people aged 65 and over without disease classification) present the result of estimated effects of reimbursement prices on number of days of treatment and units service per day. We employ various government reimbursement prices as exogenous variables with controlling quantity measures: an amount of services and length of treatment in days. Regarding medical-service quality control as Fahs (1985) discusses medical services by physicians, this study has difficulty in controlling for quality measures because of the characteristics of data. The use of conditional indexes for the detection of multicollinearity is required. The results of conditional indexes are less than 5.5 and variance of inflation factors are less than 4. We conclude that there exists no harmful multicollinearity problem. The equation for cancer (Table 8) is overidentified. The equations for heart related disease (Table 8), mental illness (Table 8) and all elderly people (Table 9) are identified. And, we examined the rank and order of conditions for all of them. The conditions of all four equations are satisfied. As an appropriate estimation procedure we employ two-stage least squares, and Tables 8 and 9 report estimation results as elasticity term[5].

The coefficients of primary interest (treatment days and services) are statistically significant for cancer, heart related disease and mental illness, and all of them are negative in Table 8. The results seem to be consistent with our prior hypothesis, i.e. inverse relationship between services and treatment days. In cancer a 1 percent increase in services will lead to a 1.515 percent decrease in days, while a 1 percent increase in treatment days will lead to a 0.426 percent decrease in services per day. For cancer treatment, the marginal impact of units of service per day on treatment in days is a net change of 17,150 yen ($168.14) for medical service providers and the marginal impact of treatment days on services per day is 3,634 yen ($35.63).[6] Put differently, the providers gain more revenue by increasing units of services, rather than by increasing treatment days for patients. Because the impact of services is greater than the impact of induced change in a treatment day. If the providers increase per day treatment, they lose revenue, and vice versa. Again the impact of per day treatment is smaller than the impact of induced change in per day services. Under the fee-for-service system the medical service providers are easily able to raise quantity of services to treat elderly patients. However, the objective of the Ministry of Health of Welfare which is to discourage a lengthy stay of an elderly patient by lowering reimbursement price is functioning. This causes the providers to loose their revenue by the lower reimbursement price, when the length of treatment in days for the elderly patients rises regardless of a change in controlled days or

of an induced day change. But the results show that the medical providers would not lose by increasing additional services because positive net gain is about 13,516 (17,150-3,634) yen per day, when the quantity of services rises regardless of a change in controlled services or of an induced services change. For the Ministry of Health and Welfare to rein lengthy hospital stays by the elderly patients, this empirical study finds that the shorter the hospital stay of an elderly patient, the larger the amount of additional services. Our results show that the government objective effectively functions. However the medical expenditures by the government for the elderly patients do not decline under the fee-for-service system in the national health insurance framework. In addition the quantity of services is a larger influence on cost saving than on treatment days from the view of the government.

In comparison to cancer, in the case of heart related disease, the estimated coefficient of treatment days is less elastic while that of services is more elastic. A 1 percent increase in services will tend to lower treatment days by a 0.9776 percent, and a 1 percent increase in the days will lower quantity of services by a 0.5375 percent. It is also notable that the impact of services on treatment days contributes 17,047 yen ($167.13) which is very similar to the amount in the case of cancer, while impact of days on services contributes only 7,516 yen ($73.69) which is however twice as large in the cancer case. An increase in services for heart related disease will again raise medical cost, by a large amount, namely, expenditures of the government (directly), and

consumers (indirectly through taxation). This is because in spite of the inverse relationship between days and services, an increase in the amount of government reimbursement by the medical providers raising the amount of services dominates the amount of the government reimbursement caused by a decline in treatment days for elderly patients. For mental illness, although the gain is small amount of 833 yen ($8.17), the result of mental illness also leads the similar conclusion.

In Table 9 the results of negative sign presents the inverse relationship between treatment days and amount of services provided per day for all elderly patients. The effect of services on days has a larger impact than that of days on services. Under the fee-for-service system in the national health insurance, medical service providers may easily raise their revenue through additional services, not by additional treatment days. Our results provide evidence for this important result, however further careful empirical testing is necessary to generalize the inverse relationship,namely trade off, between treatment days and quantity of services provided, and to measure the initiative taken by the Ministry of Health and Welfare of Japan regarding the lengthy hospital stays by the elderly patients.

Turning attention to the effect of government reimbursement price on treatment days and services, we do not examine all thirteen types of treatments in the same manner for three types of diseases because physiotherapy is close to zero and less important for cancer but not for heart related disease as Table 4 shows.

Mental treatment is almost zero share for the heart related disease. The radiology services are almost zero for the heart related disease and mental illness in our data sources. In both cancer and heart related disease our interesting finding from the results in Table 8 is that material types of service treatments, such as R.medication and R.examination, show negative signs and are statistically significant while skilled type service treatments, such as R.consultation, R.operation, R.injection, R.physiotherapy and R.treatment(general), are positively and statistically significant except R.treatment variable for cancer.

In cancer and heart related disease in Table 8 material types of R.medication and R.examination are negative. It is interesting to note that the negative signs for R.medication and R.examination are not congruent with alleged statement of excessive drugs and diagnostic examinations by the Japanese medical service providers. For example a 1 percent increase in R.medication will lower a 0.1787 percent for cancer days and a 0.4443 percent of days for heart related disease. In R.examination a 1 percent increase in the government reimbursement price will lower 0.168 percent days for cancer and 0.3819 percent days for heart related disease.

Unlike cancer and heart related disease the results of mental illness show that R.medication as material type of service treatment tends to have lengthy hospital stays and additional service treatments. This seems to reflect the characteristics of the illness. A 1 percent rise in R.medication will increase a 0.3975 percent of days and a 0.2449 percent of services for mental

illness patients. These results are different from cancer and heart related disease. The results of R.mental (mental treatment) and R.consultation (skilled type of service) indicate the negative relationship between reimbursement price, and treatment days and services. A change in government reimbursement price does not reveal a systematic effect of skilled and material types of services on the length of treatment and quantity of services provided per day. However distinction seems to exist between cancer and heart related disease, and mental illness. Another note-worthy finding is that the estimated coefficients in Table 9 indicate that skilled types of services (injection, general treatment, consultation and operation) tend to show statistically significant positive sign. And again the coefficient of R.medication shows the negative sign. From this result we may deduce that the current strict drug price control by the government induces the medical service providers to prescribe more drugs for elderly patients as the price declines (Newhouse, 1993).

Most of the estimated elasticities of the government reimbursement price are inelastic except R.radiology for cancer and R.hospital for days of heart related disease. Put differently, length of treatments and quantity of services provided per day are insensitive to the government reimbursement price regardless of qualitative signs. As for positive case, an increase in the government reimbursement price will present incentive to medical service providers to induce more specific types of service treatment, say physiotherapy, to the elderly patients of heart

related disease. A large increase in the government reimbursement price will be required to increase the treatment of physiotherapy to cover needs for elderly patients. As for negative case, a large decrease in the government reimbursement price has a small impact on a change in quantity, and the government is able to reduce a large amount of health and medical care expenditure on material type of service treatments, such as medication and diagnostic examination, by reducing the government reimbursement price.

The National Insurance and the Government-managed Health Insurance cover about 88% of the elderly people under the National Health Insurance System. The result of Insurance.D in Table 9 indicates the medical service providers treat the patient of National Insurance with fewer treatment days (about 1.1 days at the sample mean) and quantity of services per day (about 1.4 units at the sample mean) compared to those of the Government-managed Health Insurance. It is alleged that people under the community based National Insurance, i.e. farmers, self-employed and employees of small business, are inferior in health status than those of the employee based Government-managed Health Insurance. If it is true, our result is not congruent with adduced statement. Because the length of treatment and quantity of services are provided more to the Government-managed Health Insurance patients. Further careful empirical study is necessary to test the allegation. The positive Age.D in Table 9 suggests that longer treatment days is attributed to an increase in age. The elderly age 70 and over are treated about one day longer than the elderly age 65-69 at the sample mean.

Regarding the effect on quantity of service provided per day, it is positive but weak.

We are interested in the costs of these three types of leading diseases in Japan and we have a proximity of loss of economic indirect cost (loss of own earning) and direct health and medical cost by the elderly age 65 and over in 1991.[7] In cancer for a month, economic indirect costs are about 5.59 billion yen ($54.8 million: $1=102yen), and health and medical costs are about 68.201 billion yen ($668.6 million). In heart related disease for a month, economic indirect costs are 30.86 billion yen ($302.5 million), and health and medical costs are 257.497 billion yen ($2.524 billion). In mental illness for a month, economic indirect costs are 0.46 billion yen ($4.5 million), and health and medical costs are 26.43 billion yen ($259 million). We note that summing these figures still underestimates total loss of costs caused by three leading diseases of the elderly age 65 and over. For comparison purpose, we tentatively calculate and compare it with the gross national product in 1991. The total cost of three leading diseases: 4,668.456 billion yen ($45.77 billion), is about 0.3 percent of the gross national product in 1991.

V. Conclusion

This paper examines the trade off between the length of treatment in days and units of service provided per day for elderly patients in the context of the initiative taken by the Ministry of Health and Welfare of Japan to discourage lengthy

hospital treatment and/or stay by the elderly patients. By separating disease care utilization into an episode by types of treatment, our results suggest that the government measures function but it does not effectively work to reduce increasing medical expenditures by the elderly under the fee-for-service basis in the National Health Care system. The evidence of the three leading diseases (cancer, heart related disease and mental illness) by the elderly shows the interdependency between days and quantity of services and the larger impact of services on days than days on services. The medical service providers are easily able to raise their revenue by additional services, not by additional treatment days, under the government current cost containment policy toward the elderly care.

The skilled type of treatment services (injection, general treatment, consultation and operation) do not show clear distinction among types of disease as prices of service change. However, the results from all elderly age 65 and over without disease classification show some statistically significant positive impact by skilled types of service treatments on length of treatment in days and quantity of services provided per day. The material type of treatment service (medication and examination) have a negative effect on the length of treatment in days and quantity of services in cancer and heart related disease, but positive effect in mental illness. We find that our results are not congruent with alleged excessive drug and diagnostic examination by the medical service providers. However, they are

likely to prescribe more drugs as the price of drugs fall under the current strict drug price control by the Japanese government. Our result also indicates that the elderly patients under the community based National Insurance receive shorter length of treatment in days and quantity of services per day than the patients under the employee based Government-managed Health Insurance. These results suggest further careful study to assess the government measures, i.e. the objective by the Ministry of Health and Welfare to reduce the lengthy hospital treatment and/or stay by the elderly patients.

It is interesting to note that length of treatment in days and units service per day are not very responsive to changes in the government reimbursement prices. The results indicate that large health care expenditures are generally required to expand each type of treatment to promote health status for the elderly in Japan. These leading diseases by the elderly: cancer, heart related disease and mental illness, cost about 0.3 percent of the GNP in 1991 although the figure is proximity of loss of indirect- and direct costs by the elderly age 65 and over.

FOOTNOTES

1. In this paper heart related disease means ischemic heart disease, hypertensive disease and cerebrovascular disease within the circulatory system.

2. The meaning of target revenue by medical providers in this study is different from "target income hypothesis of physician pricing" which suggests that with an increase in the number of physicians, physicians will increase both their prices and their demand to provide themselves with a target income. Note there are three other types of hypotheses of hospital behavior which are different from our context: (1) a profit maximizing model which assumes that a nonprofit hospital acts as though it were a for-profit hospital but returns its profit to the community; (2) a utility maximizing model assumes that hospitals act as if they wanted to maximize their output or revenue, and they invest either in additional capacity, cost-saving technology or facilities in order to increase output or revenue; (3) a physician-control model assumes that physicians are the beneficiaries of nonprofit hospitals and the model suggests that with increased demand for medical services in the community, physicians would favor an increase in their hospitals' capacity so as to increase their productivity which in turn increases their incomes.

3. The results obtained by Coyte (1985) do not differ from a distinction made between hospital managers (entrepreneurs) and the specialists (i.e. physicians) employed. In Japan physicians are heavily involved in decision making in hospitals. In this study medical services providers mean both physicians and hospitals.

4. The revenue function is an additively separable function. There exists substitution between the length of treatment and quantity service provided, and the revenue from both cares are additive. Instead of factoring out P as usual procedure, P is

multiplied by Q/Q in order to obtain AR.

5. Kmenta (1986) and Green (1993) intensively discuss the conditional requirements to perform the simultaneous equations. The model of equations should be identified. In the model of simultaneous equation in this study, the order condition of identifiability and the rank condition were examined. And both conditions are satisfied. The instrumental variables which we use are variables of reimbursement prices, total claims per month, total government reimbursement of medication, operation, hospital, image diagnosis, home services, examination, treatment, physiotherapy, anesthesia and mental special treatment.

6. The calculation is based on Tables 8 and 10 as,
a) an impact of services on treatment days = [coefficient of services(=elasticity) x (mean of day/mean of services) x amount of per day government reimbursement] - [amount of the government reimbursement per unit x mean of per day units services].
b) an impact of treatment days on services = [coefficient of days (=elasticity) x (mean of services/mean of days) x amount of the government reimbursement per unit x mean of per day units services] - amount of per day government reimbursement.

We use an exchange rate $1=102 yen in this paper. Readers are required to be cautious of interpretation because we do not use "purchasing power parity" for this simple estimation.

7. Because of data availability we have not estimated the loss of complete direct and indirect costs, such as care giver's market opportunity costs, patients' waiting time, and expenditures of elderly in nursing homes which are in the very early stages in Japan. Waiting time costs by patients,especially in Japan, is an important factor in ascessing loss of human time (Yamada and Yamada, 1993), and Feldstein (1988) intensively discuss time costs for traveling to a provider and for waiting for treatment. The calculation is based on average labor force participation for men

and women age 65 and over considering full- and part-time workers, and average monthly salary for men and women is based on the assumption that they are full-time workers and these cancer, heart related disease and mental illness patients are healthy. The sources come from Kokumin Iryohi (National Medical Expenditure in English), Department of Statistics and Information, Minister's Secretariat, Ministry of Health and Welfare, 1993; Shakai Iryo Shiryo Koibetsu Chosa Houkoku, Vol.1 and 2, Department of Statistics and Information, Minister's Secretariat, Ministry of Health and Welfare, 1991 and 1993. Rodo Hakusho of 1991 (White Paper of Labor), The Department of Labor; Kokumin Fukushi no Doko (The Trend of National Welfare in English), 1993, The Health and Welfare Statistics Association; Kanja Chosa of 1990 (Patients Survey), Department of Statistics and Information, Minister's Secretariat, Ministry of Health and Welfare; and Kokumin Iryohi (National Health and Medical Expenditures in English), Department of Statistics and Information, Minister's Secretariat, Ministry of Health and Welfare, 1993.

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TABLE 1
Trends in Medical Care Expenditures

Year	National Medical Care Expenditures		Medical Care Expenditures for the Elderly				
	billion yen (A)	% change	billion yen (B)	% change	per elderly person 1000(yen)	% change	(A)/(B)
1986	17,069.0	6.6	4,437.7	9.1	523	4.9	26.0
1987	18,075.9	5.9	4,830.9	8.9	549	4.9	26.7
1988	18,755.4	3.8	5,159.3	6.8	568	3.5	27.5
1989	19,729.0	5.2	5,557.8	7.7	594	4.5	28.2
1990	20,607.4	4.5	5,926.9	6.6	609	2.6	28.8
1991	21,826.0	5.9	6,409.5	8.1	634	4.1	29.4

Sources: Hoken to Nenkin no Doko, Health and Welfare Statistics Association, Vol.40, Tokyo, 1993; Shakai Hosho Tokei Nenpo 1991, Sorifu Shakai Hoshoseido Shingikai Jimukyoku, Tokyo, 1993; Outline of Social Insurance in Japan, Social Insurance Agency, Tokyo, 1993.

TABLE 2
Expenditure Share of Three Leading Disease in Total Expenditures of Age 65 and over

Year	Expenditures age 65 & over	share		
		cancer	heart related disease	mental
1986	3,315.2 billion yen	12.9 %	38.2 %	5.8%
1987	3,544.7	13.4	38.7	6.0
1988	3,676.6	13.5	38.8	6.2
1989	3,897.2	13.8	38.0	6.4
1990	4,126.0	15.0	39.6	6.1
1991	4,272.4	14.0	38.9	6.3

Sources: Kokumin Iryohi (National Medical Expenditure in English), Department of Statistics and Information, Minister's Secretariat, Ministry of Health and Welfare, 1993; Shakai Iryo Shiryo Koibetsu Chosa Houkoku, Vol.1 and 2, Department of Statistics and Information, Minister's Secretariat, Ministry of Health and Welfare, 1991 and 1993.

TABLE 3

The Share of Medical Care Expenditures by Health Insurance for the Elderly

Year	1986	1987	1988	1989	1990	1991
Expenditures (billion yen)	4,437.7	4,830.9	5,159.3	5,55.78	5,926.9	6,409.5
	%	%	%	%	%	%
Government level	29.5	29.0	28.9	29.0	29.0	29.2
National	19.6	19.3	19.3	19.3	19.3	19.5
State	4.9	4.8	4.8	4.8	4.8	4.9
Local	4.9	4.8	4.8	4.8	4.8	4.9
Insurer	68.7	67.6	67.7	67.7	67.7	67.5
GMHI	15.2	17.8	18.1	18.7	19.9	20.2
SMHI	11.8	15.3	15.6	15.7	17.0	17.0
SEA	0.3	0.3	0.3	0.3	0.2	0.2
MAA	5.4	6.4	6.3	6.2	6.5	6.4
NI	36.1	27.7	27.4	26.8	24.2	23.8
Patients	1.8	3.4	3.4	3.3	3.3	3.3

Note: GMHI stands for Government-managed Health Insurance, SMHI stands for Social-managed Health Insurance, SEA stands for Semen's Insurance, MAA stands for Mutual Aid Associations, and NI stands for National Insurance.

Sources: Hoken to Nenkin no Doko, Health and Welfare Statistics Association, Vol.40, Tokyo, 1993; Shakai Hosho Tokei Nenpo 1991, Sorifu Shakai Hoshoseido Shingikai Jimukyoku, Tokyo, 1993; Outline of Social Insurance in Japan, Social Insurance Agency, Tokyo, 1993.

TABLE 4

Elderly's Expenditures for the Share by Types of Services provided Elderly age 65 and over under the Law of Elderly Health Insurance

	Cancer	Heart related disease	Mental
amount per claim	410,713 yen	324,372 yen	272,193 yen
US$ ($1=102)	$4,027	$3,180	$2,669
Medication	9.4 %	10.9 %	11.1 %
Injection	20.6	11.6	4.6
Examination	9.5	7.6	3.7
Hospital day	41.2	56.4	67.0
General treatment	2.9	4.1	2.4
Mental treatment	0.2	0.0	1.6
Consultation	1.4	1.6	0.9
Home care	0.2	0.2	0.2
Image diagnosis	7.8	2.9	7.8
Operation	4.6	2.1	0.1
Physiotherapy	0.1	2.4	0.5
Other	2.1	0.2	0.1
	100.0	100.0	100.0

Note: Radiology and anesthesia are included in "Other" in this statistics.

Sources: Shakai Iryo Shiryo Koibetsu Chosa Houkoku 1991, Vol.1 and 2, Department of Statistics and Information, Minister's Secretariat, Ministry of Health and Welfare.

TABLE 5 Definition of Variables (types of services provided)

Days
A number of hospital treatment days per claims by a monthly financial statements.

Service
A number of units service per day.

R.medication
Reimbursement price of medication (yen). It includes internal medicine, dose of medicine, eternal medicine, preparation, and others.

R.injection
Reimbursement price of injection (yen). It includes fee for injection skill, medicine, materials, and others.

R.examination
Reimbursement price of examination (yen). It includes physical test, excrement test, blood test, biochemistry test, immunity test, somatic test, supersonic-wave test, ophthalmology exam, endoscopy, and others.

R.hospital (day)
Reimbursement price of hospital day (yen). It includes room, standard bed and bedclothes, nurse, serious illness, food, special management, and others.

R.treatment(general)
Reimbursement price of general treatment (yen). It includes general treatment, first aid treatment, dermatology, bladder treatment, uterus treatment, ophthalmology treatment, otolaryngology treatment, and other.

R.radiology
Reimbursement price of radiology (yen). It includes external and internal X-ray, and others.

R.mental
Reimbursement price of mental treatment (yen). It includes standard mental analysis, counseling, group therapy, night care and special dementia treatment.

R.anesthesia
Reimbursement price of anesthesia (yen). It includes vein, spinal cord, nervous system, and others.

R.consultation
Reimbursement price of consultation (yen). It includes first visit, revisit, medical management of chronic disease, medical management for elderly outpatient, guidance, and others.

R.home care
Reimbursement price of home care (yen). It includes medical examination and treatment of home care, medical guidance and nurse for bedridden elderly, medical treatment and guidance at home, and others.

TABLE 5 (continued)

R.image
Reimbursement price of image diagnosis (yen). It includes X-rayed diagnosis, special photographing, endoradiography photographing, computer tomogram, diagnosis of nucleus medical science, and others.

R.operation
Reimbursement price of operation (yen). It includes skin transplantation, muscle, nervous system, operation related to ophthalmology, operation related to otolaryngology, breast, chest, heart, stomach, and others.

R.physiotherapy
Reimbursement price of physiotherapy (yen). It includes phototherapy, actinotherapy, exercise therapy, electric therapy, speech therapy, special treatment for mental illness, and others.

Additional Definition of Variables for the Regression of the Elderly aged 65 and over without Illness Classification in Table 9

R.other
Reimbursement price of unclassified other medical services (yen).

Insurance.D
This is a dummy variable taking the value 0 for the Government-managed Health Insurance and 1 for the National Health Insurance.

Age.D
This is a dummy variable taking the value 0 for aged 65-69 and 1 for 70 and over.

Year.D
This is the dummy variable taking the value 0 for 1989 and 1 for 1990.

TABLE 6 Means and Standard Deviations
Three Leading disease among the Elderly (types of services provided)

	(Cancer)		(Hart related disease)		(Mental)	
	Means	STD	Means	STD	Means	STD
Days	11.054	8.751	13.166	10.302	25.948	54.923
Services	16.200	9.176	15.220	8.349	13.813	9.988
R.medication	369.829	204.897	213.172	49.345	205.580	68.331
R.injection	3183.066	1906.896	2071.454	1688.130	1412.031	817.274
R.examination	1057.466	216.753	1029.911	272.608	996.605	467.112
R.hospital (day)	8766.978	606.686	7482.867	705.792	6481.897	366.222
R.treatment (general)	1026.213	858.393	651.279	336.629	590.664	262.951
R.radiology	6327.170	499.048	-	-	-	-
R.mental	1937.284	1655.428	1864.230	1031.630	1674.047	849.350
R.anesthesia	17228.133	23085.464	11284.948	23330.654	2375.719	11360.245
R.consultation	2489.464	1550.551	1851.387	934.337	1685.254	926.854
R.home care	16784.957	14059.880	8850.228	13000.875	5966.409	3245.110
R.image	2611.760	1456.625	2150.908	1429.790	2331.425	2191.047
R.operation	38901.746	79057.808	36796.437	45834.239	241151.728	1094730.332
R.physiotherapy	1077.120	606.979	1080.397	390.066	918.650	355.339
Observation	48 for cancer		54 for heart related disease		48 for mental	

Note: R.radiology is a reimbursement price of radiology treatment. We dropped it from a mean calculation for heart related disease and mental illness because of inadequate observations.

TABLE 7 Means and Standard Deviations
All Elderly People (types of services provided)

	Means	STD
Days	4.785	1.934
Services	12.043	3.833
R.medication	217.856	63.339
R.injection	1861.758	1332.885
R.examination	950.507	711.265
R.hospital (day)	7791.703	855.600
R.treatment (general)	1211.162	2363.208
R.radiology	5356.541	1308.562
R.mental	1464.497	597.003
R.anesthesia	12803.715	21868.148
R.consultation	910.339	149.053
R.home care	7133.511	8029.191
R.image	1565.738	1179.037
R.operation	24369.945	18348.212
R.physiotherapy	996.325	3471.255
R.other	644.239	56.167
Observation	120	120

TABLE 8 Estimated Coefficients
Three Leading Disease among the Elderly (types of services provided)

	Cancer		Heart related disease		Mental	
	Days	Services	Days	Services	Days	Services
Services	-1.5145a		-0.9776a		-1.3024a	
	(-9.94)		(-4.26)		(-10.68)	
Days		-0.4258a		-0.5357a		-0.7133a
		(-4.99)		(-5.18)		(-10.43)
R.medication	-0.1787b	-0.0561	-0.4443b	-0.2127c	0.3975a	0.2449b
	(-2.09)	(-1.10)	(-2.56)	(-1.81)	(3.52)	(2.70)
R.injection	-0.0383	0.0053	0.1958b	0.0105	0.0790	-0.0364
	(-0.85)	(0.20)	(2.18)	(0.17)	(0.45)	(-0.27)
R.examination	-0.1680b	-0.1021b	-0.3819c	0.0752	0.1742	0.0943
	(-2.53)	(-2.72)	(-1.71)	(0.51)	(0.78)	(0.55)
R.hospital	0.5766	0.6938c	-1.379b	-0.3833	0.4837	0.5672
(day)	(0.94)	(1.77)	(-2.60)	(-1.02)	(0.40)	(0.57)
R.treatment	-0.1116b	-0.0942a	0.1992a	0.0875b	-0.0057	0.0505
(general)	(-2.64)	(-4.10)	(3.29)	(2.03)	(-0.09)	(0.63)
R.radiology	-2.969a	-1.5153b	-	-	-	-
	(-3.02)	(-2.61)				
R.mental	-0.1720b	-0.0777c	-	-	-0.7555a	-0.5784b
	(-2.53)	(-2.00)			(-2.79)	(-2.18)
R.anesthesia	-0.0271	-0.0235	-	-	-	-
	(-1.06)	(-1.68)				
R.consultation	-	-0.0961	0.7279a	-0.0168	-0.5419c	-0.3844c
		(-0.71)	(3.25)	(-0.09)	(-2.01)	(-1.85)
R.home care	0.2202a	-	-0.1167c	-	-0.2365	-0.2640
	(2.79)		(-2.00)		(-1.32)	(-1.35)
R.image	-	-0.0834c	-	-0.0220	-0.0221	0.0105
		(-1.69)		(-0.37)	(-0.20)	(0.11)
R.operation	0.0767c	-	0.0340	-0.0169	-0.0614c	-
	(1.71)		(0.91)	(-0.75)	(-1.70)	
R.physiotherapy	-	-	0.2405b	0.1509b	-	-0.2153
			(2.13)	(2.11)		(-0.67)
Constant	28.577a	14.182b	12.883b	6.532b	9.428	7.537
	(2.92)	(2.44)	(2.63)	(2.03)	(0.87)	(0.95)
R^2	0.950	0.94	0.96	0.95	0.93	0.91
F statistics	81.57a	65.17a	143.34a	112.03a	58.31a	41.70a

t-statistics are in parentheses.
a, b and c are statistically significant at the 1%, 5% and 10% level, respectively.

TABLE 9 Estimated Coefficients
All Elderly People Age 65 and over (types of services provided)

	Days		Services	
Services	-0.7787b	(-2.49)		
Days			-0.2496b	(-2.37)
R.medication	-0.2450	(-1.05)	-0.5124a	(-5.77)
R.injection	0.1683b	(2.36)	-0.0164	(-0.36)
R.examination	0.5231b	(2.36)	0.4338a	(3.99)
R.hospital (day)	-0.7406c	(-1.91)	0.0559	(0.23)
R.treatment (general)	0.1158b	(2.10)	0.1050a	(4.05)
R.radiology	0.1346c	(1.86)	0.0834b	(2.09)
R.mental	0.0280	(0.33)	-0.0274	(-0.58)
R.anesthesia	-0.0009	(-0.04)	0.0015	(0.12)
R.consultation	-0.3083	(-0.95)	0.3203c	(1.67)
R.home care	-0.1853	(-1.31)	-	
R.image	0.0338	(0.42)	0.0808c	(1.78)
R.operation	0.0680	(1.25)	0.0969a	(3.66)
R.physiotherapy	-0.3161b	(-2.21)	-0.2238a	(-3.13)
R.other	-		0.0849	(0.12)
Insurance.D	-0.2264b	(-2.11)	-0.1129c	(-1.83)
Age.D	0.1961a	(2.68)	0.0696	(1.55)
Year.D	0.2914b	(2.47)	0.0967	(1.05)
Constant	9.2611b	(2.49)	-1.7466	(-0.39)
R^2	0.42		0.68	
F statistics	4.42a		12.85a	

t-statistics are in parentheses. a, b and c are statistically significant at the 1%, 5% and 10% level, respectively.

TABLE 10 Amount of Reimbursement for the Elderly Care

	Cancer		Heart related disease		Mental	
	1989 (yen)	1991 (yen)	1989 (yen)	1991 (yen)	1989 (yen)	1991 (yen)
Per day	19,627	19,919	12,382	12,320	8,801	8,831
Per claim	398,298	376,562	303,190	302,496	254,887	254,797
Unit service	2,375	2,330	1,640	1,660	1,729	1,624

Sources: Kokumin Iryohi (National Health and Medical Expenditures in English), Department of Statistics and Information, Minister's Secretariat, Ministry of Health and Welfare, 1993; Shakai Iryo Shiryo Koibetsu Chosa Houkoku, Vol.1 and 2, Department of Statistics and Information, Minister's Secretariat, Ministry of Health and Welfare, 1991 and 1993.

FIGURE 1 MEDICAL SERVICE