Development of Comorbidity Complication Procedure Matrix (CCPM): A revision proposal for a Japanese case-mix classification system that more closely reflects severity

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Introduction

The Diagnosis Procedure Combination/Per-Diem Payment System (DPC/PDPS) launched in 2002 by the Ministry of Health, Labour and Welfare of Japan. As the DPC produces a tiered tree structure with the condition name as the top layer, the level of one node (parent: branch condition) impacts all of the child nodes, and thus affects the structure of the diagnostic categories. Further, when there are a large number of branch conditions, there was the problem that the leaf nodes located on the tips increase too much.

The comorbidity complication procedure matrix (CCPM) that takes severity into consideration has been investigated as a new method of evaluation that enables both an accurate reflection of differences in the necessity of medical resources based on severity and control over the number of payment categories. It is expected that CCPM, by creating a matrix with various conditions reflecting the volume of medical resources while maintaining the format of diagnostic classifications to a certain extent, can enable comprehensive evaluation that according to severity, while controlling the explosion in the number of leaf nodes and compressing the number of branches. In this study, therefore, we have developed CCPM using the example of community acquired pneumonia.

Methods

Targeting patients hospitalized with pneumonia, acute bronchitis and acute bronchiolitis, only those with community-acquired pneumonia were extracted based on severity classifications. Analysis was performed on two levels using the nationwide discharge administrative database of the DPC/PDPS 1,057 hospitals voluntarily participated in the DPC Research Group conducts survey in 2012. 1) we determined the variables to be evaluated with CCPM and created a new DPC tree. 2) We could create a matrix that conformed to the treatment state and reflects appropriate medical resource consumption, and in which the number of branches was restricted. The data finally used for analysis was 135,549 cases.

As the CCPM clarified differences in comprehensive treatment fees per day based on severity, we created a tree for each severity level. Next, we carried out decision tree analysis for each severity level to investigate the variables to be used in the CCPM. For the target variable, we used rough comprehensive treatment costs, and, for the explanation variables, age (up to 14, 15-64, 65-74 and 85 and over), secondary conditions, pneumonia severity, scheduled/emergency hospitalizations, gender, emergency transport and hospitalization route were used. It was decided not to use outcome indices (LOS, change) or pharmaceutical usage data. Based on the variables described above, we developed a tree using a regression model and, following that, this was trimmed down using a regression tree. The regression tree model used the R function rpart?recursive partitioning and regression trees?. We developed the tree by setting the tree complexity parameter cp (complexity parameter) to a small value and, following that, trimmed down the regression tree. With the recursive trimming, in addition to observing the necessity of the trimming using the plotcp function, the logical meaning of the branches were determined by comparing the number of patients per branch and medical fees per day. The variables were determined using the CCPM, based on the results of the trimming. We performed decision tree analysis using medical fees per day and average LOS as the target variables, and set the matrix thresholds. The new DPC tree was recalculated based on the threshold and the classifications were corrected further from a clinical perspective.

Results

The average value for medical costs per day tended to increase in age order, while for schedule/emergency hospitalizations, a statistically-significant difference in medical costs for each category. The results of the regression tree showed that in the medical cost category, age and scheduled/emergency hospitalizations were effective variables. For the CCPM, age, scheduled/emergency hospitalizations, surgery, artificial
respiration, severity of pneumonia and secondary conditions were adopted. We amended the branch conditions, and eventually the DPC tree (284 branches) were reclassified into 9 categories and a multi-dimensional CCPM classification was created. It was confirmed that compared to the current DPC classifications, the required medical resources were reflected to a greater extent.

Conclusions

We clarified that, with CCPM, the necessary amount of medical resources can be reflected and the number of classifications controlled while maintaining the basic structure of the diagnostic group classification tree diagram. We shall continue with our aim to implement this by 2018 while exchanging opinions with clinicians and investigating deployment of CCPM on a nationwide level.

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