Available online at www.sciencedirect.com
ScienceDirect
European Journal of Operational Research 186 (2008) 1175–1183
EUROPEAN JOURNAL OF OPERATIONAL RESEARCH
www.elsevier.com/locate/ejor

O.R. Applications

Cost minimization models: Applications in a teaching hospital

Sakesun Suthummanon [a,*], Vincent K. Omachonu [b]

[a] Faculty of Engineering, Department of Industrial Engineering, Prince of Songkla University, Hat Yai, Songkhla 90112, Thailand
[b] Department of Industrial Engineering, University of Miami, P.O. Box 248294, 1251 Memorial Drive, Coral Gables FL331240623, USA

Received 31 August 2006; accepted 19 February 2007
Available online 27 March 2007

Abstract

The primary objective of this article is to explore the feasibility of the application of cost minimization analysis in a teaching hospital environment. The investigation is concerned with the development of cost per admission and cost per patient day models. These models are further used for determining the value of the length of stay that would minimize cost per patient day (projected length of stay) and for estimating the costs. This study is based on total of 109,060 observations (2002), obtained from a teaching hospital in South Florida. The top 10 diagnosis-related groups (DRGs) with the highest volume are selected for the study. The cost models are fitted to the data for an average R^2 value of 87.3%, and a mean absolute percentage error (MAPE) value of 16.1%. The result demonstrates that if a hospital can control the length of stay at the projected level, on average, the cost per admission and the cost per patient day will decrease. Based on 8703 admissions for the selected DRGs in 2002, the total cost per year and the cost per patient day are decreased by approximately 8.56% ($15,453,841) and 4.02% ($66.30), respectively. Overall, these results confirm that the concept of cost minimization analysis in economic theory can be applied to healthcare industries for the purpose of reducing of costs. Cost minimization and cost variation analyses offer useful information to hospital management for better decision-making. It would be an important aid in making management decisions, particularly for cost reduction.
© 2007 Elsevier B.V. All rights reserved.

Keywords: Cost per admission; Cost per patient day; Cost minimization; DRG

1. Introduction

The last three decades various economic models have seen applied for the healthcare industry. There have been numerous studies on the topic, nearly all in hospital environment (Tousignant et al., 2003; Smet, 2002; Dawson, 2002; Cleverley, 2002; Kearns et al., 2001; Jackson, 2000). Most of the models are generally focused on cost structure, cost-effectiveness analysis, cost utility analysis, and cost-benefit analysis. Although profit maximization has traditionally been assumed in the empirical analysis of many other industries, a variety of both institutional and behavioral features of the hospital suggest that the assumption of profit maximization is not appropriate in the case of hospitals (Cowing et al., 1986). Cost minimization is a much more reasonable assumption than profit maximization for various non-profit organizations. Robinson (1993) notes

* Corresponding author. Tel.: +66 869663678; fax: +66 74212892.
E-mail addresses: sakesun.s@psu.ac.th, sakesun91@hotmail.com (S. Suthummanon).

0377-2217/$ - see front matter © 2007 Elsevier B.V. All rights reserved.
doi:10.1016/j.ejor.2007.02.037

that cost minimization analysis is an appropriate technique to use for healthcare organizations when there is reason to believe that the outcomes of the different patients' length of stay under consideration are the same. There have been countless applications of cost minimization analysis for healthcare organizations (Jones et al., 1999; Shepperd et al., 1998; Coast et al., 1998; Halvorsen and Kristiansen, 1996). According to these studies, the cost minimization analysis was performed to determine the least costly option among several alternatives (treatment strategies) that will yield an equivalent outcome.

Nevertheless, very few information is available regarding the application of cost minimization to determine the optimal length of stay that lead to minimize cost for the diagnosis-related groups (DRGs) system. A significant study which applies the cost minimization analysis for the DRGs at a teaching hospital, was conducted by Suthummanon and Omachonu (2004). According to this study, the DRGs were further classified into four major insurance categories: Medicaid, Medicare, commercial, and self-pay. Regarding to this study the results confirm that the concept of cost minimization analysis in economic theory can be practically applied to healthcare industries for the purpose of reducing of costs. A shortcoming of this work is that the analysis for other insurance types and overall patients as a whole (all insurance types are grouped together as one model) is ignorance. Due to there are several insurance types in each DRG, therefore it is very difficult to individually analyze for each one. Hence, analysis for overall patients should be performed with the aim of understanding the cost behavior as a whole.

The literature on hospital cost models encompasses a wide variety of models. At one extreme, there are models that treat costs as dependent variable and employ numerous input factors as independent variables. The examples of widely used independent variables are patient's age, gender, race, marital status, income, health condition, and health insurance. At the other end, there are structural cost models in which costs (or the logarithm of costs) served as the dependent variable, and outputs are used as independent variables. Berki (1972) states that the cost model can be presented as $TC = f(Q)$, where TC denotes total costs and Q the quantity of output. It is important to note that patients' length of stay is used as the quantity of output in many healthcare studies (Custer and Willke, 1991; Cassimatis, 1988). Several studies have focused on cost function using the length of stay as an independent variable. In addition, previous studies including Carr and Feldstein (1967), Francisco (1970), Dowling (1976), Elnicki (1979), Grannemann et al. (1990), Phelps (1997) and Malkin (1998) conclude that the length of stay is the most determinant of hospital costs.

The primary objective of this research is to examine the feasibility of the application of cost minimization analysis for DRGs at a teaching hospital. The investigation attempts to determine the level of the length of stay at which it becomes more cost-effective to provide the services and to examine potential cost saving if the projected length of stay has replaced the actual level. The two questions addressed here are: (1) what is the projected length of stay to minimize cost per patient day? and (2) what are the effects of changing the length of stay from the actual level to the projected level, on the total cost and the cost per patient day for a hospital?

2. Methodology

This research is concerned with the development of cost per admission and cost per patient day models. Regression analysis is used to develop the cost models for each DRG. It is an exploratory data analysis which is using the data trends in the developing a theory governing the relationship between length of stay and costs. These models are further used for determining the value of the length of stay (projected length of stay) that would minimize cost per patient day and for estimating costs. The effects of changing the length of stay from the actual level to the projected level (resulting from cost minimization) on the costs are also investigated. An assumption is made for this analysis is that the quality of care is held constant across individuals in each patient group and DRG.

Two dependent variables identified for the purpose of this study are cost per patient day and cost per admission. The cost per patient day comprises all services or treatments per day a hospital provides to a patient. The cost per admission includes all services or treatments a hospital provides to a patient per admission. The length of stay is considered to be the independent variables for developing the cost models. The length of stay is defined as the number of days in a hospital from the date of admission to the date of discharge for each inpatient. There are five steps involved in this research: (1) data collection; (2) cost per admission model development; (3)

دریافت فوری ← متن کامل مقاله

ISIArticles
مرجع مقالات تخصصی ایران

✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
✓ امکان دانلود نسخه ترجمه شده مقالات
✓ پذیرش سفارش ترجمه تخصصی
✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
✓ دانلود فوری مقاله پس از پرداخت آنلاین
✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات