

Original article

Evaluation of the DPC-based inclusive payment system in Japan for cataract operations by a new model

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Abstract

We propose a new model for analyzing the length of hospital stay when variances are heterogeneous. This model is an alternative to the conventional models such as Cox's proportional hazard model and can be used to address various problems of survival analysis. The model is a heteroskedastic version of the Box–Cox transformation model and is estimated by the tobit maximum likelihood method, and its estimation can be easily done using a standard statistical package program. Using the proposed model, we analyze the effects of the diagnosis procedure combination/per diem payment system (DPC/PDPS) on the length of hospital stay following cataract operations in Japan. Data collected from six general hospitals before and after the introduction of the system are analyzed. The number of patients is 2677.

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1. Introduction

Cox's proportional hazard model [3] is widely used to examine various problems in survival analysis, such as the length of stay (LOS) in a hospital. However, we cannot use the proportional hazard model when heterogeneity exists in the baseline hazard function. For the LOS, variances are often heterogeneous even after controlling the characteristics of diseases, treatments, and patients. Therefore, it is improper to use the proportional hazard model for such a data set. Nawata et al. [11] analyzed the LOS for hip fracture patients using a simultaneous equation model. However, even in their model, the heterogeneity of variances was not considered. In this paper, we first propose a new model that considers the heterogeneity of variances. The model is a heteroskedastic version of the Box–Cox transformation model and is estimated by the tobit maximum likelihood method, and its estimation can be easily done using a standard statistical package program. We then evaluate the effect of the new Japanese inclusive payment system on the LOS for cataract operations using the proposed model.

With medical care expenses having rapidly increased, shortening the LOS by reducing the incidence of long-term hospitalization has become an important political issue in Japan. A new inclusive payment system based on the diagnosis procedure combination (DPC) was introduced in 82 special functioning hospitals (i.e., university hospitals,

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the National Cancer Center, and the National Cardiovascular Center) in April 2003 [13,19]. The DPC is an original system developed in Japan. The DPC classifies diseases, operations, treatments, and patient conditions using a 14-digit code. The first six digits classify principal diseases on the basis of the International Classification of Diseases-10 (ICD-10). The remaining 8 digits pertain to information regarding operations, treatments, and patient conditions such as the presence of a secondary disease. Because the DPC Evaluation Division of the Central Social Insurance Medical Council [6] started to call the new inclusive payment system based on the DPC the diagnosis procedure combination/per diem payment system (DPC/PDPS) in December, 2010, we refer to the new inclusive payment system as the DPC/PDPS and to hospitals participating in the DPC/PDPS as DPC hospitals in the rest of this paper. Since April 2004, the DPC/PDPS has been gradually extended to general hospitals. As of July 2009, a total of 1283 hospitals, about 14% of the 8862 general hospitals in Japan, had joined the DPC/PDPS. These 1283 hospitals have 434,231 beds, which represents nearly half of the total beds (913,234 beds) in general hospitals in Japan. Inclusive payments based on the DPC/PDPS cover fees for the following categories only: basic hospital stays, medical examinations, image diagnosis, medication, injections, treatments under 1000 points (10 yen per point has been paid to hospitals), and medicines used during rehabilitation treatments and related activities. Fees for all other categories, such as fees for operations, are paid on the basis of the conventional fee-for-service system.

Unlike the diagnosis-related group/prospective payment system (DRG/PPS) used in the U.S. and other countries, the Japanese DPC/PDPS is a per diem prospective payment system. The per diem payment becomes less as the LOS becomes longer. Three periods, Period I, Period II, and the Specific Hospitalization Period, are determined for each DPC code. Period I is set as the 25th percentile of the LOS of the surveyed hospitals. Period II is set as the average LOS, that is, the 50th percentile (although this value is actually the median, it is called the “average length of hospital stay” in the DPC/PDPS). Finally, the Specific Hospitalization Period is given by the following equation: (average LOS) + 2 × (standard deviation). The basic per diem payment is determined according to the LOS. For stays lasting less than Period I, the per diem payment to hospitals is 15% more than the average per diem payment of the patients whose stays were within the average LOS. For hospital stays lasting between Periods I and II, the per diem payment is determined such that (per diem payment in Period I – average per diem payments) × (number of days in Period I) equals (the average per diem payments – per diem payment between Periods I and II) × (number of days between Periods I and II). For stays between Period II and the Specific Hospitalization Period, the per diem payment is reduced by an additional 15%.¹ For stays over the Specific Hospitalization Period, the per diem payment is determined through the conventional fee-for-service system.

The introduction of the DPC/PDPS was one of the largest and most important revisions of the payment system since the Second World War. The Medical Service Fee Schedule, which determines payments to hospitals including the DPC/PDPS, is revised every two years. To ensure the effective use of medical resources, it is absolutely necessary to thoroughly analyze the DPC/PDPS to identify needed improvements for future revisions. However, since the system was introduced recently, sufficient evaluations of the system using econometric models have not yet been done. Although the DPC Evaluation Division of the Central Social Insurance Medical Council [4,5] published reports on the effects of the DPC/PDPS, these reports are no more than simple comparisons of the LOS.

The number of cataract patients in Japan has been increasing rapidly with the ageing of the population [8]. 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. For example, according to the American Academy of Ophthalmology and the American Society of Cataract and Refractive Surgery [1], the standard schedule for visiting the hospital is that the first visit is the day after the surgery, the second is approximately 1 week later, the third is approximately 3 weeks later, and the fourth is 6–8 weeks later. 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 LOS have become very important. Shimizu et al. [14] reported that the LOS in the ophthalmology department in one hospital had shortened by 2.4 days after the introduction of the DPC/PDPS due to the reduction of patients over the Specific Hospitalization Periods. However, factors such as the characteristics of patients, types of diseases, and treatments were not considered in this study.

¹ In the case of the cataract operations studied in this paper (DPC code: 021103x01x000), the per diem inclusive payment in 2005 was 2546 points up to the third day of hospitalization; 1882 points for the 4th–6th days; and 1600 points for the 7th–10th days.

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