Chapter 1
Efficient Managerial Decision-Making in Healthcare Settings:
Examples and Fundamental Principles

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ABSTRACT

This chapter illustrates the predictive and analytical decision-making power of healthcare management engineering compared to traditional management reasoning. An overview of the domain of healthcare management engineering is provided. Four types of problems are illustrated in details: (i) dynamic supply and demand balance using discrete event simulation, (ii) the probabilistic resource optimization for specimen screening testing, (iii) principal component analysis for identifying a few significant independent contributing variables (factors) for a large patient demographic data-base, and (iv) recursive forecasting of a time series using its auto-correlation function to identify the strongly correlated past data-points.

Traditional managerial decision-making and management engineering methodology are discussed and applied side by side to analyze the same problems in order to illustrate and explain their differences. Some fundamental management engineering principles are summarized in conclusion.

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The irony of the Information Age is that it has given new respectability to uninformed opinion.

Michael Crichton, Airframe, New York, 1996

INTRODUCTION

Modern medicine has achieved great progress in treating individual patients. This progress is based mainly on life science (molecular genetics, biophysics, biochemistry) and the development of medical devices and imaging technology.

However, according to a report published jointly by National Academy of Engineering and Institute of Medicine, relatively little material resources and technical talent have been devoted to the proper functioning of the overall health care delivery as an integrated system in which access to efficient care should be delivered to many thousands of patients in an economically sustainable way (Reid et al, 2005).

As this report strongly points out, a real impact on quality, efficiency and sustainability of the health care system can be achieved only by using methods and principles of system engineering or healthcare delivery engineering (Reid et al, 2005).

At the same time, this report states in an unusually blunt way, "In fact, relatively few health care professionals or administrators are equipped to think analytically about health care delivery as a system or to appreciate the relevance of engineering tools. Even fewer are equipped to work with engineers to apply these tools."

Thus, it is often difficult for many administrators to appreciate the role of management engineering methodology to the health care delivery process analysis. On the other hand, engineering professionals do not always have enough knowledge of health care delivery processes or the role of the physicians in making management decisions. Healthcare has a culture of rigid division of labor. This functional division does not effectively support the methodology that crosses the functional areas, especially if it assumes significant change in traditional relationships (Reid et al, 2005).

A systematic way of developing managerial decisions for efficient allocating of material, human and financial resources needed for delivery of high quality care using quantitative methods is the scope of what is called healthcare management engineering. (The term 'management engineering' is sometimes substituted by the terms 'operations research', 'system engineering', 'industrial engineering', or 'management science'. All these terms have practically the same meaning).

Management engineering methodology is indispensable in addressing *typical* pressing hospital issues, such as:

- **Capacity:** How many beds are required for a department or unit? How many procedure rooms, operating rooms or pieces of equipment are needed for different services?
- **Staffing:** How many nurses, physicians and other providers are needed for a particular shift in a unit (department) in order to best achieve operational and service performance objectives?
- **Scheduling:** What are the optimized staff schedules that help not only delivering a safe and efficient care for patients but also take into account staff preferences and convenience?
- **Patient flow:** What patient wait time at the service stations is acceptable (if any at all) in order to achieve the system throughput goals?
- **Resource allocation:** Is it more efficient to use specialized resources or pooled (interchangeable) resources (operating/procedure rooms, beds, equipment, and staff)?
- **Forecasting:** How to forecast the future patient volumes (demand) or transaction volumes for the short- and long-term budget and other planning purposes?