An Analysis of the Length of Hospital Stay for Cataract Patients in Japan

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EXTENDED ABSTRACT

The number of cataract patients in Japan has also been increasing rapidly with the ageing of the population. According to the surveys of the Ministry of the Health, Labor and Welfare, the number of cataract patients was 1.29 million in 2002 and the number of cataract operations in the month of June was 33,286 in 1995, 61,117 in 2000, and 65,864 in 2002. This implies that nearly 1 million cataract surgeries are performed annually. Cataract patients in Japan remain in the hospital for a long period after undergoing an operation. As a result, analyses of the length of hospital stays have become very important.

In this paper, the length of hospital stay is analyzed using data pertaining to patients hospitalized for cataract and related diseases (Diagnosis Related Groups (DRG) 2041) in Japan. DRG were developed in the United States in the 1970s. These groups categorize combinations of diseases, operations, and treatments into groups based on International Classification of Diseases (ICD) 9 or 10. We utilize the data pertaining to 4,151 patients on whom one-eye lens operations were performed. The variables that may affect the length of stay are analyzed by the discrete-type proportional hazard model.

Estimates of the Child and Other Facility Dummies are negative and significant. These variables affect the leaving rate and the length of stay. With regard to the type of operations and treatments, the estimates of dummy variables are negative and significant at the 1% level, except for those of “Mechanical phacofragmentation and other aspiration of cataract” (International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) 13.43) and “Other extracapsular extraction of lens” (ICD-9-CM13.59). It has been determined that the leaving rates reduce and the length of stay becomes longer for the abovementioned operations as compared with the case of “Phacoemulsification and aspiration of cataract” (ICD-9-CM13.41). We also found large differences in the length of stay among hospitals despite eliminating the influence of both the characteristics of the patient and the types of operation and treatment. The longest average length of stay is over 3 times as long as the shortest average length of stay.

Finally, we analyzed the factors pertaining to hospitals that may affect the lengths of stay. The estimates of Profit and Cold Region Dummy are negative and significant; in other words, the leaving rate reduces and the length of stay becomes longer if the hospital becomes more profitable and is located in the cold regions of Hokkaido and Tohoku.

The results of analysis strongly suggest that in order to reduce the length of stay there is a necessity for improvement in the Medical Service Fee Schedule, such as introducing the Prospective Payment System (PPS), where a hospital is paid a fixed fee regardless of the length of stay. For this purpose, it is necessary for us to analyze the data after introduction of the Diagnosis Procedure Combination (DPC) system, system in a future study. The results of this study also suggest the possibility of reducing the length of stay by providing suitable means of transportation to and from the hospital in the winter season in cold regions.

1. Introduction

With medical care expenses having rapidly expanded, shortening the average length of stay in hospitals by reducing incidences of long-term hospitalization has become an important political issue in Japan. The requisite average length of stay in general hospitals was shortened by the Revision of Medical Service Fee Schedule, which was implemented in April 2002. It was important to evaluate the length of hospital stay in order to consider future medical policies, such as medical-care payments.

Recently, numerous eye surgeries, such as those for cataract, have been performed worldwide. For example, approximately 1.5 million cataract surgeries have been performed annually in the United States (Schein et al. 2000). It has also been reported that with the ageing of the population the number of such surgeries has been increasing in Sweden and other countries (Lundström et al. 2001 and 2002).

The number of cataract patients in Japan has also been increasing rapidly with the ageing of the population. According to the surveys of the Ministry of the Health, Labor and Welfare, the number of cataract patients was 1.29 million in 2002 and the number of cataract operations in the month of June was 33,286 in 1995, 61,117 in 2000, and 65,864 in 2002. This implies that nearly 1 million cataract surgeries are performed annually. In the United States and Europe, a majority of the cataract surgeries are outpatient; in other words, patients are discharged from the hospital in 1 day.

On the other hand, cataract patients in Japan remain in the hospital for a long period after undergoing an operation. As a result, analyses of the length of hospital stays have become very important. Under the Diagnosis Procedure Combination (DPC) system, the daily payment to the hospital is 2,661 points for up to 2 days, 2,140 points for between 3 to 6 days, 1,819 points for between 7 to 12 days, and for over 12 days it is based on the actual expense (the medical care fee is measured by points in Japan; this system was introduced in 1943, and 10 yen per point has been paid to hospitals since 1958). A longer length of stay causes the medical expense to increase. If the average length of stay for cataract patients can be reduced by 1 day, the total medical expense of the country could decrease by as much as 20 billion yen. However, a sufficient number of analyses on the length of stay have not been conducted thus far.

In this paper, the length of hospital stay is analyzed using data pertaining to patients that have been hospitalized for cataract. We utilize the data pertaining to 4,151 patients hospitalized for cataract and related diseases on whom one-eye lens operations were performed. The discrete-type proportional hazard model is used in the analysis.

2. Data

2.1 Surveyed Hospitals

In this paper, we utilized the data set collected from 36 general hospitals (Hp1–36) in Japan. These hospitals were part of "The Project for Information Standardization and System Developments for Efficient Hospital Management." The items surveyed for hospitals are number of beds, financial data, number of doctors and nurses, lease, prices and depreciation costs of medical appliances, and the number of new and total patients. The dates of admission and discharge from the hospital, dates of birth, sex, placement after hospitalization, names of principle and secondary diseases, and types of medical operation and treatment are reported for patients. In order to protect the privacy of individual patients, we utilized only a general data set. The names of principle and secondary diseases are based on the International Classification of Diseases 9 (ICD-9) or ICD-10 and the type of operations and treatment is based on the International Classification of Diseases, 9^{th} Revision, Clinical Modification (ICD-9-CM).

In this study, we analyzed the data pertaining to patients classified in the 2041 category of the Diagnosis Related Groups (DRG 2041) - those patients that underwent lens operation without complication. DRG were developed in the United States in the 1970s. These groups categorize combinations of diseases, operations, and treatments into groups based on ICD-9 or ICD-10. In this survey, the International Refined Diagnosis Related Groups (IR-DRG) is used (hereafter referred to simply as DRG.). The patients belonging to this group were hospitalized for cataract (and related diseases) and underwent lens operations from April 2000 to March 2001. The type of operation and treatment was reported using the ICD-9-CM. In order to eliminate patients who were hospitalized for other diseases and also underwent lens operations, we only utilized the data of patients who underwent the operation and treatment classified in categories 13 (operations on lens) and 14 (operations on retina, choroid, vitreous, and posterior chamber). We did not utilize data pertaining to patients who underwent any operation and treatment in other categories.

Unlike in other countries, in Japan, in addition to the one-eye operation (a single eye of the patient is operated in a single period of hospitalization) the two-eye operation (both eyes of the patient are operated in a single period of hospitalization) is also performed. It is natural that the two-eye operation requires a patient to remain hospitalized for a longer period of time. Therefore, we utilized data pertaining to only those patients who underwent one-eye operations. Since 11 hospitals from among

36 did not perform these operations, we analyzed the data pertaining to 25 general hospitals (Hp1–3, 5–8, 13, 15, 17–24, 26–32, and 36). The average number of beds, doctors, and total patients during the period were 575, 90, and 190,417, respectively. The hospitals were located as follows: 7 in the Hokkaido and Tohoku region, 2 in the Kanto region, 7 in the Hokuriku and Tokai region, 5 in the Kinki region, 1 in the Chugoku region, 1 in the Shikoku region, 1 in the Kyushu region, and 1 in Okinawa.

The managerial organizations related to the hospitals are as follows: 5 local governments; 4 mutual-aid associations; 3 Red Cross; and 13 medical associations, corporations, and other organizations. The total number of patients who underwent the one-eye operation was 4,151.

2.2 Length of Stay

The summaries of the length of hospital stay (number of days stayed) is presented in Figure 1. For all patients, the average length of stay is 7.29, the standard deviation is 8.10, the skewness is 21.72, the kurtosis is 857.99, the minimum is 1, the median is 4.0, and the maximum is 357. The maximum average length of stay by hospital is 11.56 (Hp18) and the minimum is 3.52 (Hp20). The skewness and kurtosis values are large. In other words, the distributions are rather different from the normal distribution, and the large skewness values imply that there are patients that are staying in the hospital for long periods of time.

2.3 Explanatory Variables

In this paper, we select variables that represent i) characteristics of patients, ii) types of operation and treatment, and iii) influence of hospitals as explanatory variables. The variables that represent the characteristics of the patient are age, sex, and place of stay after hospitalization. With regard to the age, the average is 72.03, the standard deviation is 10.64, the skewness is –1.278, the kurtosis is 3.903, the minimum is 2, the median is 73, and the maximum is 96 for all patients. The minimum average age by hospital is 66.03 and the maximum is 76.48. Females represent 60.1% of all patients; in this respect, the minimum is 36.9% and the maximum is 80.0% by hospital. 98.05% of the patients returned home, 1.40% went to other hospitals, and 0.55% went to other (non-hospital) facilities post-hospitalization. All patients that were discharged from 18 hospitals returned home.

The type of operation and medical treatment is classified according to the ICD-9-CM. The ICD-9-CM classifies the operation and treatment by codes up to 4 digits from general to detailed categories. For example, 13 represents "Operations on lens," 13.1 is "Intracapsular extraction of lens," and 13.11 more specifically represents "Intracapsular extraction of lens by temporal inferior route." In this paper, we select "Intracapsular extraction of lens by temporal inferior route" (ICD-9-CM13.1), "Phacoemulsification and aspiration of cataract" (ICD-9-CM13.41), "Mechanical phacofragmentation and other aspiration of cataract" (ICD-9-CM13.43), "Other extracapsular extraction of lens" (ICD-9-CM13.59), and other lens operations and treatments as the primary operations and treatments. Further, "Insertion of prosthetic lens (pseudophakos)" (ICD-9-CM13.7, including 13.70-2), "Operations on vitreous" (ICD-9-CM14.7, including 14.71-9), and other affiliated operations and treatments were selected as the affiliated operations and treatments.

Among the primary operations and treatments, the proportion of "Intracapsular extraction of lens by temporal inferior route" (ICD-9-CM13.1) is 5.88%, "Phacoemulsification and aspiration of cataract" (ICD-9-CM13.41) is 84.20%, "Mechanical phacofragmentation and other aspiration of cataract" （ICD-9-CM13.43） is 6.19%, "Other extracapsular extraction of lens" (ICD-9-CM1359) is 3.73%, and other lens operations and treatments is 1.42%. Among the affiliated operations and treatments, the proportion of "Insertion of prosthetic lens (pseudophakos)" (ICD-9-CM13.7) is 76.42%, "Operations on vitreous" (ICD-9-CM14.7) is 3.52%, and other affiliated operations and treatments is 0.75%. Dummy variables are used to represent the influence of hospitals. The base of these variables is Hp18, where the average length of stay was the longest.

3. Discrete-Type Proportional Hazard Model

To analyze the length of stay at the hospital correctly, it is not enough to compare the ALOSs of hospitals. It is necessary to consider different characteristics of the patients, such as age and sex, by hospitals. The length of stay is a discrete-type variable taking positive integers (1,2,3,…). Therefore, the analyses using ordinary methods such as the least squares methods are not proper for the length of stay and we analyze the length of stay by the discrete-type proportional hazard model. Let $h_i(t)$ be a conditional probability such that the i-th patient staying at the hospital on the t-th day will leave the hospital on that day. We call $h_i(t)$ as the leaving rate. (Although it is the same as the hazard rate of survival analysis models, we call it "leaving rate" to clarify the fact that the patient leaves the hospital.) For the i-th patient to leave hospital on the t-th day, it is necessary for the patient to stay until t-th day and leave on that day. Therefore, the probability of the i-th patient to leave the hospital on the t-th day is a function of $h_i(t)$ and given by

$$h_i(t) \quad , \quad t = 1 \quad ,$$

(1)

$p_i(t) = \{$

$$[\prod_{s=1}^{t-1}\{1-h_i(s)\}]h_i(t) \quad , \quad t \geq 2 \quad ,$$

$i = 1,2,...,n$.

where n is the number of patients. To remove influences of a small number of patients who stay at the hospital over a long period of time, we choose T as the maximum number of days staying in the hospital. For patients staying more than T days, we just use the information such that they stay in the hospital more than T days. Let $p_i(T+1)$ be the probability such that the i-th patient stays in the hospital more than T days. $p_i(T+1)$ is given by

$$p_i(T+1) = \prod_{s=1}^{T}\{1-h_i(s)\} . \qquad (2)$$

Let x_i be a vector of explanatory variables which represent the characteristics of the i-th patient. As usual continuous proportional hazard models (Cox 1973), we assume that $h_i(t)$ is given by

$$h_i(t) = d_t \exp(x_i'\beta) , \quad t = 1,2,3,....,T \qquad (3)$$

Although d_t represents the "leaving rate" of the t-th day, a proper functional form is unknown. Hence, we do not assume a functional form as the usual continuous proportional hazard model, and estimate $d_1, d_2,..., d_T$ individually. This means that the model is a non-parametric form regarding *t*. It is one of the advantages of the model since we do not assume any functional form. From equations (1)-(3), we get the likelihood function. By maximizing the likelihood function, we get the maximum likelihood estimator (MLE). Note that x_i does not contain a constant term for identification of the model.

4. Results of Estimation

4.1 Estimation of β

In this paper, we used variables representing characteristics of the patient, types of operation and treatment, and influence of hospitals; these variables are represented as x_i - a vector of explanatory variables. The variables representing the characteristics of a patient - age, sex, and place of stay after hospitalization - were readily available. With regard to age, the treatment method and calculation of medical fee are different if the age of the patient is under 7. Moreover, the length of hospital stay is longest if patients are in their 40s. Therefore, in addition to the Age of the patient, we used the Child Dummy (1 if the patient is under 7 and 0 otherwise) and the Age 40 dummy (1 if the patient is under 40 and 0 otherwise). With regard to other variables, we used the Female Dummy (1 if the patient is female and 0 otherwise), the Other Hospital Dummy (1 if the patient goes to another hospital after hospitalization and 0 otherwise), and the Other Facility Dummy (1 if the patient goes to another facility after hospitalization and 0 otherwise). With regard to the type of primary and affiliated operations and treatments, we used the Operation and Treatment Dummies. The base of these dummy variables was "Phacoemulsification and aspiration of cataract" (ICD-9-CM13.41), which is currently the standard operational method. The influence of hospitals was measured by the Hospital Dummies, based on Hp18, where the average length of stay was the longest. $x_i'\beta$ of Equation (3) becomes

$$\begin{aligned} x_i'\beta \ = \ & \beta_1 \text{ Female Dummy} \qquad (4) \\ & + \beta_2 \text{ (Age – Average Age)} \\ & + \beta_3 \text{ Child Dummy} \\ & + \beta_4 \text{ Age 40 dummy} \times \text{(Age – 40)} \\ & + \beta_5 \text{ Other Hospital Dummy} \\ & + \beta_6 \text{ Other Facility Dummy} \\ + & \sum \beta_j \text{ j-th Operation and Treatment Dummy} \\ + & \sum_k \beta_k \text{ k-th Hospital Dummy.} \end{aligned}$$

Since two or more patients left the hospital within 27 days, we selected T = 27 and calculated the net leaving rate, d_t, for up to 27 days. Four thousand one hundred patients - 99% of all patients - left the hospital within 27 days. It must be noted that we also estimated models using different values of T, and considered the possibility that values of T may affect the results of estimation. However, the results were rather similar to those presented in this paper.

Table 1 presents the estimates of β. Having evaluated the leaving rates, it can be stated that a larger value of $x_i'\beta$ implies a shorter length of hospital stay. The estimate of Age is positive but not significant at the 5% level. The estimate of the Child Dummy is negative and significant at the 5% level. This implies that the leaving rate of children is low and that they stay in the hospital for a long period; this is reasonable since examination by a pediatrician is often required and self-control is difficult for children. The estimate of the Age 40 Dummy × (Age – 40) is negative but not significant at the 5% level. We cannot state that the length of stay changes at age 40. The estimate of the Female Dummy is positive but not significant at the 5% level. With regard to the Other Hospital and Other Facility Dummies, the estimate of the Other Facility Dummy is negative and significant at the 1% level, and strongly affected the leaving rates.

With regard to the types of operation and treatment, the estimates of dummy variables are negative and significant at the 1% level, except "Mechanical phacofragmentation and other aspiration of cataract" (ICD-9-CM1343) and "Other extracapsular extraction of lens" (ICD-9-CM1359); in other words, the leaving rate reduces and the length of stay increases as compared with the case of "Phacoemulsification and aspiration of cataract"

(ICD-9-CM1341). In particular, the estimate of "Operations on vitreous" (ICD-9-CM147) is –1.351 and its t-value is –14.638. The length of hospital stay increases to a large extent if this operation is performed.

With regard to the estimates of the Hospital Dummies, the maximum is 1.515, the minimum is –0.471, and the difference between the maximum and minimum values is 1.986. There are large differences among hospitals, despite eliminating the influence of characteristics of patients and types of operation and treatment. For example, let us consider a patient of age 72, male, who returns home post-hospitalization after undergoing "Phacoemulsification and aspiration of cataract" (ICD-9-CM13.41) and "Insertion of prosthetic lens (pseudophakos)" (ICD-9-CM13.7). In Hp15, where the leaving rate was the highest and the length of stay was the shortest, The average length of stay was only 3.92 days. On the other hand, in Hp31, where the leaving rate was the lowest and the length of stay was the longest, the average length of stay becomes 12.41 days (the real value is larger than this number), which is 3.1 times as large as that of the hospital with the shortest length of stay.

4.2 Distribution of d_t

The distribution of d_t, the net leaving rate, is provided in Figure 2. The distribution of d_t is important for analyzing the efficiency of treatments. There are two clear peaks on the eighth and fifteenth days. Furthermore, the value of the twenty-second day is clearly higher than the neighboring values; this implies that there is a one-week cycle in the net leaving rates. This fact implies with high probability that the patient leaves the hospital on the same day of the week as being admitted to the hospital. Considering the efficiency of treatments is an interesting subject for future study.

5. Factors Pertaining to Hospitals that May Affect the Net Leaving Rates

There exist large differences in the leaving rates and lengths of stay among hospitals despite eliminating the influences of characteristics of patients and types of operation and treatment. In the previous section, dummy variables were used to evaluate the influence of hospitals. The values of the dummy variables represented the net effects of hospitals on the length of stay. In this section, we analyze the estimates of the Hospital Dummies by regression analysis (the value of Hp18 is set to 0.) Size, profits, managerial organizations, and regions where hospitals are located are used as explanatory variables of the regression model.

The variables representing the sizes of hospitals, namely, the number of beds, number of doctors and nurses, number of patients, and incomes and expenses are readily available. Since these variables are highly correlated, we use Number of Beds as an explanatory variable. We also use the number of patients in the ophthalmology departments (Number of Patients) to evaluate the sizes of these departments. Managerial organizations are local governments, mutual aid associations, Red Cross, medical associations, corporations, and other organizations. Since hospitals managed by local governments, mutual aid associations, and the Red Cross are considered to have public functions, we use the Public Dummy for these hospitals. Profits accruing to hospitals represent business situations and policies of hospitals. We use profit rates (Profit) in order to remove the effects of the size of hospitals. For the variables representing regional effects, we use the Cold Region (Hokkaido and Tohoku regions) and West Japan (Kinki, Chugoku, Shikoku, and Kyushu regions) Dummies. The estimates of $\hat{\beta}_k$, coefficient of Hospital Dummies, are analyzed by

$$\begin{aligned}\hat{\beta}_k = {} & b_0 + b_1 \log(\text{Number of Beds}) \\ & + b_2 \log(\text{Number of Patients}) \\ & + b_3 \text{ Public Dummy} + b_4 \text{ Profit} \\ & + b_5 \text{ Cold Region Dummy} \\ & + b_6 \text{ West Japan Dummy} + \varepsilon_k .\end{aligned} \qquad (5)$$

The standard errors of $\hat{b}_j$ are estimated by the robust estimation method. The results of estimation are provided in Table 2. The estimate of Profit is negative and significant at the 5% level. The estimate of the Cold Region Dummy is negative and significant at the 1% level with a one-sided test. This implies that the leaving rate becomes smaller and the length of stay becomes longer if the hospital becomes more profitable and is located in the cold regions of Hokkaido and Tohoku. It is considered that the profit rates are related to the occupation rate of beds. Reducing open beds and keeping the occupation rate high may prove to be advantageous for hospital managers. The possibility that the length of hospital stay becomes longer because of the business perspective must be considered. This is an important problem when considering the future medical fee payment system. (The diseases analyzed in this paper are only a small percentage of the entire gamut of medical treatments provided by hospitals. The patients with these diseases represent 0.1% of the total patients. The occupation rate of beds for these diseases is 2% at most and less than 1% in a majority of the hospitals. Therefore, it is extremely unlikely that a longer length of stay for these diseases (solely due to medical reasons) causes a hospital to become more profitable. It is reasonable to consider that business situations and policies of hospitals affect the length of stay.)

In cold regions, it is considered that patients stay in the hospital until they have recovered completely because commuting to the hospital during the winter is difficult. If this is a valid reason, it may be possible to reduce the length of stay by providing suitable commuting methods to and from the hospital during the winter season.

Although the other variables are not significant at the 5% level, estimates of the Number of Beds, Number of Patients, Public, and West Japan Dummies are negative. The t-values of the Number of Beds, Number of Patients, and West Japan Dummies are 1.03~1.28, and are relatively large. With regard to these variables, the number of hospitals may be a reason for being unable to obtain statistically significant results. It may be necessary to investigate additional hospitals in order to precisely evaluate the effects of these variables.

6. Conclusion

In this paper, we have analyzed the length of hospital stay for ophthalmology treatment. Data pertaining to 4,151 patients who have been hospitalized for cataract and related diseases (DRG 2041) have been analyzed using the discrete-type proportional hazard model. We have also analyzed those factors pertaining to hospitals that may affect the length of stay. Although cataract is an important disease and a large number of operations have been performed to remove it, the length of hospital stay has not been sufficiently studied.

Estimates of the Child and Other Facility Dummies are negative and significant. These variables affect the leaving rate and the length of stay. With regard to the type of operations and treatments, the estimates of dummy variables are negative and significant at the 1% level, except for those of "Mechanical phacofragmentation and other aspiration of cataract" (ICD-9-CM13.43) and "Other extracapsular extraction of lens" (ICD-9-CM13.59). It has been determined that the leaving rates reduce and the length of stay becomes longer for the abovementioned operations as compared with the case of "Phacoemulsification and aspiration of cataract" (ICD-9-CM13.41).

With regard to the estimates of the Hospital Dummies, the maximum is 1.515, the minimum is –0.471, and the difference between the maximum and minimum values is 1.986. There are large differences among hospitals despite eliminating the influence of both the characteristics of the patient and the types of operation and treatment. The longest average length of stay is over 3 times as long as the shortest average length of stay. The operation and treatment methods for cataract are standardized and their difficulty level is not high. It is surprising that such large differences exist among hospitals with regard to the length of stay.

Finally, we analyzed the factors pertaining to hospitals that may affect the lengths of stay. The estimates of Profit and Cold Region Dummy are negative and significant; in other words, the leaving rate reduces and the length of stay becomes longer if the hospital becomes more profitable and is located in the cold regions of Hokkaido and Tohoku.

The results of analysis strongly suggest that in order to reduce the length of stay there is a necessity for improvement in the Medical Service Fee Schedule, such as introducing the Prospective Payment System (PPS), where a hospital is paid a fixed fee regardless of the length of stay.

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Table 1. Estimates of β

Variable	Estimate	Standard Error	t-value
Age	0.00057	0.00107	0.52935
Child Dummy	–1.24382	0.61140	–2.03646
(Age – 40)*Age 40 Dummy	–0.01427	0.01114	–1.27882
Female Dummy	0.02604	0.02442	1.05794
Other Hospital Dummy	0.13650	0.12503	1.07887
Other Facility Dummy	–0.57254	0.21588	–2.65139
Major Operation and Treatment Dummies			
131	–0.50389	0.21146	–2.85700
1343	0.28458	0.18821	1.46363
1359	–0.09265	0.11145	–0.91452
Other Major Operations	–0.34080	0.13131	–2.61308
Type of Affiliated Operations and Treatments			
137	–0.25591	0.07097	–3.70039
147	–1.35112	0.09249	–14.63835
Other Affiliated Operations	–0.69192	0.19182	–3.61284
Hospital Dummies			
Hp1	0.50725	0.24996	1.62420
Hp2	0.91865	0.22280	3.67105
Hp3	0.39264	0.21925	1.31754
Hp5	–0.26147	0.22907	–1.58162
Hp6	0.35093	0.24034	1.04048
Hp7	0.24179	0.22824	0.61812
Hp8	0.32581	0.23554	0.96055
Hp13	1.32498	0.21845	5.57071
Hp15	1.51506	0.21709	6.51289
Hp17	0.62011	0.23057	2.25448
Hp19	0.75549	0.25895	2.52583
Hp20	0.98504	0.22643	3.90420
Hp21	0.57801	0.23522	2.02735
Hp22	0.45505	0.22790	1.55482
Hp23	0.06225	0.22528	–0.14844
Hp24	–0.09145	0.22478	–0.84866
Hp26	–0.09714	0.23934	–0.85483
Hp27	0.08554	0.24215	–0.06452
Hp28	0.25726	0.25262	0.65457
Hp29	0.08272	0.25314	–0.06623
Hp30	0.39888	0.35636	0.83635
Hp31	–0.47100	0.27119	–2.09818
Hp32	0.01325	0.24453	–0.35582
Hp36	0.59971	0.22530	2.21262

Table 2. Results of the Analysis of Hospital Factors Affecting the Length of Stay

Variable	Estimate	Standard Error	t-value
Constant	2.1010	0.9301	2.2589
log(Number of Beds)	–0.2016	0.1573	–1.2813
log(Number of Patients)	–0.0222	0.0761	–0.2923
Profit	–1.4384	0.6276	–2.2918
Public Dummy	–0.2932	0.2324	–1.2617
Cold Region Dummy	–0.5697	0.2183	–2.6096
West Japan Dummy	–0.1774	0.1718	–1.0326
R^2	0.47179		

* Standard errors are calculated by robust estimation.

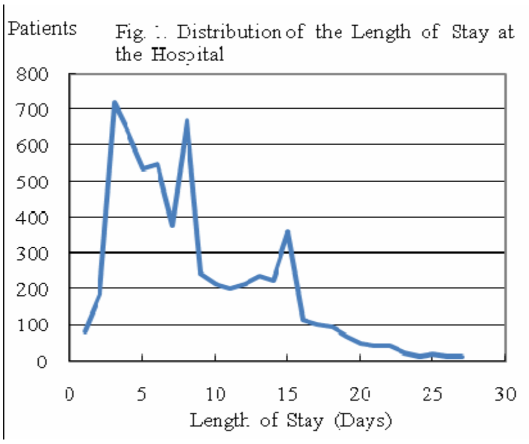

Fig. 1. Distribution of the Length of Stay at the Hospital

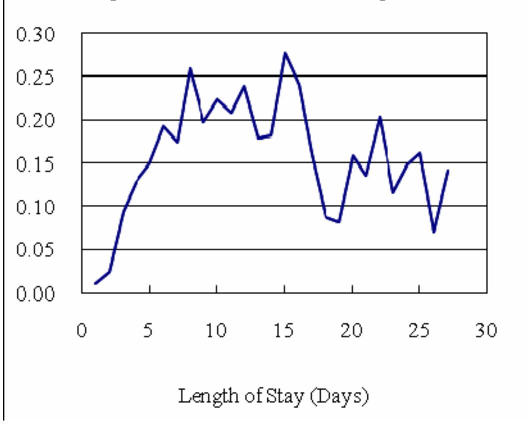

Fig. 2. Distribution of Net Leaving Rates