Volume Measurement of Health Care Service in Japan: A Preliminary Study

Hideaki Kitaki†

Paper Prepared for the Meeting of the Expert Group on National Accounts
2-4 May 2012

† Department of National Accounts, Economic and Social Research Institute, Cabinet Office.

1. Overview

Measuring output of health care service as a non-market service is of interest in Japan as well as in other countries. The mandatory social insurance schemes guarantee all Japanese access to domestic medical institutions and to the receipt of treatment with a fairly lower copayment, both of which have played important roles in improving quality of life. However, as population aging progresses, with subsequent increases in health care expenditures, insurance premiums and copayments of those schemes rise. Moreover, the regulation of health care supply by the government seems inconsistent, which deteriorates the efficiency of distribution of human resources related to health care service. Some evidence of this view is the shortage of obstetricians in Japan, especially in rural area. This situation is enough for people to be more conscious of the value for money or productivity of health care service.

The Japanese SNA (JSNA) currently employs an approach based on the health care expenditures to measure health care service output because of both the limitations of coverage and the timeliness in the primary statistics. Though the lack of such information is quite hard to overcome, this paper attempts to estimate CWOI for health care service output under some assumptions.

2. Framework of Volume Measurement

2008SNA describes volume measurement as being desirable in evaluating the output of non-market services such as health care and education. CWOI (cost-weighted output index) is a common approach for its implementation, which this paper also follows.

Focusing on the estimation of health care service output, a basic model of CWOI is expressed as follows:

$$y_t = \frac{\sum_{i=1}^{n} c_0^i x_t^i}{\sum_{i=1}^{n} c_0^i x_0^i} \qquad (1)$$

Here, for service i, c_0^i represents a cost weight in the base year and x_t^i the number of treated patients in year t respectively.

Introducing quality adjustment to the model (1), it follows

$$y_t = \frac{\sum_{i=1}^{n} c_0^i x_t^i \left(\frac{q_t^i}{q_0^i}\right)}{\sum_{i=1}^{n} c_0^i x_0^i} \qquad (2)$$

where q_t^i is the quality of service i. Note that the rate of quality change is assumed to be equivalent to the same rate of change in the number of patients in model (2).

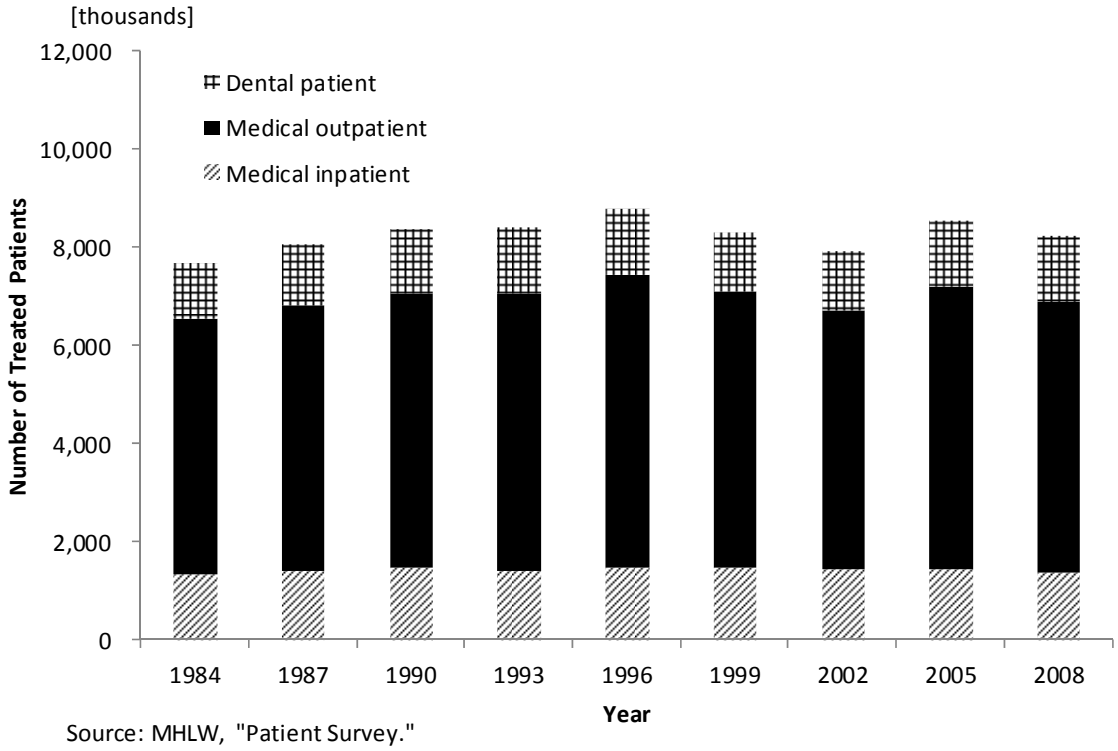
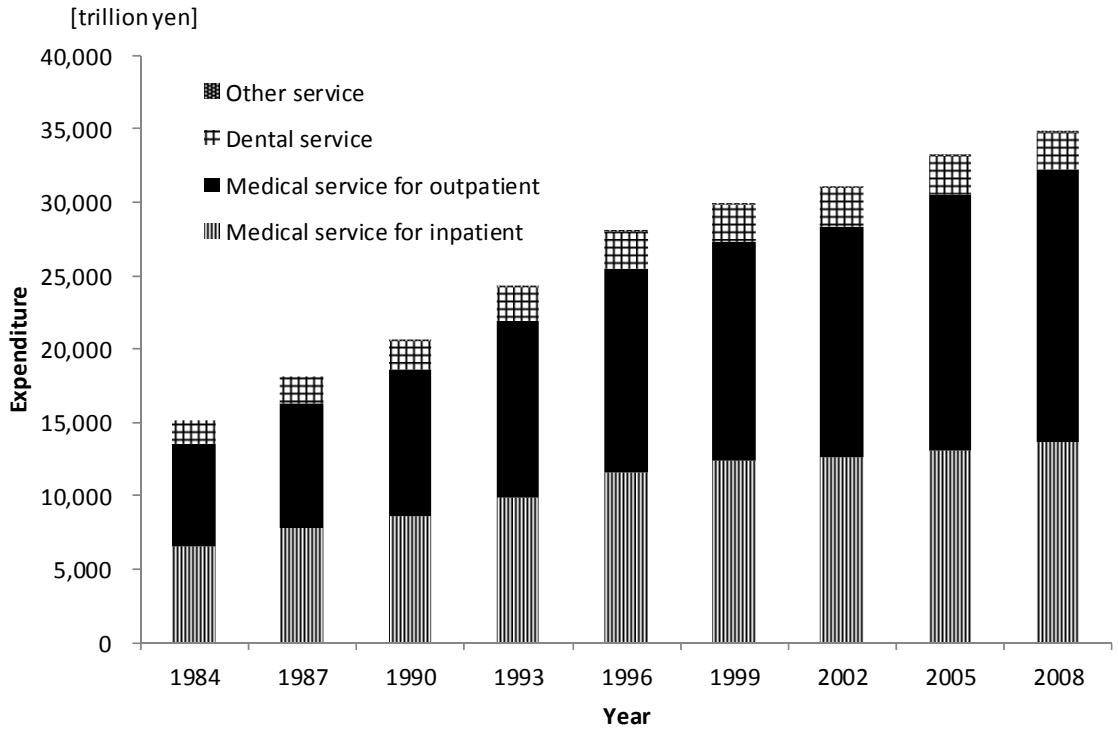


Figure 1: Estimated Number of Treated Patients

3. Estimation of Overall CWOI

Estimating overall CWOI for health care services with model (1) requires two things: a time series of the number of treated patients, and a set of cost weights in the base year. Data on the total number of treated patients can be obtained from the *Patient Survey* by the Ministry of Health, Labour and Welfare (MHLW). Since it is conducted only every three years, the estimation of CWOI is subject to its availability. Figure 1 shows the estimated number of treated patients by type of service and by inpatient/outpatient on a designated day of the year.

This figure depicts two points. First, notice that the total number of treated patients has not been necessarily increasing since 1996, even though it had constantly grew by that time. Second, the change in the total number of treated patients mainly reflects that in the number of treated medical outpatients. As a matter of fact, the number of treated medical inpatients did not significantly change over the period. One reason is that the government regulates the number of beds of hospitals in Japan, which in turn decides how much medical human resource such as doctors and nurses should be assigned to hospitals by law.

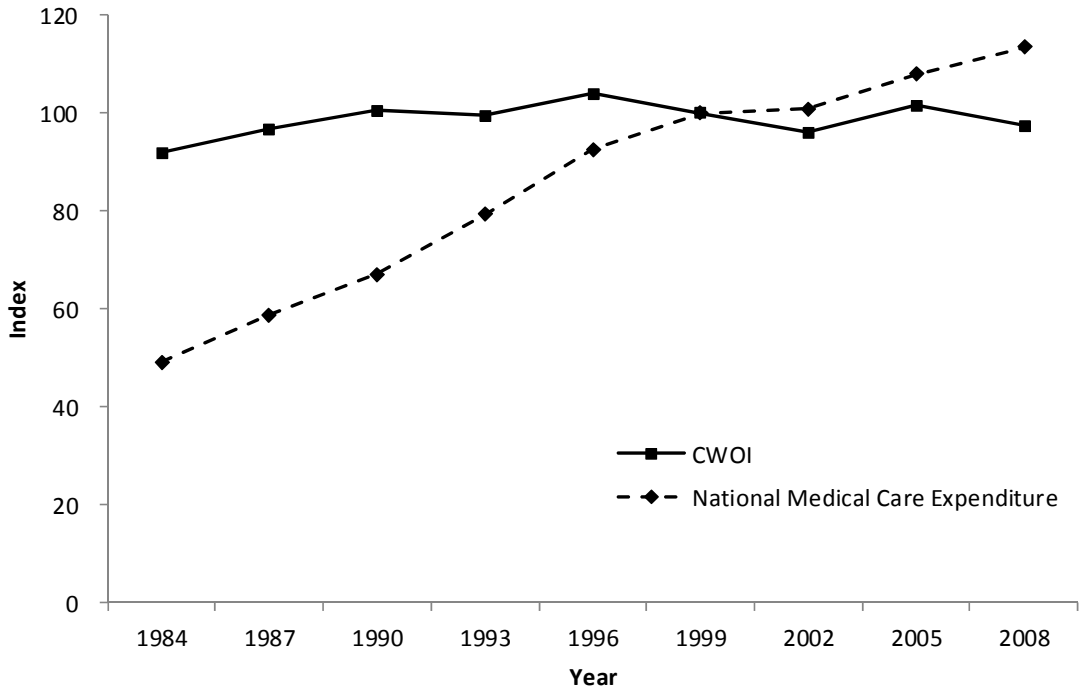


Source: MHLW, "Estimates of National Medical Care Health Expenditure."

Figure 2: National Medical Care Expenditure by Service

Determining the scope of health care service is also important to estimate overall CWOI. Japanese mandatory social insurance schemes cover almost all treatment expenditures, except those of optional or highly advanced treatments. However, the health care service output in JSNA also includes the expenditure of service, which is not necessarily associated with treatment. For instance, it contains the cost of medical examination and natural delivery. Nevertheless, the volume indicators corresponding to those services are often not available, unlike in the case of treatment. Due to that constraint, this paper uses only the expenditure of medical and dental treatment to estimate cost weights. Even if such approximation may affect the estimation result, the effect will not be significant, since the cost of those services is only a small portion of total output (about 9% of total output in 2005). The costs of those services are also assumed to be in proportion to the expenditures for them in this paper, since it is difficult to know their true costs in Japan.

Figure 2 illustrates the cost structure of National Medical Care Expenditure (NMCE) which is estimated by MHLW every year. By and large, the change of total national medical care expenditure is mostly related to that in the expenditure of medical service. The expenditure of dental and other services is stable and has little impact on the total.



Source: MHLW, "Estimates of National Medical Care Expenditure" and author.

Figure 3: CWOI and National Medical Care Expenditure Index (1999=100)

Combining those two components to estimate model (1) leads to overall CWOI for health care service. According to Figure 3, the overall CWOI curve is much flatter than that of the NMCE index. The average annual rate of change in overall CWOI is 0.24% between 1984 and 2008, and -0.54% between 1996 and 2008. It is a consequence of a stable total number of treated patients. The results may contrast with those of other countries (the United Kingdom, for instance). ONS (2011) estimated health care service output with volume measurement and acquired 4.4% as an average annual rate of change in the output index between 1995 and 2009. An interesting aspect of the results is that the expenditure of health care itself has been increasing in both countries. It implies that a unit cost of treatment per patient may have increased quickly during the period in Japan, a situation that does not necessarily hold in the United Kingdom.

4. Estimation of Quality-adjusted CWOI for Cancer Treatment

Quality adjustment in a CWOI framework is inevitably difficult in choosing appropriate quality indicators, since neither defining nor measuring quality of health care service is easy. However, careful inspection of indicators may facilitate recognizing quality changes in the treatment of some diseases. This paper takes cancer as an example of such a disease and attempts to estimate quality-adjusted CWOI (QACWOI).

Figure 4 and 5 present the number of treated cancer patients by inpatient/outpatient and by site including cancers of the stomach, breast, lung, and leukemia. They indicate that the total number of treated cancer patients has been increasing for at least these two decades. Though stomach cancer has had the largest number of treated patients among typical ones, it has been decreasing since 1996. On the other hand, the number of treated patients of bronchus/lung cancer and breast cancer has been gradually increasing.

Regarding cost of cancer treatment, input cost by site of cancer should be identified to estimate QACWOI for cancer treatment, since it is usually convenient to handle the quality of treatment by site. However, there is little information about how much is expensed without coverage of Japanese social insurance schemes for cancer treatment. Hence, the proposed estimation framework of QACWOI only takes the expenditure covered by social insurance schemes into consideration. Estimating cost weights from such data assumes that the total cost of cancer treatment of a site, including a portion which the patients pay for themselves, is in proportion to the expenditures covered by social insurance schemes. The estimation result should be carefully reviewed on account of this limitation.

As a whole, the change in the treatment expenditure by site of cancer is similar to that in the number of treated patients. Comparing cancer treatment expenditure for inpatients with that for outpatients, the former is more than twice as large as the latter, however (Figure 6 and 7). Another point is that, especially for inpatients, the total expenditure of cancer treatment has been increasing much faster than the number of treated patients. It implies that a unit cost of cancer treatment for inpatients may have grown during the period.

In general, we can't always observe the quality of medical treatment itself. However, a survival rate will be a good proxy of quality or technological standard for cancer treatment. This paper uses a 5-year relative survival rate for a typical site of cancer as a quality indicator (Table 1). The survival rate for cancer of the bronchus and lung had the largest improvement between 1993 and 2002, while that for leukemia had little change during the same period.

Since the data are discrete, it is assumed that the survival rate changes linearly and reaches the figure in the middle of a given period (62.1% in the middle of 1998 for stomach cancer, for instance) for interpolation and extrapolation. On average, survival rates increase at a rate of between 0 and 1 percent per year for those typical sites of cancer. It is also assumed that there is no quality change in the treatment of other sites of cancer, since no information is available for them.

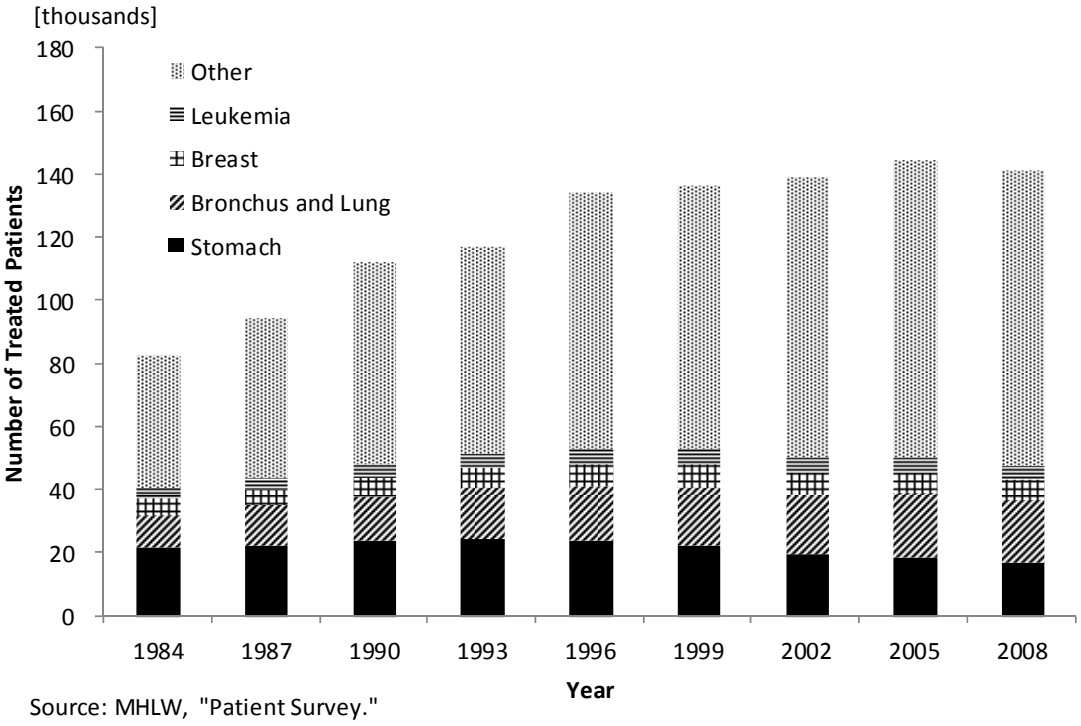


Figure 4: Estimated Number of Treated Cancer Patients (Inpatient)

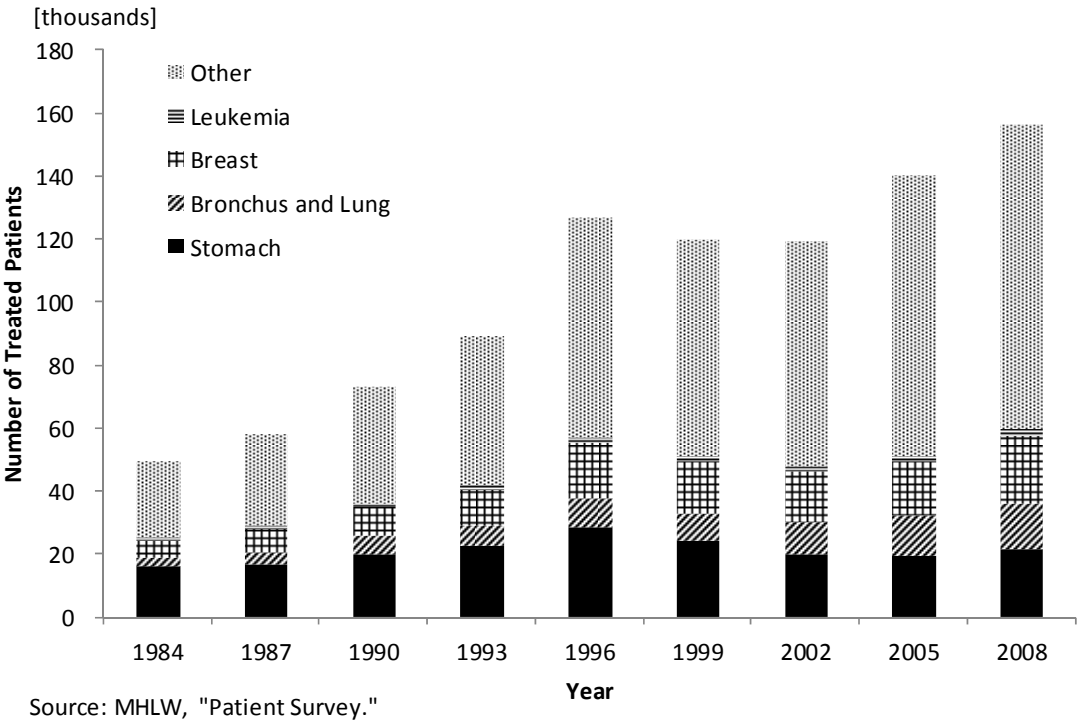
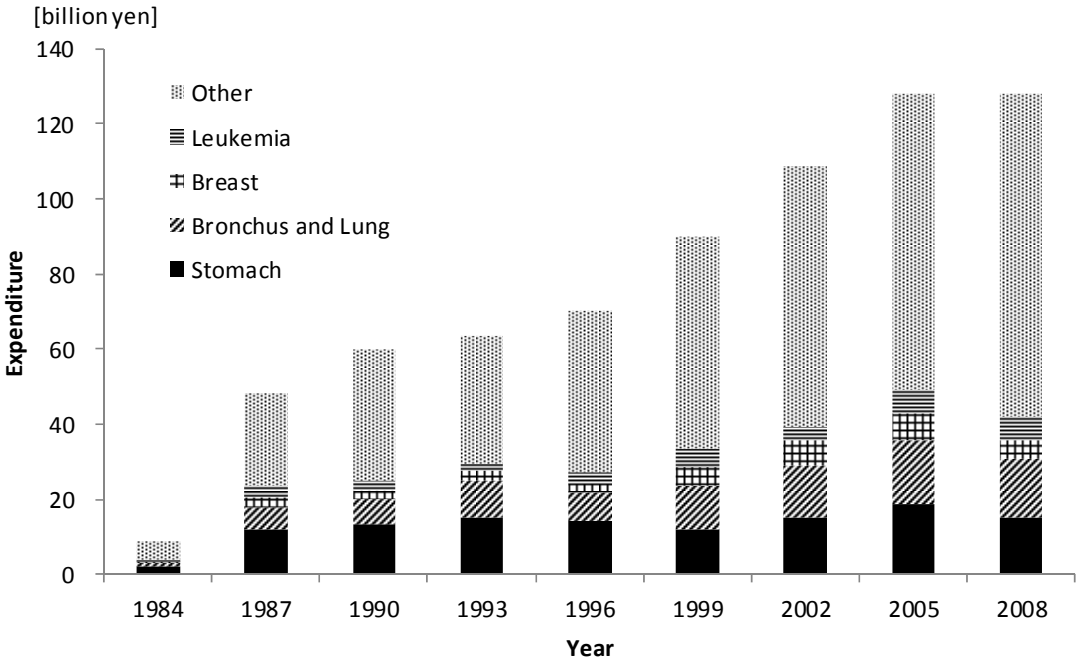
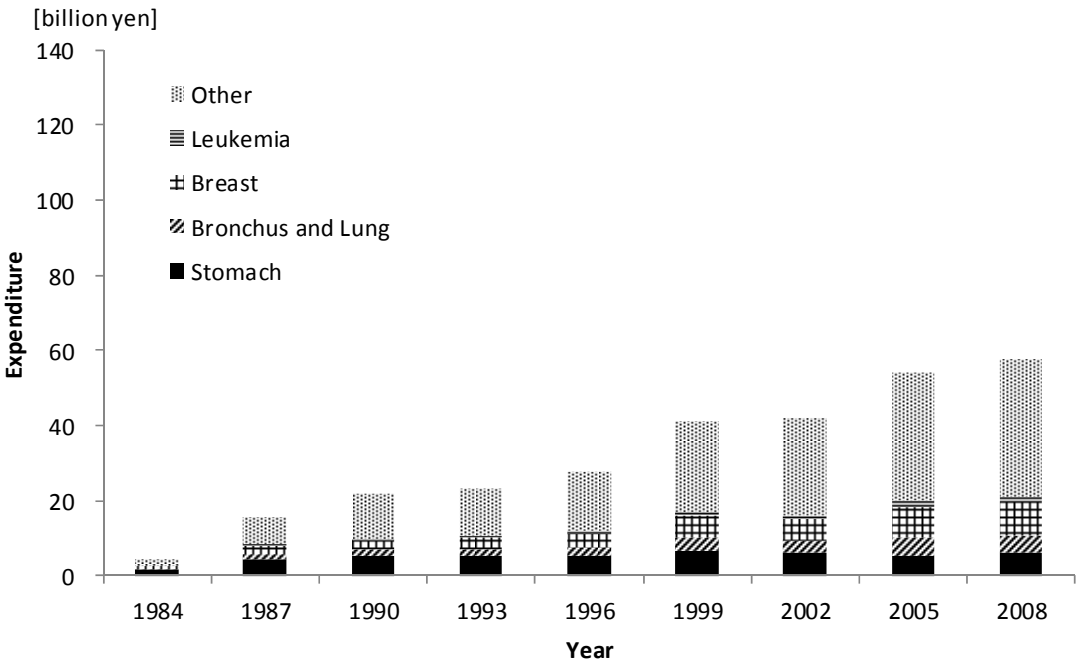


Figure 5: Estimated Number of Treated Cancer Patients (Outpatient)



Source: MHLW, " Survey of Medical Care Activities in Public Health Insurance."

Figure 6: Expenditure of Cancer Treatment Covered by Social Insurance Schemes (Inpatient)



Source: MHLW, " Survey of Medical Care Activities in Public Health Insurance."

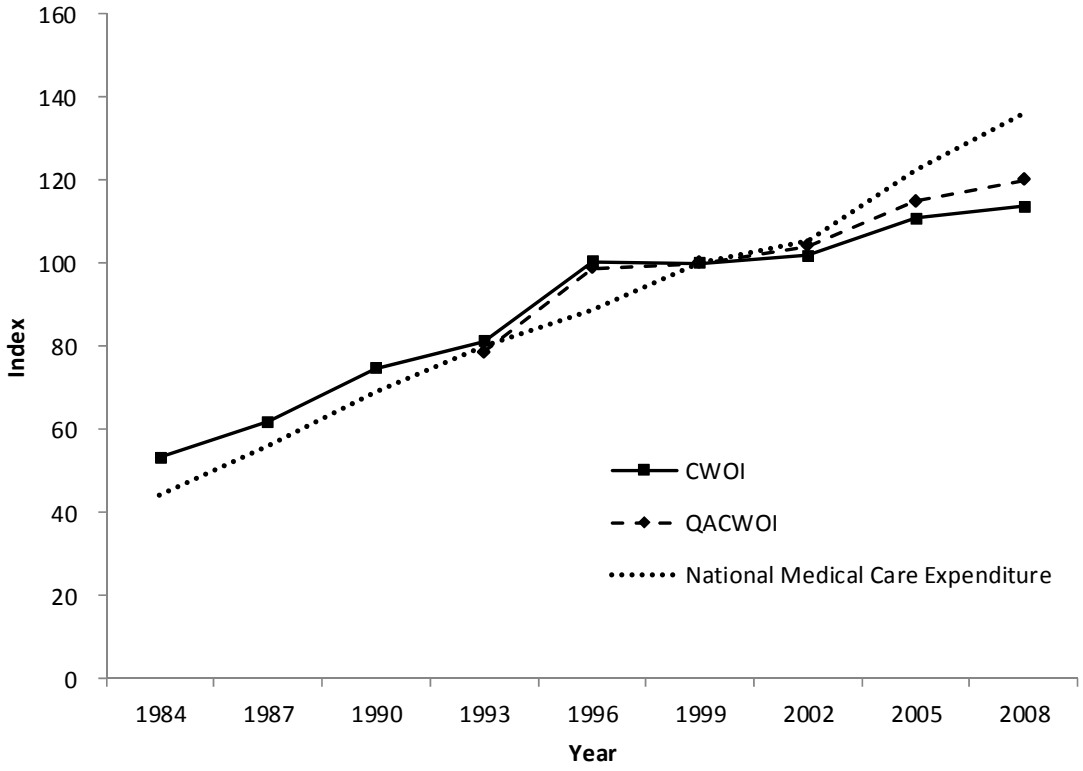
Figure 7: Expenditure of Cancer Treatment Covered by Social Insurance Schemes (Outpatient)

Table 1: 5-Year Relative Survival Rate by Site of Cancer

[%]

	1993-1996	1997-1999	2000-2002
Stomach	61.6	62.1	64.3
Bronchus and Lung	22.5	25.6	29.0
Breast	84.4	85.5	87.7
Leukemia	32.3	32.9	32.1

Source: National Cancer Center (2011), "Population-based Survival of Cancer Patients Diagnosed Between 1993 and 1999 in Japan: A Chronological and International Comparative Study."



Source: MHLW, "Estimates of National Medeical Care Expenditure" and author.

Figure 8: QACWOI, CWOI and National Medical Care Expenditure for Cancer Treatment (1999=100)

The estimation results of QACWOI compared with CWOI (without quality adjustment) and NMCE for cancer treatment are shown in Figure 8. As expected, QACWOI increases more rapidly than CWOI between 1999 and 2008. The average difference of annual rates of increase between QACWOI and CWOI is approximately 0.6 percentage points per year, which is interpreted as a measure of overall quality improvement on the treatment of cancer. Though the quality adjustment in this QACWOI is limited to cancer, a similar result was obtained by ONS (2010), which obtained 0.9% between 2002 and 2009 as the composite

measure of health care quality. Note that it is likely to be the lower bound since it is assumed that quality of treatment for other sites of cancer is constant in the estimation.

5. Conclusion

This paper estimates overall CWOI and QACWOI for cancer treatment under some assumptions to complement the lack of information on quality and quantity of health care service in Japan. The results mainly reflect changes in the number of treated patients rather than the cost, which is intended by the motivation of volume measurement. Quality adjustment of CWOI for cancer treatment with a relative survival rate yields a reasonable consequence, at least to some extent.

A CWOI framework may potentially give a useful insight of non-market service output. One good example has been already presented in Section 3 as the difference of change in output index and expenditure between the United Kingdom and Japan. However, there are still many challenges remaining in both of quantity and quality evaluation to apply volume measurement to practical estimation. For instance, an estimation result of CWOI depends not only on volume indicators but also on cost weights. Hence, changing the base year may cause unexpected results. Another issue is the way of quality adjustment. Model (2) assumes that a rate of quality change is assumed to be equivalent to the same rate of change in quantity. This assumption seems to require much further discussion. Since those are proper to CWOI, the proposed framework in this paper also has the same characteristics.

In the case of Japan, constraints on the availability of statistics on health care services, such as the number of treated patients and cost weights, are relatively serious, which implies that applying volume measurement to regular estimation of health care output must have many assumptions. At the same time, more study and discussion on quality adjustment will be particularly essential, since it may have a significant impact on the result. Thus the analysis of this paper is preliminary and looks forward to future improvement.

Reference

Ministry of Health, Labour and Welfare, “Estimates of National Medical Care Expenditure.”

Ministry of Health, Labour and Welfare, “Patient Survey.”

Ministry of Health, Labour and Welfare, “Survey of Medical Care Activities in Public Health Insurance.”

National Cancer Center (2011), "Population-based Survival of Cancer Patients Diagnosed Between 1993 and 1999 in Japan: A Chronological and International Comparative Study."

ONS (2011), “Public Service Output, Inputs and Productivity: Healthcare.”