

Developments in Business Simulation & Experiential Exercises, Volume 9, 1982

A HOSPITAL SIMULATOR (HOSPSIM) A REPORT OF THE MODEL AND RESULTS EXPECTED FROM FIELD TESTING

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ABSTRACT

This paper describes the need for overall management training for hospital administrators and traces the work done with hospital simulation games in health care education to date. The computer-based management decision-making game discussed in this paper (HOSPSIM) is designed to provide a new training vehicle for acute care hospital administrators. The model described will simulate the interaction of several competing urban area acute care hospitals. The December 1981 field test of the model is discussed and future plans for the use of the game are considered.

INTRODUCTION

The 1980's are heralding a new era for the providers of health care. Increased concern for ever escalating health care costs, federal, state and local regulations coupled with nursing shortages and the prediction of a surplus of physicians are forcing hospitals to reevaluate their positions in such an environment.

The emergence of multi hospital chains, independently operated minor emergency clinics and alternative methods for health insurance has caused Administrators in many situations to view the operation of hospitals as a truly competitive business. Health care planning can no longer be solely concerned with building plans for expansion or the addition of more sophisticated equipment. Planning must now take place to critically evaluate the hospital's position in a market area, establish a strategy for market position and document alternatives based upon changes in the environment.

This environment places the hospital Chief Administrator in a role similar to that of a Chief Executive in industry. He must take a critical look at the services presently provided and decide what mix is most appropriate to insure sufficient revenue needed for the hospital to remain viable. To do this the present day Administrator needs an expanded financial reporting system, a reliable decision making system and advanced methods for planning. Additionally, a team approach is needed by hospital executives representing Administration, Operations, Finance and Nursing to jointly plan and make strategic decisions.

One of the best mediums to accomplish the dual goals of education and team building is the computer based business simulation. Industry has used this medium for a number of years to teach executives how to cope with production, sales, distribution, cash flow and resource planning. Such simulation allows experimentation with various approaches designed to maximize profitability without the risk of taking such steps in the real world. They also help to dramatically illustrate the need for a fully integrated management team to solve complex problems.

Several starts have been made to satisfy the needs of such a simulation model for health care administrators.

A model entitled The Hospital Game developed by Jack Meredith and published by Shasta Publications has been available since 1978. The effort of David B. Starkweather has produced the Financial Management and Regulation Game which is currently used in annual competition among teams from graduate health care programs throughout the United States. A similar game, The Health Planning Game by Michael Warner of Duke University, is available and is also in use by several graduate health care programs at this time. The late Chris Mader, a professor at the Wharton School of Business, adapted simulation models of business administration and its environments to the hospital industry for both the Hospital Corporation of America and Shared Medical Systems Corporation. A major effort underway at this time is the model being developed under the sponsorship of a Kellogg Foundation grant by James A. Moore, Everett A. Johnson, and Max C. Holland at Georgia State University. This model will attempt to replicate most environmental factors encountered by hospital administrators of all types of acute care facilities found in the United States.

The model this paper introduces is an effort to provide a hospital management game of medium difficulty that will service an unmet need for a specific yet significant portion of the acute health care field, i.e. community hospitals in the 300-500 bed size.

THE HOSPITAL SIMILATOR

The Hospital Simulator (HOSPSIM) is a computer-based management decision-making game for hospital administrators. Participants make decisions relating to individual functional areas of a simulated hospital and learn to integrate those decisions to serve the objectives of the overall organization. HOSPSIM does not duplicate any actual situation however it does utilize relationships that exist in many urban area health care environments. HOSPSIM uses real-world acute care hospital characteristics where possible.

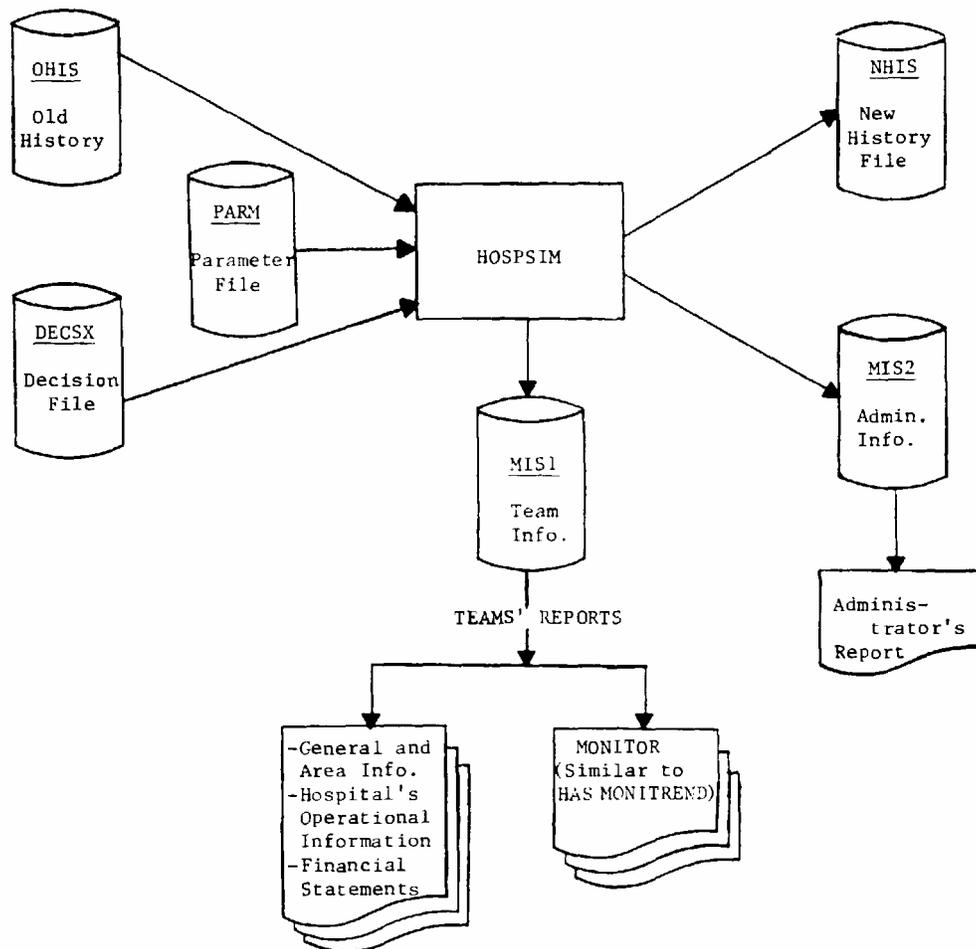
The computer environment for the simulation is shown in Figure 1. There are three inputs to HOSPSIN, the history or response factors from previous periods of play, the parameters of the model and the quarterly decision variables developed by each hospital's management team. The three outputs are the response information provided to participants, response factors that serve as an update for the state of each hospital for the next period of play and the progress reports for the game administrator.

HOSPSIM places participants in a "real-world" environment and provides experiences in making decisions based on incomplete information and living with the results of these decisions. Information on the past performance of a hospital is available for analysis and for determination of future patterns and trends. Participants rake decisions which are then evaluated by a computer program. The results of each team's decision are available for evaluation, further analysis and new

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FIGURE 1

HOSPSIM GENERAL FLOW DIAGRAM



decisions. The process continues until the desired period of time has been simulated.

The Hospital Simulator simulates the interaction of two to five urban acute care hospitals in a shared, common service area. In this game, participants are organized into management teams, each team represents a hospital and competes with other hospitals for a share of patient demand in the common service area. Decision making emphasis is on top management decisions where participants represent the top management team of a hospital and make decisions in each of the functional areas of the hospital's operation.

HOSPSIM is a short-run model in that decisions are made quarterly and the results of these decisions are available after each quarter's simulation. The simulator is also a long-run model because as many quarterly decisions as desired may be made by participants to reflect the passage of time of several years.

Hospitals compete by means of decision variables such as the service offered, the medical and hospital staff available, the quality of the service offered and the public image of each institution. Decisions are made by each team by entering values for the decision

variables in a decision form on a quarterly basis. Specific quarterly decisions relate to such factors as:

- Medical Staff size/mix
- Nursing Service hours available
- Bed capacity/mix
- Ancillary procedure capacity
- Maintenance expenditure
- Housekeeping expenditure
- Education/Training expenditure
- Capacity expansion/contraction

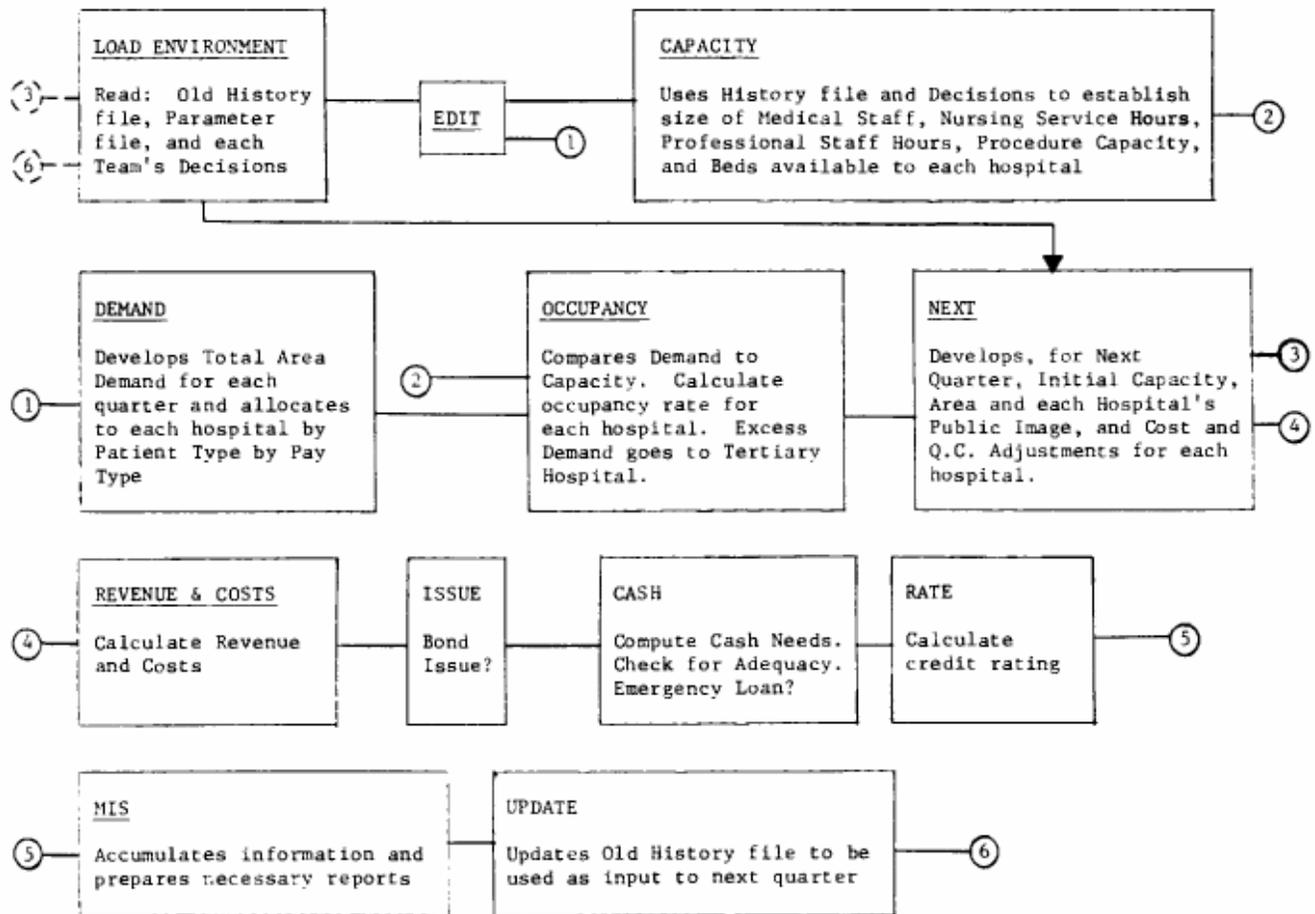
These values and others are entered into a computer by a game administrator as variables in a mathematical model and the results as computer printouts are returned to each "management team" for analysis of their quarterly performance. Output results available to each team consist of health care related statistics for the shared service area plus operational and financial data relating to each hospital's past quarterly performance.

The interaction of the competing hospitals is programmed into the computer model which causes the decision of each hospital to affect the results of other hospitals in a way that approximates the interaction of

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FIGURE 2

H O S P S I M



hospitals in a real-world environment. For example, quality of care improves at Hospital A relative to the quality of care provided by competing hospitals, therefore physicians are attracted to the medical staff of Hospital A at the loss of Hospital B, C and D, if all other decisions remain the same.

The computer program used in HOSPSIM is a mathematical model based on relationships abstracted from the health care environment of the real-world. The model, as expected, does not include all possible relationships but does include many general concepts related to the actual workings of acute care hospitals.

The overall scheme of HOSPSIM is shown in Figure 2. The relationships of the major aspects of the model and the data reflecting the quantitative basis for these relations are further explored in the remainder of this paper.

ENVIRONMENT

External Environment

The model's external environment encompasses two major aspects: first, the area in which the hospital serves and second, the regulatory requirements imposed on the participants.

The Hospital's primary service area generally has the same characteristics as the overall United States Population. The Hospital is located on the fringe of the city of Surbana which is in Any state of the United States. HOSPSIM assumes that factors contributing to the level of health of a population and, in turn, to the level of services needed to provide health care include the age, race, sex, educational level, and income level of the population.

No attempt is made in HOSPSIM to duplicate all existing health care guidelines and/or regulations. While some general real-world guidelines and regulations are used to add realism to the model, a major objective is to constantly remind the hospital administrator/planner

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of the need for effective operational and strategic planning and at the same time emphasizing that planning must be accomplished in the context of an ever changing and increasingly complex environment in which all levels of government will probably continue to play a role by establishing new guidelines and regulations.

Internal Environment

The internal environment portion of the model, or the actual hospital to be managed by the simulation participants has three major components, first the physical facility, second the hospital staff and third, the medical staff.

THE MODEL

The model allows up to five level II or regional hospitals in the service area. Each hospital starts from the same position and each has been operating for the same length of time before a management group begins to operate the Hospital. Thus, the history of each hospital is the same as the history of all other competing hospitals.

The hospital each team manages is one of the 2 to 5 regional acute care, non-profit hospitals that serve an urban service area. In addition to these competing hospitals there are one tertiary level hospital and several primary hospitals (2 to 5) in the service area. The regional hospitals are the only ones that compete for the patient demand generated. Unsatisfied demand will automatically flow to noncompeting hospitals.

Service Area and Area Demand

The size of the service area (total population) is a function of the number of competing hospitals participating in the simulation exercise. Area demand for acute hospital care is basically a function of the service area population. The expected annual patient days of care per one thousand population for each competing hospital are parameters of the model. Other factors influencing area demand are economic conditions, seasonal effect and area image.

The model considers patient day demand for five patient service types: medical, surgical, obstetrical, gynecological, and pediatric. The annual patient days per 1,000 population expected for each of the five patient service types by selected age groups, the average length of stay by age group and patient service type, and the expected source of payment (private pay, government third party, other third party) for these same age groups are parameters of the model.

Individual Hospital Component

Demand for patient days of care at each individual hospital is influenced by that hospital's medical staff size and composition, and the hospital's public image.

Ancillary procedure capacity is one of three major constraints of HOSPSIM. The term procedure as used describes in general terms the therapeutic and diagnostic procedures of the various medical specialties. The term also includes supplementary and/or related services. It encompasses all direct professional (excluding nursing) services that are identifiable for a specific patient type's stay in the hospital.

The model uses two composite procedure types for each patient type, i.e. critical procedures and routine procedures. These procedure types are merely an arbitrary method of simplifying reality and at the same time retaining a requirement for the simulator's decision maker to monitor his hospital's procedure capacity versus anticipated demand.

The next major constraint in the model is the number of professional staff hours available to provide ancillary procedures for potential patients. The remaining major constraint is the number and mix of beds available. While the model considers nursing service hours a vital ingredient in care provided, the model does not treat nursing service hours as a current quarter constraint but allows patients to be admitted on a nursing service overtime basis. The impact of such an outcome is a lagged result that impacts subsequent quarters.

Source of Revenue

HOSPSIM assumes three sources of payment for patient services rendered: government, self-pay and other. Because the Hospital has previously received federal funds for construction it provides at least \$125,000 annually to indigents without further charge to these patients. The principal components of government payments are Medicare and Medicaid. Self-pay payments are from the individual patient or the patient's private sponsor. The "other" payment source is private health insurance, consisting of Blue Cross and other private or commercial insurance plans.

Team Feedback

Each management team receives four reports each quarter.

1. **An Area Report** This report contains general information about the operations of all hospitals competing in the simulation exercise. In addition this report contains information relating to the state of the economy and other items of interest to the health care community.
2. **A report of general operational data** unique to the hospital a team manages.
3. **Financial statements** for the hospital a team manages.
4. **MONITOR** A detailed report of operational and financial indicators for the hospital a team manages, the report also contains averages of comparable data items for other competing hospitals in the service area.

The first three of these reports are provided automatically each quarter. The fourth report, MONITOR, is provided only if a hospital management team elects to purchase it.

THE FIELD TEST

HOSPSIM will be a major part of a three day management training seminar for hospital administrators. Four man teams from five real-world hospitals will operate five hypothetical hospitals all competing for patient demand in the same service area. Each team will be composed of representatives from various areas within a hospital such as Administration, Nursing, Finance and Operations and will operate their hypothetical hospital in competition with the other hospitals. A trial decision will be made to acquaint the participants with the simulated environment after which six decisions, representing a year and a half passage of time, will be simulated.

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Interspersed with the decisions, the seminar faculty will conduct learning sessions on decision making and strategic planning and provide feedback on the game's progress. Each management team will be expected to prepare a strategic plan for each hospital so that results can be measured against the plan.

Team performance will be assessed on the basis of several criteria: adequacy of the strategic plan developed, effective utilization of resources, financial management of the simulated hospital and team decision-making behavior during the session.

EXPECTED LEARNING OUTCOMES

There are several expected learning outcomes for this field test which HOSPSIN is expected to achieve. The seminar should:

1. Create an environment where participants are highly motivated to take part and learn.
2. Make abstract ideas such as strategy, policy, planning, and organizing more meaningful.
3. Demonstrate the benefits of team planning.
4. Give specialists from various functional areas such as nursing, finance, and personnel an understanding of how other parts of the organization operate.
5. Give participants an understanding of how an organization must allocate limited resources to attain various goals and objectives.
6. Help to develop specific decision-making skills.

SUMMARY

The Hospital Simulator has been developed to run on a 32K minicomputer with a one-half megabyte disk drive. The field test will be conducted at Methodist Central Hospital in Memphis, Tennessee starting December 14, 1981. If the results of the field test are as expected HOSPSIM will be a valuable addition to the training options available to hospital administrators. In addition, because of the model's characteristics, with minor modifications it should have the potential for other possible uses. The authors will be pleased to receive any suggestions for other such possible uses.