A REFINED METHOD FOR ESTIMATING MEDICAL EXPENDITURES FOR LIVER DISEASE USING THE PATIENT SURVEY AND CLAIM DATA IN JAPAN

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Objective This study was performed to develop a estimation method for medical expenditures based on detailed data for the various kinds of liver disease.

Methods Using claim data from the Survey of National Medical Care Insurance Services and the Patient Survey in Japan, we estimated the medical expenditures for various liver diseases using a refined method, in which the amount of expenditure by age and sex was multiplied by the respective numbers of patients.

Results According to our estimates, the total medical expenditures per year for all liver diseases in Japan was 680 billion yen. The breakdown included: viral hepatitis (256 billion yen); malignant neoplasms of the liver and intrahepatic bile ducts (170 billion yen); cirrhosis of the liver (97 billion yen); other liver diseases (63 billion yen); chronic hepatitis (61 billion yen); and alcoholic hepatitis (33 billion yen).

Conclusion These are the first published estimates, not only for the total medical expenditure for all liver diseases, but also for individual categories. The method we employed in this study can readily be applied to estimate medical costs for other diseases.

Key words: Medical care expenditure, Malignant neoplasms of the Liver, Hepatitis, Cirrhosis of the liver, the Survey of National Medical Care Insurance Services, the Patient Survey

I. Introduction

As total medical costs in Japan rises, the amount spent on chronic diseases is increasingly becoming a cause for concern. Liver disease has long been regarded as a "National Disease" due to its high prevalence in Japan and thus, it is particularly important to estimate associated medical expenditure. However, official statistics are only available for the condensed list of causes of diseases (the aggregated category of diseases) and not for the detailed list based on the 10th revision of the International Classification of Disease (the detailed list of diseases)[1)]. In the case of liver disease, the reason that figures for medical expenditure are unavailable is not only because some are included under the aggregated category of digestive diseases, but also because others are included under the aggregated category of neoplasms or infectious diseases[2)]. Thus, it has not been possible to identify medical expenditure for all liver diseases from current statistical reports.

The refined method we have developed, summing the age-sex-specific product of the amount of expenditure and the number of patients by age and sex in that category, is considered to give an accurate estimate in theory if there are large differences between age and sex in terms of the number of patients and the expenditure. In the case of liver diseases, medical expenditures differ due to age, sex, and the type of liver disease. Thus, combining the refined method using claim data should permit an accurate estimation of the medical expenditure for each single disease.

For this reason, it was chosen to develop a method for estimating the medical expenditures for the various kinds of liver disease based on detailed list[3)]. Using claim data from the Survey of National Medical Care Insurance Services (SNMCIS) and patient numbers from the Patient Survey, we estimated the medical expenditures for different liver diseases using our refined method, in which expenditure was multiplied by the number of patients of each age and sex.

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II. Methods

Data

Every June, the Ministry of Health, Labour and Welfare (MHLW), based on SNMCIS, gathers data on the frequency of operations, procedures, and consultations by sampling data on claims submitted to the National Health Insurance and other health insurance systems (Shakai Iryo Shinryo Kouibetsu Chosa)[4]. The survey samples insurance claims submitted from medical institutions in June every year, which were summed up for all medical charges by patient in the previous month. After receiving permission to use anonymous data from the above survey in 2002 (permission date: January 7, 2004; the Statistics Bureau of MHLW), we calculated the average expenditure per day for each type of liver disease by age, sex, and whether it involved hospitalization or outpatient treatment.

Every three years, the MHLW carries out a Patient Survey (Kanja Chosa)[5], and the most recent one available was the 2002 edition. The survey is based on a cross-sectional survey of inpatients and outpatients at the sampled medical institutions on the survey date and estimates the total number of the patients by age, sex and disease in Japan. The definition of diagnostic categories of liver diseases now follows the International Classification of Diseases version 10 (ICD-10).

Formula used for estimation

Let i, j, and k denote sex, the age group, and the diagnostic category, respectively, and let N and D denote the number of cases in the survey period (date), and average expenditure per consultation day. The formula for outpatients included a coefficient for adjustment of clinic days in a week[6]. Then the annual medical expenditure for the k-th diagnostic category is expressed as follows:

(i) inpatients

$$\sum_i \sum_j (N_{ijk} \times D_{ijk} \times 365)$$

(ii) outpatients

$$\sum_i \sum_j (N_{ijk} \times D_{ijk} \times 365 \times 6/7)$$

III. Results

Table 1 shows general characteristics for the data sampled for liver disease (n=5,601) from SNMCIS received from the Statistics Bureau of MHLW in 2002. In total, the number of males was slightly greater than the number of females, and most patients were aged 15 years or over. The majority of cases were treated as outpatients. Since the samples were not large, we divided them into 3 age categories; 0–14 years, 15–64 years, and 65 years and over. In terms of disease categories, viral hepatitis (n=2,167) was the most common, followed by chronic hepatitis (n=1,106).

Table 1. Characteristics of the sampled data for liver disease from the Survey of National Medical Care Insurance Services 2002 (n=5,601)

Characteristics	n (%)
Sex	
Male	3,092(55.2%)
Female	2,509(44.8%)
Age (years)*	
0–14	31(0.6%)
15–64	2,692(48.3%)
65–99	2,855(51.2%)
Hospitalization	
Inpatient	1,553(27.7%)
Outpatient	4,048(72.3%)
Classification of hepatic diseases	
Viral hepatitis	2,167(38.7%)
Malignant neoplasms of the liver†	782(14.0%)
Alcoholic hepatitis	188(3.4%)
Chronic Hepatitis‡	1,106(19.7%)
Cirrhosis of the liver‡	648(11.6%)
Other liver diseases	710(12.7%)

* Twenty-three samples had insufficient age information.

† Including malignant neoplasms of the intra-hepatic biliary tract

‡ Excluding alcoholic hepatitis

Tables 2 and 3 show the average expenditure on inpatients and outpatients, respectively, with the different types of liver disease by age and sex per day in the SNMCIS. Since the number of patients aged 14 years and under was very low, some categories in Table 2 and Table 3 contained no patients. Overall, expenditure for malignant neoplasms of the liver and intrahepatic bile duct was the highest. Table 4 shows the estimated numbers of inpatients and outpatients by sex and age in the Patient Survey of 2002. Again, some categories contained no patients.

Table 5 provides a summary estimate for medical expenditure for each liver disease using the refined method. The total medical expenditure for liver diseases per year was 300 billion yen for inpatients and 379 billion yen for outpatients.

IV. Discussion

According to our estimates, the total medical expenditure for all liver diseases in Japan in the year

Table 2. Average daily expenditure on inpatients by type of liver disease, age and sex, in the Survey of National Medical Care Insurance Services 2002 (thousands of yen)

	Age (years)		
	0–14	15–64	65–99
Males			
Viral hepatitis	21.6	27.5	23.6
Malignant neoplasms of the liver*	26.2	35.6	36.3
Alcoholic hepatitis	—	22.4	14.2
Chronic hepatitis†	—	19.7	14.6
Cirrhosis of the liver†	—	22.5	21.3
Other liver diseases	31.7	22.2	23.9
Females			
Viral hepatitis	10.2	28.3	17.3
Malignant neoplasms of the liver*	26.3	33.9	30.2
Alcoholic hepatitis	—	17.5	11.9
Chronic hepatitis†	—	20.4	13.4
Cirrhosis of the liver†	15.0	25.1	18.2
Other liver diseases	14.6	21.4	15.7

* Including malignant neoplasms of the intra-hepatic biliary tract

† Excluding alcoholic hepatitis

Table 3. Average daily expenditure on outpatients by type of liver disease, age and sex, in the Survey of National Medical Care Insurance Services 2002 (thousands of yen)

	Age (years)		
	0–14	15–64	65–99
Males			
Viral hepatitis	4.8	8.4	7.5
Malignant neoplasms of the liver*	—	14.3	14.4
Alcoholic hepatitis	—	8.2	7.5
Chronic hepatitis†	2.4	7.0	7.9
Cirrhosis of the liver†	—	12.7	11.2
Other liver diseases	4.9	7.5	9.5
Females			
Viral hepatitis	10.2	8.6	7.8
Malignant neoplasms of the liver*	—	13.9	18.5
Alcoholic hepatitis	—	4.4	4.5
Chronic hepatitis†	—	6.8	7.3
Cirrhosis of the liver†	12.2	13.1	10.7
Other liver diseases	9.0	6.6	8.0

* Including malignant neoplasms of the intra-hepatic biliary tract

† Excluding alcoholic hepatitis

Table 4. Estimated daily numbers of inpatients and outpatients by sex and age in the Patient Survey 2002 (thousand)

	inpatient			outpatient		
	0–14	15–64	65–99	0–14	15–64	65–99
Males						
Viral hepatitis	—	2.2	1.3	—	22.5	19.1
Malignant neoplasms*	—	2.4	5.0	—	1.6	3.0
Alcoholic hepatitis	—	1.2	0.7	—	4.3	2.4
Chronic hepatitis†	—	0.7	0.5	—	6.4	5.5
Cirrhosis of the liver†	—	1.7	1.8	—	3.0	3.6
Other liver diseases	—	1.3	1.0	—	4.6	2.0
Females						
Viral hepatitis	—	1.1	1.5	—	15.8	22.9
Malignant neoplasms*	—	0.6	2.9	—	0.5	1.8
Alcoholic hepatitis	—	0.2	—	—	0.8	0.2
Chronic hepatitis†	—	0.3	0.5	—	3.6	5.8
Cirrhosis of the liver†	—	0.6	2.3	—	2.1	4.6
Other liver diseases	—	0.8	1.4	—	3.7	1.8

* Malignant neoplasms of the liver and the intra-hepatic biliary tract

† Excluding alcoholic hepatitis

Table 5. Summary of estimates for medical expenditure by type of liver disease using the refined method (billions of yen)

	Medical expenditures		Total
	Inpatient	Outpatient	
Viral hepatitis	54.1	202.2	256.3
Malignant neoplasms of the liver*	136.8	33.3	170.1
Alcoholic hepatitis	14.7	18.0	32.8
Chronic hepatitis†	12.4	48.4	60.7
Cirrhosis of the liver†	48.7	48.4	97.0
Other liver diseases	33.5	29.1	62.6
Total	300.2	379.4	679.6

* Including malignant neoplasms of the intra-hepatic biliary tract

† Excluding alcoholic hepatitis

2002 was 680 billion yen (approximately US$ 6.2 billion). The breakdown was, in decreasing order: viral hepatitis (256 billion yen); malignant neoplasms of the liver and intrahepatic bile duct (170 billion yen); cirrhosis of the liver (97 billion yen); other liver diseases (63 billion yen); chronic hepatitis (61 billion yen); and alcoholic hepatitis (33 billion yen). These are the first published estimates to our knowledge, not only for total medical expenditure for all liver diseases, but also for the individual categories.

We could roughly estimate the total expenditure for each liver disease using data from SNMCIS (ir-

respective of the distribution by age and sex) and the coverage proportion of SNMCIS (the proportion of the subjects of the survey among all insured people in Japan). The coverage proportion was 0.92[7] and the rough estimation of expenditures for viral hepatitis and malignant neoplasms of the liver were 210 and 170 billion yen, respectively. Only the latter figure was close to our estimation with the refined approach. The reason for the difference for viral hepatitis might be the fact that the age distribution of sampling in SNMCIS does not necessarily reflect the true distribution of the total population in Japan.

Conventionally, the National Medical Care Expenditure Survey, in which medical expenditure is estimated from the aggregated amounts of payment from various health insurance sources, has been used to determine expenditure for each disease category in Japan[1]. The survey reported that the total medical expenditure for liver disease, included as a part of digestive diseases, was 306 billion yen in fiscal 2002[1]. However, these figures did not include liver cancer and viral hepatitis, because these are categorized as neoplasms and infectious diseases, respectively. Our estimation of the expenditure for liver diseases, excluding liver cancer and viral hepatitis, was 253 billion yen, and therefore considerably different from the above figure, possibly due to variation in the age distribution. However, even our approach may give an overestimating of outpatient medical expenditure. We used 6/7 as the coefficient for adjustment of clinic days in a week, which SNMCIS also applied for estimation of the number of outpatients from the number of claims in a day[4]. The reference study[6] for the coefficient was made with a six-day workweek. Since public medical institutions have a five-day workweek, our figure for total medical expenditures might therefore be somewhat an overestimation.

Our estimate has advantages over the National Medical Care Expenditure Survey. The refined method we have developed, summing up the age-sex-specific product of the amounts of expenditure and the numbers of patients by age and sex, should give an accurate estimate in theory if there are large differences between age and sex in terms of the number of patients and the amounts of expenditures. In the case of liver diseases, medical expenditures differ with the age, sex, and place of treatment. However, there are limitations with the refined method when the numbers in a subgroup are too small to be reliable and in this study, this was the case for patients aged 14 years and under. Nevertheless, the percentages of individuals in these subgroups were very small and accounted for only limited expenditure, so that the possible range of error would also be small.

Virnig and McBean have referred to the strengths and weaknesses of studies using administrative claim data[8]. One of the strengths is the capacity for combination with group-level data[9~14]. In the present study, combining SNMCIS with the Patient Survey allowed for a theoretically accurate estimate for the medical expenditure for liver diseases. Another strength of administrative data, as was the case in the current study, is the shorter delay as compared to manually abstracted charts between collecting data and their availability.

Among the several strengths of administrative data, population coverage is perhaps the most important[8,15]. The claims that we used were randomly sampled from strata of all Japanese medical care institutions. The sampling rates of SNMCIS were 1/50 for inpatients and 1/500 for general hospital outpatients in terms of the first sampling basis, though excluding the claims of some health insurers: the medical aid for the indigent, mutual aid associations for civil servants and health insurance of National Health Insurance submitted from medical institutions outside of the respective prefectures. Therefore, the age distribution of sampling in SNMCIS does not necessarily reflect true distribution of the total population in Japan and the Patient Survey therefore gives a more accurate prevalence of liver disease by age, since it first stratifies the study population into 360 medical administrative areas, and then investigates all patients in randomly sampled medical care institutions within each stratum. The sampling rates for the Patient Survey differ with the kind of medical institution and service: 7/10 for inpatients, 3.3/10 for general hospital outpatients in general hospitals, and 7/100 for general clinics. Our estimate is useful for inferring medical expenditure because both surveys cover all types of medical institution and the sampling rates were relatively large. It should be noted in this context that the sampling rate of the National Medical Care Expenditure Survey reported by MHLW, which has been conventionally used as the source for medical expenditures for diseases, is not specified.

There are some weaknesses associated with the date source in our study. First, claim data are often criticized for diagnostic and coding inaccuracies[16]. Certain conditions, such as depression[17] and diabetes[18], are often under-diagnosed in clinical populations, because the claim data files only contain information on primary diagnoses. This method may be inaccurate for those diseases that tend to be under-diagnosed and treated as secondary diseases (e.g. hyperlipidemia). In the case of our estimates, liver diseases are rarely under-diagnosed because they are usually treated as primary disease, though

such estimates could include expenditures for the other coexistent conditions[19]. Second, services that are not covered by the insurance system will not appear in claim databases, regardless of whether or not they are received[20,21]. Third, much interesting clinical information is not included in the data[14,22]. For example, if SNMCIS were to contain more detailed data on viral hepatitis, it would be possible to estimate medical expenditures on hepatitis by virus type. Finally, the limited sampling period and the difference of the survey period could have introduced a seasonal bias into our estimate. The time periods for the SNMCIS and the Patient Survey were May and September (October for outpatients). Any seasonal bias is, however, would be expected to have little affect on our estimates, because the incidence of generally hepatic diseases does not show seasonal variation.

In conclusion the method applied in this study could be introduced to estimate medical expenditure for any diseases, and not just those in the liver. Since the total medical expenditure in Japan is increasing, estimating costs for major diseases is becoming even more important and urgent and thus effective means for accurate assessment are a high priority.

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