

Examination of Public Hospital Unions Technical Efficiencies Using Data Envelopment Analysis and Machine Learning Techniques

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Abstract : Regional planning in health has gained speed for developing countries in recent years. In Turkey, 89 different Public Hospital Unions (PHUs) were conducted based on provincial levels. In this study technical efficiencies of 89 PHUs were examined by using Data Envelopment Analysis (DEA) and machine learning techniques by dividing them into two clusters in terms of similarities of input and output indicators. Number of beds, physicians and nurses determined as input variables and number of outpatients, inpatients and surgical operations determined as output indicators. Before performing DEA, PHUs were grouped into two clusters. It is seen that the first cluster represents PHUs which have higher population, demand and service density than the others. The difference between clusters was statistically significant in terms of all study variables ($p < 0.001$). After clustering, DEA was performed for general and for two clusters separately. It was found that 11% of PHUs were efficient in general, additionally 21% and 17% of them were efficient for the first and second clusters respectively. It is seen that PHUs, which are representing urban parts of the country and have higher population and service density, are more efficient than others. Random forest decision tree graph shows that number of inpatients is a determinative factor of efficiency of PHUs, which is a measure of service density. It is advisable for public health policy makers to use statistical learning methods in resource planning decisions to improve efficiency in health care.

Keywords : public hospital unions, efficiency, data envelopment analysis, random forest

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