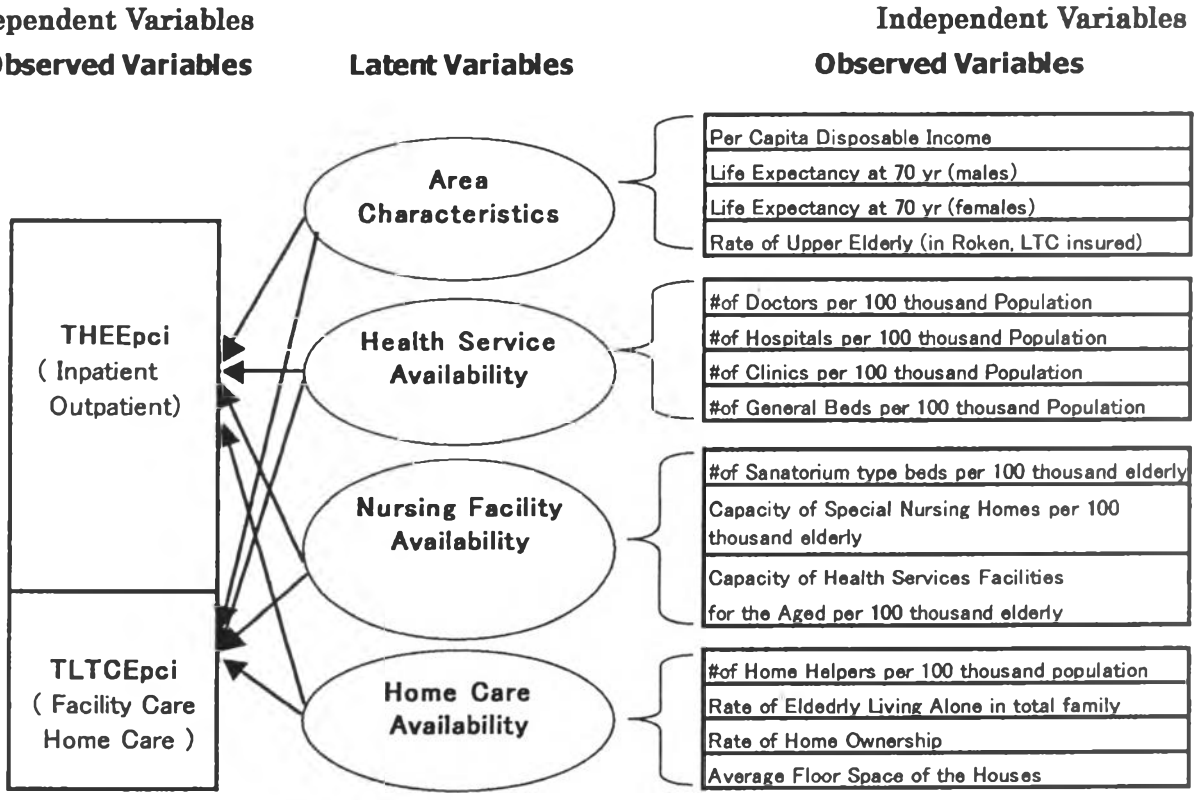
CHAPTER 4

RESEARCH METHODOLOGY

4.1 Conceptual Framework

Frail elderly had been taken care from their family before the achievement of the universal coverage of health insurance. Hospital admission rate has been increased since 1973, because the co-payment for elderly became free in that year. It created the problem "Social Hospitalization[28]". Home helpers and nursing facilities has been developed according to the Gold Plan and New Gold Plan[29]. The implementation of LTC insurance accelerated the stream. In this study, I will measure the effect of 15 variables upon the THEE and TLTCE by using four latent variables such as health service availability, nursing facility availability, home care availability, and area characteristics amongst 47 prefectures.

Figure 4.1 Conceptual Framework



[28] Unnecessary hospitalization, induced by the lack of nursing facilities, nuclear family, the difference of co-payment between hospitals and private financed nursing facilities.
[29] National 10 year program for promoting home care and nursing facilities, which started in 1989.

4.2 Operational Definitions of the Term

Social Hospitalization (Shakaiteki Nyuin)

Social Hospitalization is a hospitalization because of a family problem, financial problem and so on, rather than because of the need of health care services. It requires considerably more cost than care at nursing facilities or at home (Japan Medical Plan, 2001). In addition, these patients negatively affect the availability of hospital space to meet the needs of patients who truly need health care. Furthermore, the quality of life at hospitals is less that at home or at nursing facilities. For instance, the average area available for patient use is small and there are some time constraints to meet with their family or friends in the hospital. Therefore, it is important to reduce Social Hospitalization for efficient resource use. The government has been trying to increase home care and nursing facility care since 1989.

4.3 Data Processing

4.3.1 Data Sources

A single cross section of 47 prefectures in Japan in 2000 was used as the unit of analysis in this study. Currently, panel data analysis is the mainstream in the study of international comparison of the Total Health Expenditure[30]. However, panel data analysis[31] requires the stability of the system. There is also a barrier to study panel data analysis, because some data are not collected every year. Therefore the results of the panel data analysis were not so different as those of cross section studies (Innami and Hori 2002). Therefore cross section analysis is used in internal country comparison study. The basic statistics have mainly been compiled from Secondary data from Ministry of Health, Labour and Welfare and from Statistics Bureau (Ministry of Public Management, Home Affairs, Posts and Telecommunications). With regard to area characteristics, "Minryoku" year book published by the Asahi Newspaper Company will be used as a source of secondary data in this study. All independent variables are transformed into the standardized data, because it enables to compare the variables with different unit.

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[30] For instance, Hitiris and Posnett 1992, Roberts 1999,

[31] Panel data analysis is a study mixed with the cross sectional analysis and time series analysis.

4.3.2 Procedures

1. Firstly, make correlation matrix and check the possibility of multicollinearity. Make a multiple regression model. The estimation was restricted to a logarithmic form (double-log form) because Gerdtham and Jonsson (1991b) reported that, based on Box-Cox transformation framework analysis, the logarithmic transformation was the most adequate in the context of cross-country analysis. Calculate the multiple regressions using stepwise method.

2. Secondly, to compare the difference between the higher health status group and the lower health status group, classify the prefectures into two groups: above the average life expectancy at 70 years of age[32], and below the average life expectancy at 70 years of age for both genders, and test the significance of the difference of means between each two groups. Run the OLS using the two-grouped data. Then compare the difference of the determinants of THEE and TLTCE between two groups.

[32] The average life expenditure at the age of 70 was calculated by the weighted average method according to the ratio of male and female of elderly aged 70 or over in each prefecture.

4.3.3 Formulae of OLS Models

Formulae

(a) All Prefectural Models:

THEE $Y_1 = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}, X_{14}, X_{15a*}) + \varepsilon$ ..... (1)

IP $Y_2 = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}, X_{14}, X_{15a*}) + \varepsilon$ ..... (2)

OP $Y_3 = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}, X_{14}, X_{15a*}) + \varepsilon$ ..... (3)

TLTCE $Y_4 = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}, X_{14}, X_{15b**}) + \varepsilon$ ..... (4)

NC $Y_5 = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}, X_{14}, X_{15b**}) + \varepsilon$ ..... (5)

HC $Y_6 = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}, X_{14}, X_{15b**}) + \varepsilon$ ..... (6)

(b) Two-grouped Models:

THEE H $Y_7 = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}, X_{14}, X_{15a*}) + \varepsilon$ ..... (7)

THEE L $Y_8 = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}, X_{14}, X_{15a*}) + \varepsilon$ ..... (8)

IP H $Y_9 = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}, X_{14}, X_{15a*}) + \varepsilon$ ..... (9)

IP L $Y_{10} = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}, X_{14}, X_{15a*}) + \varepsilon$ .....(10)

OP H $Y_{11} = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}, X_{14}, X_{15a*}) + \varepsilon$ .....(11)

OP L $Y_{12} = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}, X_{14}, X_{15a*}) + \varepsilon$ .....(12)

TLTCE H $Y_{13} = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}, X_{14}, X_{15b**}) + \varepsilon$ .....(13)

TLTCE L $Y_{14} = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}, X_{14}, X_{15b**}) + \varepsilon$ .....(14)

NC H $Y_{15} = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}, X_{14}, X_{15b**}) + \varepsilon$ .....(15)

NC L $Y_{16} = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}, X_{14}, X_{15b**}) + \varepsilon$ .....(16)

HC H $Y_{17} = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}, X_{14}, X_{15b**}) + \varepsilon$ .....(17)

HC L $Y_{18} = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}, X_{14}, X_{15b**}) + \varepsilon$ .....(18)

Prefectures were classified into two groups from the following criterion. The criterion to separate the prefectures is the mean of the life expectancy at 70 years of age (20.60 year, higher group 23 prefectures: lower group 24 prefectures).

Notice: Variable 15a* means the percentage of upper elderly (75 years or over) amongst Roken Eligible while variable 15b** means the percentage of upper elderly amongst LTC Insured, because the population of Roken eligible citizens and LTC Insured are different.

4.4 Definition of Variables

In this study, six dependent variables and fifteen independent variables were used for the estimation. The independent variables were classified into four categories: Health Service Availability, Nursing Facility Availability, Home Care Availability and Area Characteristics. All variables were transferred into logarithmic form. Detailed information are described in the Table 4.1 and the following explanation.

Table 4.1 Summary of the Variables Used in This Study

Variables	Expression	Definition	Unit of Measurement***	Source of the Data	Expected Sign of Each Coefficients					
					THEE			TLTCE		
					THEE	IP	OP	TLTC	NC	HC
Y* 1	THEE	Total Health Expenditure for Elderly	per capita, (Thousand Yen)	MoHLW						
Y 2	IP	Expenditure for Inpatient Care	per capita, (Thousand Yen)	MoHLW						
Y 3	OP	Expenditure for Outpatient Care	per capita, (Thousand Yen)	MoHLW						
Y 4	TLTCE	Total Long-term Care Expenditure	per capita, (Thousand Yen)	MoHLW						
Y 5	NC	Expenditure for Care at Nursing Facilities	per capita, (Thousand Yen)	MoHLW						
Y 6	HC	Expenditure for Home Care	per capita, (Thousand Yen)	MoHLW						
Health Services Availability										
X** 1	DOC	# of doctors	Per 100 thousand population	MoHLW	+	+	+	+	+	+
X 2	CLINIC	# of clinics	Per 100 thousand population	MoHLW	+	+	+	+	+	+
X 3	HOSP	# of hospitals	Per 100 thousand population	MoHLW	+	+	+	+	+	+
X 4	BED	# of general beds	Per 100 thousand population	MoHLW	+	+	+	+	+	+
Nursing Facility Availability										
X 5	SANATO	# of sanatorium type beds	Per 100 thousand elderly (65yr or over) populations	MoHLW	+	+	+/-	+	+	+/-
X 6	HSF	Capacity of Health Services Facilities for the Aged	Per 100 thousand elderly (65yr or over) populations	MoHLW	-	-	+/-	+	+	+/-
X 7	SNH	Capacity of Special Nursing Homes	Per 100 thousand elderly (65yr or over) populations	MoHLW	-	-	+/-	+	+	+/-
Home Care Availability										
X 8	HMHELP	# of Home Helpers	Per 100 thousand population	Statistics Bureau	-	-	-	-	-	+
X 9	ELDALO	Rate of elderly living alone	Per total # of families	Statistics Bureau	+	+	+	+	+	-
X 10	HMOWN	Rate of home ownership	Per total # of families	Statistics Bureau	-	-	-	-	-	+
X 11	FLOOR	Average floor space of the houses	Per family	Statistics Bureau	-	-	-	-	-	+
Area Characteristics										
X 12	INCOME	Average disposable income	Per capita	Statistics Bureau	+/-	+/-	+/-	+/-	+/-	+/-
X 13	LIFEMA	Life expectancy at 70 years of age (males)	Years	MoHLW	-	-	-	-	-	-
X 14	LIFEFE	Life expectancy at 70 years of age (females)	Years	MoHLW	+	+	+	+	+	+
X 15 (a)	UPEL70	Rate of Upper Elderly (75yr or over) in Roken eligible citizens(70yr or over)	Percent in elderly population	MoHLW	+	+	+	+	+	+
X 15 (b)	UPEL65	Rate of Upper Elderly (75yr or over) inLTC Insured (65yr or over)	Percent in elderly population	MoHLW	+	+	+	+	+	+

* Dependent Variables

** Independent Variables

*** All numbers are data in each prefecture

4.4.1 Dependent Variables:

There were six dependent variables used in this model. These were: Health Expenditure for Elderly, inpatient care expenditure, outpatient care expenditure, total long-term care expenditure, long-term care expenditure at nursing facilities and long-term care expenditure at home. Detailed information is described in the Table 4.1 and as follows:

Y1: THEE (Total Health Expenditure for Elderly)
Y2: IP (Expenditure for Inpatient Care), Y3: OP (Expenditure for Outpatient Care)

Total Health Expenditure for Elderly is expenditure for the elderly (people 70 years or over and bedridden people 65 years or over), covered by the public Health Insurance scheme. It does not contain the expenditures which are not covered by the public Health Insurance[33]. Expenditures covered by public assistance[34] were also excluded from the Total Health Expenditure for Elderly. In this study, expenditure for inpatient care and expenditure for outpatient care were also used as dependent variables as well as Total Health Expenditure for Elderly. The fiscal year for the Total Health Expenditure for Elderly begins March 1 and end February 28 (29).

Y4: TLTCE (Total Long-term Care Expenditure)
Y5: NC (Expenditure for Care at Nursing Facilities), Y6: HC (Expenditure for Home Care)

Total Long-term Care Expenditure is an expenditure which is covered by the public Long-term Care insurance scheme for the elderly aged 65 or over and people aged 40 – 64 who suffer from elderly diseases such as dementia. The expenditure is divided into two categories: (1) Expenditure for care at nursing facilities including sanatorium type beds in hospitals and clinics, Special Nursing Homes and Health Services Facilities for the Aged (2) Expenditure for home care. Unpaid care by family members was excluded. Expenditures covered by public assistance were also excluded. The fiscal year for the Long-term Care Expenditure begins March 1 and ends February 28 (29). The fiscal year 2000 included eleven months, since the Long-term Care Insurance was implemented in April 2000.

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[33] For instance, extra charge for private room, organ transplantation etc.
[34] The population covered by public assistance was less than one percent of total population in 2000.

4.4.2 Independent Variables:

(a) Health Service Availability

X1 DOC (# of doctors per 100 thousand population)

It represents the access to the health care and long-term care, therefore the expected sign of all coefficients are positive. According to the various previous studies (Mori and Miyake 1988, Iizuka 1990) the sign of the coefficient is positive. The number is divided by the total population in each prefecture, because all generation utilize doctor's service.

X2 CLINIC (# of clinics per 100 thousand population)

The number of clinic is divided by the total population in each prefecture, because all generation utilize clinic services. This variable represents an access to outpatient care services, therefore the expected sign for outpatient care expenditure is positive. According to the path analysis conducted by Innami (1997), the path coefficients of clinic factors are negative to inpatient expenditure. He reasoned that when the availability of clinic service is higher, utilization of outpatient care would increase. It results in a decrease in the share of inpatient care in THEE. However, his recent study (Innami and Hori 2002) showed the opposite results, i.e. the path coefficient of clinic factors were positive for both inpatient care expenditure and outpatient care expenditure. One possible cause for this could be the result is that if the utilization of outpatient care increase, the utilization of inpatient care also increase because some of the inpatient admission is referred through clinics. The years in which data are gathered are different between two studies. It could be the effect of the change in referral rates for inpatient care by the government policy. MoHLW has been promoting the establishment of a referral system recently.

X3 HOSP (# of hospitals per 100 thousand population)

It represents the access to the health care and long-term care, therefore the expected sign of all coefficients are positive. According to Innami (1997), the hospital factors are positively correlated with THEE. The number is divided by the total population in each prefecture, because all generation utilize hospital services.

X4 BED (# of general beds per 100 thousand population)

It represents the access to the health care and long-term care, therefore the expected sign of all coefficients are positive. According to Mori and Miyake (1988), the number of hospital beds was positively correlated with THEE.

(b) Nursing Facility Availability

X5 SANATO (# of sanatorium type beds per 100 thousand elderly population)

It represents the access to nursing facilities. Currently, however, both Health Insurance and Long-term Care Insurance cover this type of facilities. Therefore the expected sign of both inpatient care expenditure and long-term care expenditure at nursing facilities are positive. Up to now, there are no studies which use the number of sanatorium type beds as a explanatory variable for Total Health Expenditure for Elderly and Total Long-term Care Expenditure.

X6 HSF (Capacity of Health Services Facilities per 100 thousand elderly population)

It represents the access to nursing facilities. Therefore, the sign of long-term care expenditure at nursing facilities is positive, while the sign of inpatient care expenditure is negative, because nursing homes and hospitals are substitute for Socially Hospitalized patients. According to Mori and Miyake (1988), capacity of special nursing homes was positively correlated with THEE but it was not significant. According to the path analysis conducted by Innami (1997), Health Service Facilities had a positive correlation with Total Health Expenditure for Elderly. Logically, the availability of special nursing homes, which substitute for inpatient care, has been considered to decrease the THEE. However, if availability of special nursing homes does not meet the demand yet, these facilities tend to establish at areas that have more demand for inpatient care. This makes the relationship between special nursing homes and Total Health Expenditure for Elderly as a spurious correlation.

X7 SNH (Capacity of Special Nursing Homes per 100 thousand elderly population)

It represents the access to the nursing facility same as the variable for Health Service Facilities for the aged. Therefore, the sign of long-term care expenditure at nursing facilities is

positive, while the sign of Inpatient Care expenditure is negative. Because nursing homes and hospitals are substitute. According to Mori and Miyake (1988), capacity of special nursing homes was positively correlated with Total Health Expenditure for Elderly but it was not significant. According to the path analysis conducted by Innami (1997), it had also positive correlation with the Total Health Expenditure for Elderly. Logically, the availability of special nursing home, which substitutes for inpatient care, has been considered to decrease Total Health Expenditure for Elderly. However, if availability of special nursing homes does not meet the demand yet, these facilities tend to establish at the areas that have more demand for inpatient care. That is, the relationship between special nursing homes and Total Health Expenditure was spurious correlation.

(c) Home Care Availability

X8 HMHELP (# of home helpers per 100 thousand Population)

It represents the availability of home care. Therefore the expected sign for home care expenditure is positive. However, home care substitutes the care at hospitals and the expected sign for inpatient care expenditure is negative. It does not affect to the outpatient care services. The number is divided by 100 thousand population, because home helpers serves for younger generation as well as elderly.

X9 ELDALO (Rate of elderly living alone amongst total number of families)

It represents the unavailability of home care. Therefore the expected sign for home care is negative. However, unavailability of home care leads the patients to utilize more hospitalization or long-term care at nursing facilities, therefore, the expected sign for inpatient care expenditure and long-term care at nursing facilities are positive. It does not affect to the outpatient care expenditure.

X10 HMOWN (Rate of home ownership)

It affects the availability of home care indirectly, because LTC insured can utilize the home improvement expenditure for barrier free. Therefore, the expected sign for home care expenditure positive. However, home care substitutes the care at hospitals for Socially Hospitalized patients. Therefore, the expected sign for inpatient care expenditure is negative. It

does not affect to outpatient care expenditure. According to Mori and Miyake (1988), the rate of home ownership and Total Health Expenditure for Elderly were negatively correlated.

X11 FLOOR (Average floor space in the house)

It represents the availability of home care. Therefore the expected sign for home care expenditure is positive. However, home care substitutes for care for Socially Hospitalized patients and the expected sign for inpatient care expenditure is negative. It does not affect the outpatient care expenditure. According to Mori and Miyake (1988), average floor space in the house is negatively correlated with THEE, whereas Iizuka reported that the relationship in both variables were positive in Hokkaido prefecture.

(d) Area Characteristics

X12 INCOME (Average disposable income per capita)

It represents the ability to pay for health and LTC expenditure, so the expected sign would be positive. However, there are ceiling for both expenditure, the coefficient might be very small. Newhouse (1977) found the chief determinants of the increase of total health expenditure as income (GDP) when compared internationally, per capita total health expenditure is higher in the rural low-income area According to Mori and Miyake (1988), per capita income in each prefecture was positively correlated with Total Health Expenditure for Elderly .

X13 LIFEMA, X14 LIFEFE (Life expectancy at 70 years of age for males for females)

As a proxy of health status in each prefecture, life expectancy at birth has often been used in the previous studies. However, life expectancy at birth is affected by the IMR. Therefore, life expectancy for both males and females at 70 years of age was used for this study. This represents the health status for elderly in each prefecture, so the expected sign is negative for both THEE and TLTCE. Generally speaking, females live longer than males. Therefore, the expected sign of male life expectancy is negative for inpatient care expenditure, because this reduces the amount of time that females (their wives) live alone. On the other hand, the expected sign of female life expectancy is positive, because it prolongs the time that females live alone.

X15(a) UPEL 70 (Rate of upper elderly (75 yr or over) in Roken eligible citizens(70 yr or over)
X15(b) UPEL 65 (Rate of upper elderly (75 yr or over) in LTC insureds (65yr or over)

In the previous studies, the aging rate amongst the whole population has been often used as the proxy of aging in each region. However, if the aging rate is higher in some regions, the denominator is also higher. Therefore it might not reflect the actual effect of aging. Therefore, the aging rate in elderly population is used in this study. This represents the age structure of elderly population in each prefecture, so the expected sign is positive for both THEE and TLTCE. If the percentage of upper elderly (75 years old or over) is higher in one prefecture, the THEE or TLTCE per capita is also higher.

4.5 Hypotheses

1. When hospital service availability is increased, THEE of inpatient and outpatient would be increased. TLTCE would not be changed, ceteris paribus.

2. Ceteris paribus, when nursing facilities availability is increased, TLTCE of nursing facility would be increased. However, THEE of inpatient care would be decreased, because the patients of social hospitalization shift from hospitals to nursing facilities. THEE of outpatient care and TLTCE of home care would not change.

3. Ceteris paribus, when the availability of home care is increased, THEE of inpatient care and TLTCE of nursing facility would be decreased. Because inpatient care by social hospitalization will be replaced to home care. THEE of outpatient would not be changed.