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COMPUTER SIMULATION OF HOSPITAL OPERATIONS
SESSION INTRODUCTION

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Annual national expenditures for hospital care have increased dramatically, rising from $13.9 billion in 1965 to over $100 billion in the 1980's.[1] Rapidly escalating expenditures have been worrisome to all of us, but particularly so to federal and state governments which pay over half of the national bill for hospital care. In response to rising costs, a new system of reimbursement to hospital has been developed. Initiated by legislation in 1982 called TEFRA (Tax Equity and Fiscal Responsibility Act), this new payment system is being introduced in phases which began in October, 1983.

Prospective payment is the term used to describe this new system of reimbursement which assigns a flat fee for a given patient stay. The fee is based on the diagnosis attached to the admission. Medicare uses a list of 467 Diagnosis Related Groups (DRG's) to categorize an admission and determine a fee. Heretofore, hospitals were billing based on whatever costs were generated during an admission.

Whether a fixed reimbursement plan based on DRG's will actually reduce costs remains uncertain. What is clear, however, is that a new cost-conscious environment has evolved. DRG's have started a revolution in health care, and have sent hospital administrators scrambling to identify costs and monitor them in an effort to increase productivity.

Simulation was first used to analyze hospital systems 20 years ago.[2] A literature review of simulation models in health care documents their feasibility and desirability.[5] Most of these studies were academic investigations and not implemented studies. Roberts and England [5] speculate on why practical studies have not been initiated. They cite the lack of economic incentives in the 1970's for most health care institutions to reduce operating costs. Related to this was the lack of incentive to collect the data necessary to perform analyses.

With the advent of prospective payment, hospitals are recognizing that new types of information, techniques and skills are needed to improve productivity and efficiency in operations. Computer simulation represents state-of-the-art engineering and systems analysis methods. As such, simulation should be expected to gain an increasing role in health care administration.

Simulation has potential utility in the analysis of many cost centers in a hospital. Examples include:

- o Admissions.
- o Laboratory.
- o Radiology.
- o Pharmacy.
- o Material handling.
- o Ancillary services.
- o Operating rooms.
- o Nursing services.
- o Ambulatory care.
- o Central supply.
- o Strategic planning.

The papers that follow describe four applications of simulation analysis of hospital operations. The first by Meier, Sigal and Vitale describe the use of a model in planning for ambulatory surgery The model describes the operation of an inpatient facility that is experiencing increasing demand for ambulatory surgery. It also describes a freestanding center that is planning an expansion. The model was used to aid decision-making in an analysis of a joint venture among surgeons, the hospital and the freestanding center.

The second paper, by Sepulveda, presents a model that simulates cost per patient based on the expected DRG case mix for a hospital. It can be used to gauge the effect of various hospital management policies on costs and fees under the DRG system. It also provides insight on where a hospital should concentrate cost reduction programs.

A third paper focuses on the unusual scheduling problems of the operating room. Since the operating room is a major cost center for the hospital, it is important to be run effectively. Murphy, Duket and Sigal describe the use of simulation in evaluating different scheduling options. This model has been used for evaluating block schedules, planning for ambulatory surgery, and for evaluation proposed expansion of operating rooms and recovery rooms.

The final paper, by Lawrence, Marini and Naron, describes the use of simulation in evaluating new technology in the radiology department. A simulation of a hospital picture archiving and control system is presented.

More studies like these four should be expected in the near future. There are three factors effecting health care that make the present time ripe for an increased role for simulation studies. First of all, prospective payment has focused attention on productivity and operations and, hence, provides incentive for analysis. Second, there has been an influx of computer data systems in hospitals that can serve as a basis for computer simulation studies. Finally, the general experience of other industries and the availability of simulation software make the adaptation to health care feasible in a relatively short time period.

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Elliott Sigal received his B.S. and M.S. in Industrial Engineering from Purdue University. In 1973, he co-founded the simulation firm, Pritsker and Associates, with Professor Alan Pritsker and David Wortman. From 1973 to 1976, he served Pritsker and Associates as Vice President and consulted for government and industry in the use of computer simulation. Clients included Prudential Insurance, the U.S. Air Force, the Department of Justice, the Aerospace Medical Research Laboratory and the First National Bank of New York. He contributed to the development and application of several simulation languages, including GASP IV, SMOOTH, Q-GERT, and SAINT.

Returning to academia in 1976, he completed his PhD at Purdue University in industrial engineering (computer simulation and network analysis), and then pursued the study of medicine. Dr. Sigal received his M.D. from the University of Chicago in 1981, and completed internship and resident training at the University of California Medical Center in San Francisco. He is board-certified in internal medicine and is currently a pulmonary research physician at the Cardiovascular Research Institute in San Francisco. Research interests include chemical mediators of asthma and computer simulation approaches to medical problems.

Dr. Sigal has served as a consultant to hospitals and other organizations applying simulation to the analysis of health care problems. He is the co-author (with A.A.B. Pritsker) of the book, Management Decision Making, A Network Simulation Approach, and has authored several articles on the use of simulation in industry and health care.