Application of Diagnosis Procedure Combination Case Mix System and National Patient Database to Regional Estimation of Disease Structure and Disease Management

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Abstract

The estimation of medical expenses based on disease structure is necessary to improve the efficiency of the health care delivery system and to maintain the social health insurance system in Japan in the face of the rapid aging of the population which is anticipated in the near future. Our aim is to estimate regional needs for health care services by using a national patient database in conjunction with the diagnosis procedure combination (DPC) patient classification system. A data warehouse was constructed with dimensions including year, regions, DPC disease classification, and provider attributes, and then subjected to OLAP analyses. Needs for health care services in the designated medical service areas were estimated from disease structure in the districts and the average health service utilization for relevant DPC groups, as determined from DPC claim data. Actual needs for acute care hospital beds were estimated from disease structure in the districts, and revealed a large excess of acute care beds in most of areas. Admissions of patients to hospitals in medical service areas different from those for patients' residences were quantitatively determined for each of the DPC groups. It was found that patients requiring cardiac surgeries traveled farther than those with other diseases to reach hospitals conducting a large volume of such surgeries. Our results indicated the feasibility and the effectiveness of the arrangement of regional health care delivery plans based on the DPC case mix system and national patient database.

Key words: DPC, disease structure, health care resource allocation, Japan

❖ Introduction

The Japanese government has been successfully administrating the health insurance system, providing health care services to all citizens for more than 40 years; however, financial difficulties due mainly to the extremely rapid aging of the population in recent years require urgent improvement in the efficiencies of the health care delivery system in Japan. Thus, the estimation of medical expenses based on disease structure is necessary. The case mix classification-based national patient database is expected to be useful for the arrangement of regional medical care plans in view of social health care delivery including primary ambulatory, acute, emergent and chronic care. In Japan, patient surveys have been conducted every three years since the 1970's in all medical institutions and basic patient data regarding primary diseases, coded according to the ICD10, have thereby been accumulated. Thus, our aims are to construct a region-domain case mix database using a patient classification system diagnosis procedure combination (DPC)

developed in 2003 in Japan[1–5], and to estimate regional needs for health care services according to disease structure and the stages of diseases.

❖ Methods

Using 9.4 million micro data records from patient surveys obtained from the Ministry of Health, Labor and Welfare, we have constructed a data warehouse with dimensions including year, regions, disease classification, and age for multidimensional OLAP analysis. Included in the survey data were facility information on all hospitals, outpatient data, and discharge data extracted so that the data represent each of 47 prefectures for outpatient data and 360 secondary medical service areas for inpatient data. Each patient record was assigned to one of 1132 primary case mix classifications of the DPC, as determined from the ICD10 code and operation information.

Regional needs for health care services by DPC groups and stages of diseases were estimated from the regional disease structure and the average quantity of health services provided by acute care hospitals obtained from DPC claim data. The needs for acute care beds were estimated from the number of patients and the average hospital stay in acute care hospitals where the DPC system is applied. The needs for ICU beds were estimated from the average use of ICU beds obtained from DPC claim data. Similarly, needs for expensive radiographic equipment were estimated

from the quantity of the corresponding radiography services estimated from DPC claim data. Regional health costs for acute care services were estimated from the regional disease structure, expected hospital stays for specific diseases, and the relative weights for DPC groups.

❖ Results

Regional differences in disease structure were elucidated by multidimensional cross tabulation for dimensions including DPC groups, length of stay and types of operations. As shown in Figures 1 and 2, operation-related short stays are dominant in the metropolitan area whereas long stays related to vascular diseases and cancer are dominant in the rural area.

From the patient database based on the DPC case mix classification, the length of stay, procedures performed, and actual needs for acute care hospital beds were estimated and revealed a large excess of acute care beds in most regions of Japan (Figure 3). Using similar methodology, actual regional needs for emergency rooms, intensive care units (ICU), expensive imaging equipment such as MRI and PET, and long-term care hospitals were estimated and simulative model plans for regional health care covering the spectrum from preventive and primary care to long-term and terminal care were designed. In addition, regional medical expenses for acute care were estimated from standardized relative weights for DPC
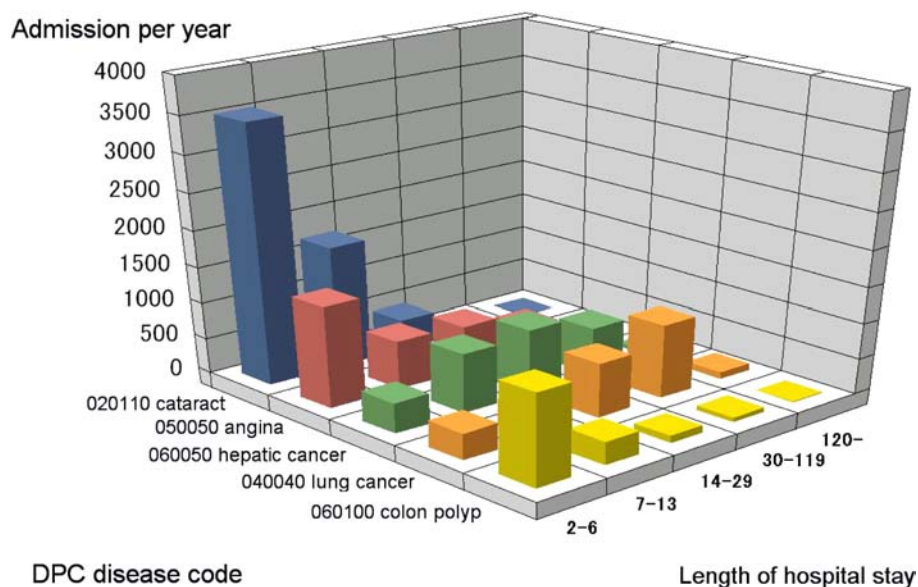

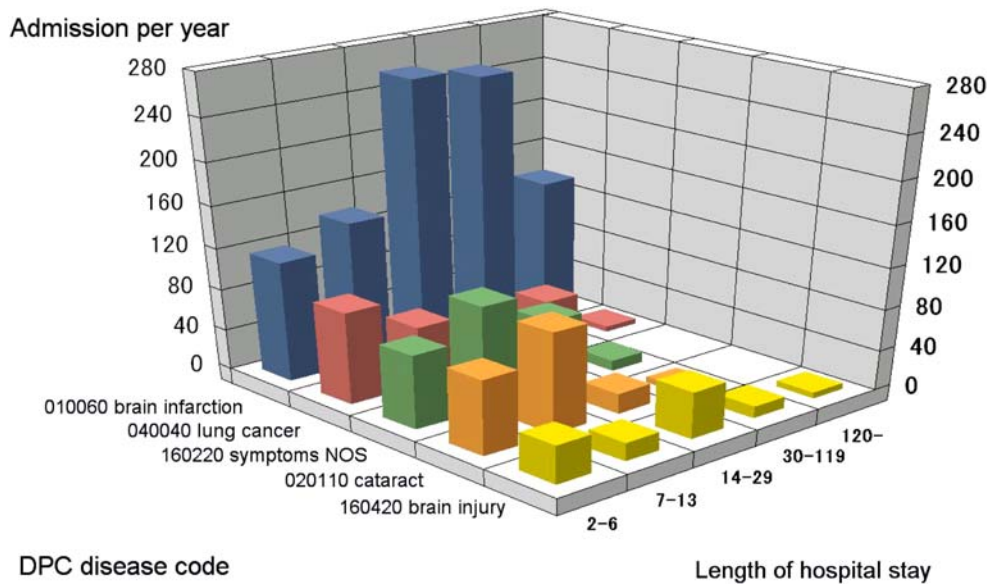Figure 1. Profile of elderly patients in Tokyo metropolitan area

Figure 2.   Profile of elderly patients in a rural area near Tokyo

groups, number of patients and length of hospital stay.

Local governments are required to establish medical service areas (MSAs) and to plan regional health care delivery. Secondary MSAs are established to assure that most medical services can be provided to residents within the designated areas, whereas primary MSAs are for primary care and tertiary MSAs for advanced care. We identified considerable gaps between actual medical service areas and the secondary MSAs established by health departments of local governments for several diseases including breast cancer and ischemic heart diseases. In Figure 4, the residential areas for patients are shown on the left and MSAs for admitting hospitals are indicated by the color bars for cardiac surgeries. It is conceivable that four functional MSAs could be formed rather than the
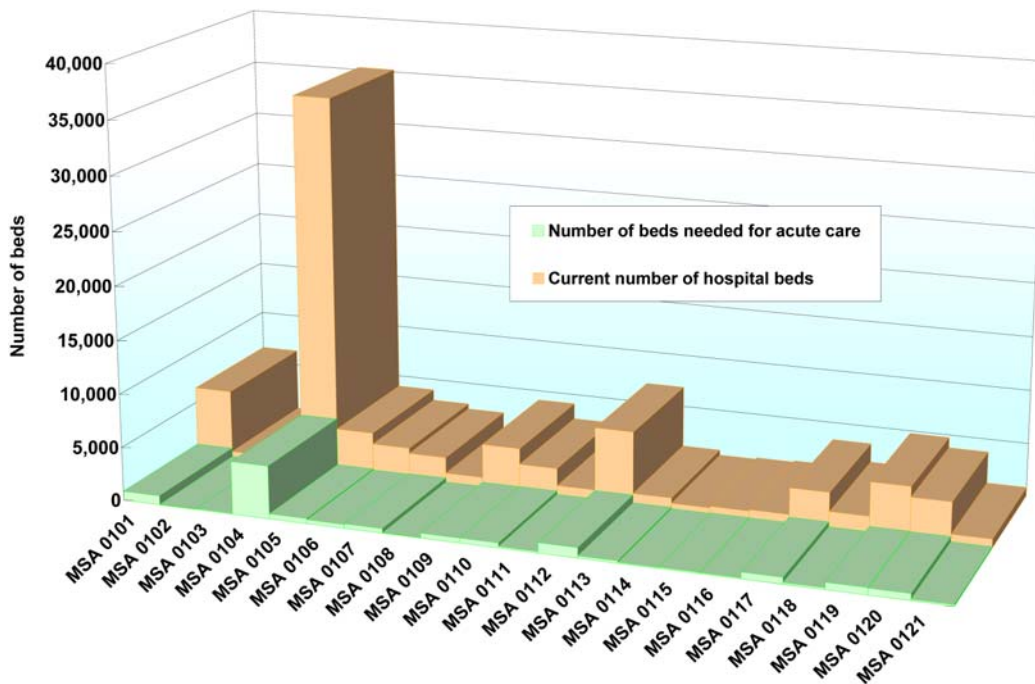

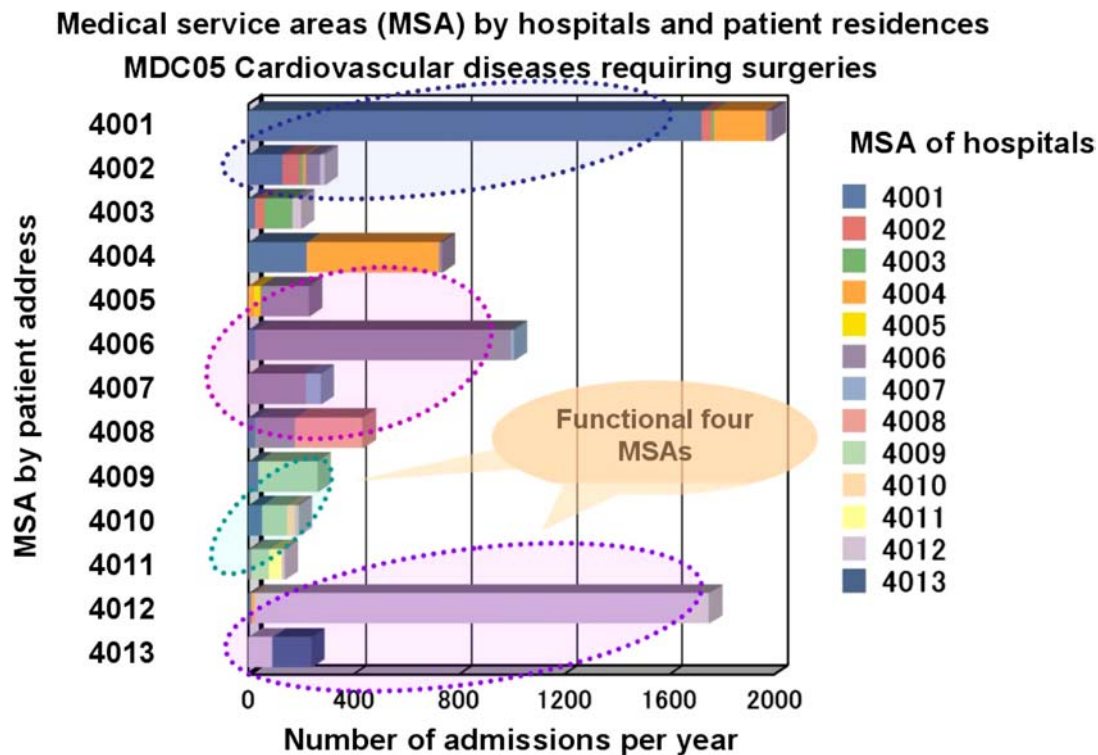Figure 3.   Estimation of number of beds needed for acute care

Figure 4.   Functional and actual medical service areas different from administrative areas

designated 13 MSAs. We have found functional reconstruction of MSAs to be more frequently observed for elective and relatively high-tech surgeries such as cardiac intervention and surgeries for malignant diseases, indicating patients' preferences and traveling to hospitals with a high volume of surgeries and interventions even when they are available in other MSAs.

❖ Discussion

We have shown the feasibility of arranging regional health care delivery plans using the DPC case mix system and national patient database. Required health care resources in the districts were easily estimated from the DPC-based disease structure and the average use of health services predicted for the relevant DPC groups.

DPC-based estimation of disease structure has the following advantages: First, the recognition and improvement of transparency for professional medical information are anticipated to be simplified. Local governments are required to assess the efficiency and the quality of health services, to plan the delivery of health services, and to provide related information to residents in the designated areas. However, the majorities of officers in charge of local governments are not specialists in medicine and are not familiar with disease names and medical professional terms. By using the DPC system, they can share professional information with medical specialists. This advantage is the same for insurers and patients. These groups can easily share medical professional information with doctors and other health care providers.

Second, reference data can easily be obtained for the assessment of differences in the efficiency and quality of health care in one district as compared to those in other districts. It is well known that there are large geographical variations in the efficiency of care provision, including the average length of hospital stay and cost per admission in Japan. It is expected that these variations can easily be assessed by using the DPC system, since increasing quantities of hospital performance data are being published for acute care hospitals where the DPC payment system is applied.

Finally, the DPC system can be used for health care resource allocation in the region. From the disease structure in the district and standardized resource utility per DPC group, health resources including

acute care beds, medical staff, and medical equipment can be appropriately allocated. The strategic resolution of the nursing staff shortage, which has recently been reported in rural areas of Japan, by DPC-based resource allocation for hospital beds and the work force can hopefully be achieved. In addition, the notorious excesses in radiographic scanning machines in Japan, which potentially diminish the efficiency of health care resource utilization, can be accurately assessed by DPC-based resource allocation and over-investment in these types of equipment by hospitals can potentially be restrained.

❖ Acknowledgement

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