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Spatial Analysis of Referrals from Secondary Care and to Aftercare in a Tertiary Care University Hospital in Japan

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Abstract

All Japanese citizens are covered by the national insurance system, which provides universal free access to healthcare services. We studied the pattern of referral of inpatients from secondary care hospitals to a tertiary care university hospital and the pattern of reverse referral in Japan using a geographic information system (GIS). The results showed that 55.7% of the patients were directly admitted to the hospital without referral from other hospitals or clinics and that 89.1% of the inpatients were referred to the outpatient department of the hospital to which they had been admitted. GIS analysis for the inpatients service area showed that the tertiary care university hospital functions also as a primary and secondary care hospital for patients living near the hospital. There were several foci of inpatients with prolonged length of hospital stay. These results suggest that the function of university hospitals in Japan is unspecialized and that the referral route from a university hospital to aftercare is also ill equipped.

Keywords:

geographic information systems, university hospitals

Introduction

In Japan, all citizens are covered by the national insurance system, which provides universal free access to healthcare services. There are no general physicians or "gatekeepers" in the Japanese healthcare system. Patients in Japan can freely choose between going to a physician's office or a hospital [1]. Hospitals are popular because of their prestige and high quality of care. On the other hand, there is no clear differentiation between large and small or public and private hospitals or between hospitals and private practices in the healthcare system in Japan [1]. Functional differences between hospitals and nursing homes for the elderly are also not clear despite the introduction of long-term care insurance [2]. Hospitals often function as nursing homes for the elderly, which is one of the main reasons for the extraordinarily long hospital length of stay (LOS) in Japan. LOS is very long in Japan compared with that in other Organization for Economic Co-operation and Development (OECD) countries [3], particularly for the elderly. The government has tried to address the issue of undifferentiated functions of health care facilities. A system of fees for referral was introduced in 1988, and outpatient consultation fees for university hospitals were increased if more than 30 percent of their new ambulatory care patients came with referrals [4]. Since 1996, patients who visit a large hospital without referral from a primary care physician have had to pay an extra charge [5]. In 2003, an inclusive payment system for acute inpatient care was introduced in university hospitals [6]. These systems are based on a policy of facilitating functional differentiation of health care facilities. However, little is known about the actual patterns of referral from secondary care hospital to tertiary care university hospitals and the reverse referral in Japan. We therefore studied the pattern of referral form secondary care hospitals to a tertiary care university hospital and the pattern of reverse referral in Japan.

Materials and methods

Data

Niigata University Hospital had 810 inpatient beds, 23 clinical departments and medical staff of 818 in 2004. The service area of the hospital as a tertiary care hospital covers all districts in Niigata Prefecture, which has a population of 2,400,000. The size of the hospital is typical for a Japanese university hospital. Data were analyzed for all patients who had received inpatient care at Niigata University Hospital during the period from April 2004 to March 2005. Data on patient age, sex, residential address, route of referral to Niigata University Hospital, discharge diagnosis classified by Japanese case mix classification for inpatients (diagnosis procedure combination, DPC) [5,6], length of hospital stay (LOS), outcome of admission and route of referral from Niigata University Hospital were obtained from the hospital information system. In the DPC system, patient discharge is classified into 16 major diagnostic categories (MDC) and 1,727 case-mix groups. Data on average and standard deviation (SD) of LOS of the patients in Japan, who were assigned to each DPC, were obtained from the Ministry of Health, Labor and Welfare. Spatial analyses were performed using GIS software ArcView GIS 3.1a and ArcGIS 9 (Environment Systems Research Institute Inc., CA, USA). Road network data (Pasco, Tokyo, Japan) also contain codes for different classes of roads, average car speed and rules of the roads in order to calculate how long it would take to drive along a particular road segment [7].

Referral from clinics and other hospitals

To study the geographic distribution of patients admitted to Niigata University Hospital, the geographic distributions of all inpatients were geo-coded by residential addresses to a GIS map. Empirical Bayesian estimates for the rate of inpatients per population at risk were plotted on a GIS map with 2 km meshes [8]. To study the relationship between spatial accessibility to Niigata University Hospital and the distribution of patients, the number of inpatients who lived within an area that is a certain time by car from Niigata University Hospital was calculated by using Network Analyst (ESRI Japan). The same procedure was performed for other hospitals in Niigata Prefecture in order to compare the inpatient service areas of Niigata University Hospital and general hospitals. The distribution of patients referred from other medical facilities was plotted on GIS maps using the kernel density method [9,10].

Referral to aftercare

Aftercare was defined as referral to an aftercare program, such as outpatient care and transfer to inpatient wards of other hospitals, not including foster care, a group home or a nursing home [11]. Distributions of patients referred to the Outpatient Department of Niigata University Hospital, patients referred to outpatient care of other medical facilities and patients transferred to paediatric wards of other hospitals were plotted on GIS maps. Since delay in referral of a patient to aftercare prolongs LOS of the patient, spatial differences in LOS of inpatients might reflect the spatial differences in accessibility to aftercare. To estimate the spatial differences in accessibility to aftercare, LOS of each patient was scored and plotted on a GIS map. The SD scores for LOS (LOSSDS) of a patient who was assigned to a DPC were calculated as follows:

$$\frac{\left[\left(\textit{actual LOS of the patient}\right)-\left(\textit{average LOS of the DPC}\right)\right]}{\textit{SD of the LOS of the DPC}}$$

Contour maps of LOSSDS of the patients were produced by interpolation using the ordinary Kringing method [12].

Results

Referral from clinics and other hospitals

During the study period, a total 8,545 patients were admitted to Niigata University Hospital (Table 1). Among them, data for 8,177 patients living in Niigata Prefecture were used for analysis in this study. The empirical Bayesian estimates for the rate of inpatients per population at risk were plotted on a map with 2 km meshes. Although these patients were predominantly distributed around Niigata City, the capital of Niigata Prefecture, there were some meshes with large numbers of inpatients far from Niigata City. This indicated that patients visited Niigata University Hospital from a broad area of the prefecture. In addition, there were marked spatial differences in the distribution of residences of inpatients living in or near Niigata City, suggesting competition with other primary and secondary care hospitals to get inpatients.

Table 1 – LOSSDS of all inpatients

Major Diagnostic Category	Number of patients	LOSSDS Average (SD)
Nervous system	646	-0.19 (3.70)
Eye	743	0.36 (2.11)
Ear, nose, mouth and throat	413	0.90 (5.65)
Respiratory system	444	0.48 (6.26)
Circulatory system	547	0.83 (4.44)
Digestive and hepatobiliary system	1,273	0.04 (2.28)
Musculoskeletal system	715	-0.05 (1.91)
Skin and subcutaneous tissue	250	-0.35 (1.65)
Breast	48	-0.53 (1.36)
Endocrine, nutrition and metabolic system	362	-0.06 (2.21)
Kidney and urinary tract	634	-0.04 (3.76)
Female reproductive system and pregnancy	1,202	-0.41 (2.20)
Blood and immunological disorders	135	2.31 (6.00)
Newborn and other neonates	640	-0.71 (1.69)
Children	76	-0.17 (5.27)
Injury, poison and burns	417	0.36 (7.68)
Total	8,545	0.06 (3.67)

The number of patients admitted to Niigata University Hospital without referral from other hospitals and clinics was 4,524 (55.3%), which differed remarkably by MDC or clinical department from 38.8% to 63.0% (median 55.7%). Detailed information on referral was obtained by analyzing data for inpatients admitted to the Pediatric Department. The rate of the inpatients referred from other medical facilities was found to be 38.8%. Only 19.0% of patients admitted to Niigata Hospital lived in an area 30 min from the hospital by car, suggesting that even patients living far from the hospital are often admitted to the hospital without referral from other medical facilities. Results obtained by using the kernel density method indicated that pediatric inpatients living near Niigata City tended to be admitted directly to Niigata University Hospital, whereas inpatients living far from Niigata University Hospital tended to be referred from other medical facilities (Fig. 1). This tendency was the same for other clinical departments. These results suggest that a tertiary care university hospital in Japan has characteristics of both a primary care hospital and a secondary care hospital for inpatients living near the hospital.

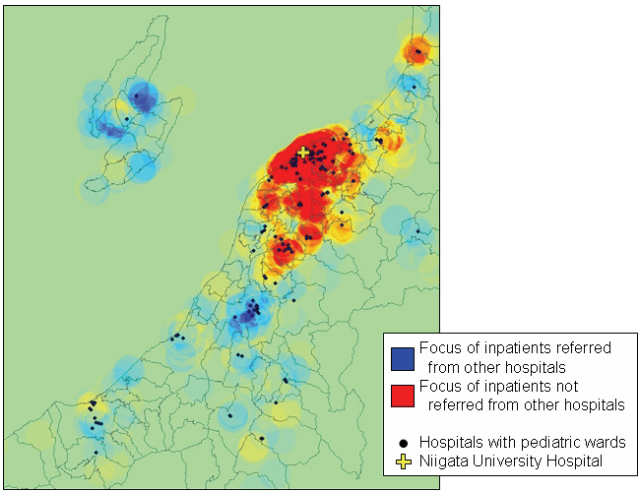

Figure 1 - Focus of inpatients referred from other medical facilities

Referral from clinics and other hospitals

Almost all of the inpatients (7,745 out of 8,177, 94.7%) received referral to aftercare, and 6,907 (89.1%) of them received care in the Outpatient Department of Niigata University Hospital after discharge. Only 838 patients (10.2%) were referred to clinics or outpatient departments of other hospitals, and 199 patients (2.4%) were transferred to other hospital wards after discharge from Niigata University Hospital. The patients referred to clinics or outpatient departments of other hospitals and the patients transferred to wards of other hospitals tended to be distributed far from Niigata City and in Sado Island, which is located 40 km away from Niigata City. The situation was the same for pediatric inpatients. Almost all of the pediatric inpatients (96.4%) received referral to aftercare, and 82.8% of them received aftercare in Niigata University Hospital. Only 11.6% of them were referred to clinics or outpatient departments of other hospitals, and 2.0% of the pediatric patients were transferred to other hospital wards after discharge from the hospital.

Next, we investigated spatial difference in trends of referral using LOSSDS in order to ascertain whether there were barriers to referral to aftercare in each district. The LOSSDS of each MDC of Niigata University Hospital is shown in Table 1. There were also remarkable differences in LOSSDS among clinical departments. Figure 2 shows the data for pediatric inpatients. There were some foci with high LOSSDS near Niigata City (A and B), where there might be some barriers to referral to aftercare. We paid special attention to one of the foci (A) and investigated why the patients who lived in that focus showed high LOSSDS. There were no problems in spatial or physical accessibility in the focus, because the focus was located over arterial roads. The focus was located within an area 30 min by car from two hospitals. Although these hospitals had beds for children, each hospital had only one pediatrician. Therefore, shortage of pediatric manpower is one of the reasons for the clustering of patients.

Discussion

The results of our study indicate that about half of inpatients visited a tertiary care hospital in Japan without referral from other medical facilities and that more than 80% of inpatients were referred to the outpatient department of the hospital. Most of the inpatients received outpatient care, inpatient care and aftercare in the same hospital. Patients living near the hospital tended to use the hospital as a secondary care hospital or were admitted without referral from other medical facilities. As a secondary care hospital, the hospital was in competition with other secondary care hospitals to get inpatients. On the other hand, patients who lived far from the hospital tended to use the hospital as a tertiary care hospital and were referred to the hospital from other medical facilities.

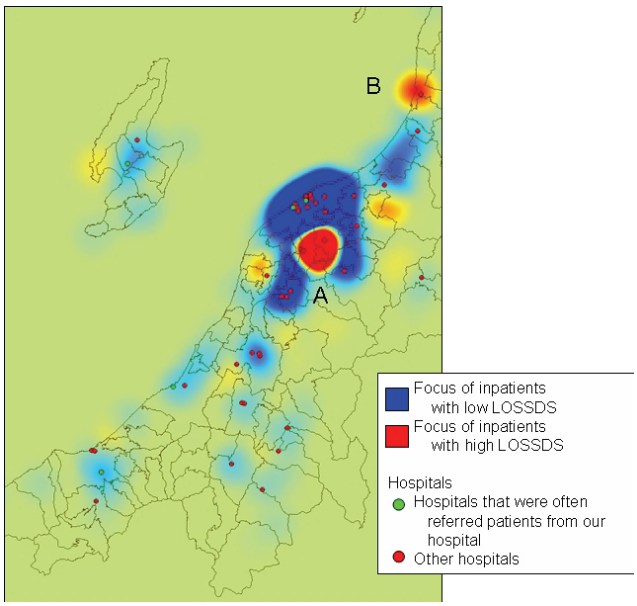

Figure 2 - Focus of inpatients with high and low LOSSDS.Our results showed that even a tertiary care university hospital functions as a secondary care hospital, especially for patients living near the hospital. Moreover, acute care hospitals in Japan usually provide care that is usually provided by nursing homes and home caregivers in other countries such as the USA and UK. The undifferentiated functions of acute care hospitals in Japan make LOS of inpatients extraordinarily long compared with that in other advanced countries [3]

Although the care provided by so-called acute care hospitals in Japan is a mixture of various kinds of care, there are trends toward differentiation and specialization in these

hospitals. One such example is the introduction in 2003 of a new inclusive payment system for acute inpatient care in the eighty main hospitals at universities and national centers to replace the traditional fee-for-service payment system [6]. Under this payment system, hospitals can obtain medical fees more efficiently as the LOS decreases. Actually, the LOS of inpatients in these hospitals has become significantly shorter after the introduction of the new payment system [13]. Reduction in LOS leads to a new incentive to acquire new patients to fill the unoccupied inpatient beds. This can be accomplished by an increase in referrals from other medical facilities, and the reduction in LOS needs a close partnership between medical facilities participating in aftercare. The results of our study clearly showed spatial differences in partnership between other medical facilities in terms of both referral to the hospital and referral from the hospital. By using GIS, we could easily find districts where the hospital had not established a strong partnership with medical facilities. The results of analysis of LOSSDS provided a hint as to why inpatients living in a region stay in the hospital for a long time. The methodology described in this article can be used to study regions in which a partnership between medical facilities has not been established and why a partnership has not been established in the regions [14-16]

Conclusion

The results of our study suggested that the function of university hospitals in Japan is unspecialized and that the referral route from a university hospital to aftercare is also ill equipped.

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