Measuring Technical Efficiency in Health Care Organizations

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The rising cost of health care has created great interest in developing methods to increase the efficiency of health care organizations. Despite this interest most analyses of prospective payment and other programs designed to control expenditures have examined costs and not efficiency. This article examines a new technique—data envelopment analysis (DEA)—that facilitates the conduct of efficiency studies. The utility of DEA is analyzed by comparing this technique with other methods used to measure efficiency, by discussing the application of DEA in the health care industry and by assessing the validity of results from DEA studies. The article concludes with an assessment of the strengths and weaknesses of DEA and suggestions for refining this technique.

INTRODUCTION

An inflationary spiral has plagued the U.S. health care industry since the 1960s. During this period the proportion of GNP spent on health care has more than doubled—going from 5% in 1960 to over 11% in 1989. In response to this problem a number of cost containment efforts have been proposed and implemented. Among these initiatives are the stimulation of competition, controls on capital formation, utilization review, managed care, and rate regulation.

Currently, rate regulation is the most prominent approach by the government to stem the rising tide of health care expenditures. The federal government launched the Medicare Prospective Payment System (PPS) in 1983. By 1988 care-based prospective payment systems regulated rates of compensation for hospital patients in 18 states.1

It is common to argue that by placing the health care organization (HCO) at financial risk for profit or loss prospective payment will cause hospitals to operate in a more efficient manner, thereby restraining cost increases.2 On the other hand, HCOs may respond to prospective payment by reducing the quality of care. It is ironic that although rate regulation is intended to increase efficiency, there is little evidence that researchers have attempted to document this result. A recent review of empirical studies of rate...
regulation programs reported that 32 studies examined the impact of rate-setting on costs while only one study examined the effect of rate-setting on efficiency.\textsuperscript{2}

The emphasis on cost analysis can be attributed, in part, to the ease of conducting cost function studies relative to structural studies of production. However, the recent development and refinement of new techniques to measure efficiency will allow more studies to be conducted in this area. The purpose of this article is to demonstrate the utility of the application of an efficiency measurement technique, data envelopment analysis, in the health care field. This will be done by reviewing the literature of efficiency analysis in HCOs and by describing possible refinements and extensions of these techniques.

\section*{EFFICIENCY MEASURES}

Technical and allocative efficiency of health care organizations have been examined. The former measures the extent to which a given combination of inputs produces as much output as is feasible in an engineering sense. For example, the production function $Q = 2L^{0.5}K^{0.5}$ implies that the input combination $L = 16, K = 4$ will result in no more than 16 units of output. If the health care organization uses this combination of inputs and produces only 10 units of output, its efficiency rating is 10/16 or 0.625.

The concept of technical efficiency is also shown in Figure 1. Operating at point A with 4 units of capital and 16 units of labor on the isoquant $Q_1$ (a curve depicting a locus of points in which different combinations of capital and labor are capable of producing the same amount of output) the HCO is capable of producing at most 16 units of output. HCOs producing this level of output are classified as efficient and are assigned an efficiency rating of 1.0. If fewer units are produced with this combination of inputs, the HCO is classified as relatively inefficient and will be assigned an efficiency rating of less than 1.

Allocative efficiency, on the other hand, measures the extent to which a firm is minimizing the cost of producing a desired level of output. Using the terminology of production theory, allocative efficiency measures the extent to which the optimal combination of inputs is employed by considering the relative marginal productivity and prices