

SIMULATION DESIGN IN HEALTHCARE

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Abstract

Increased pressure to control costs and increased competition has prompted health care managers to look for tools to more effectively operate their institution. Managers are increasingly using simulation modeling to understand and to run their own process. A simulation model has been complemented with a series of decision making routines. These routines use a hierarchical approach to organize the various scenarios under which the model may run. This concept will present a simulation model of general in patients flow in a hospital. Simulation was used to analyze the inpatient flow. The main objective of this study was to determine the best way to optimize patient arrival at the hospital in order to reduce the queue of patients.

Keywords: Promodel, Healthcare Simulation, Model Building

Abstrak

Meningkatnya tekanan untuk mengatur pembiayaan dan semakin tingginya kompetisi telah mendorong manager pusat kesehatan untuk mencari sarana yang dapat membuat institusi mereka bekerja dengan efektif. Manager menggunakan model simulasi untuk memahami dan menjalankan proses yang mereka gunakan. Suatu model simulasi telah dilengkapi dengan serangkaian perintah pengambilan keputusan. Perintah-perintah tersebut menggunakan pendekatan hirarki untuk mengatur bermacam-macam skenario untuk menjalankan program. Konsep yang ditampilkan pada tulisan ini menampilkan model simulasi alur pergerakan pasien di rumah sakit. Simulasi digunakan untuk menganalisa alur pergerakan pasien. Tujuan utamanya adalah untuk menentukan cara terbaik mengoptimalkan kedatangan pasien di rumah sakit untuk mengurangi waktu mengantri.

Kata Kunci: Promodel, Simulasi Pusat Kesehatan, Pemodelan

1. INTRODUCTION

Nowadays health care managers pushed to look for tools to effectively operate their institution. This situation occurs as well as the increased pressure to control cost and increased competition among health care institution. Emergency rooms are the first steps of contact between the community and the institution, hence it can be recognized that emergency rooms are a vital part of a hospital institution. Based on this, it is appropriate to pay close attention to decisions made that need high responsibility to its operation. These decisions include policies regarding the number of physicians, scheduling the nurses and clerks, physical lay out and the adoption of a new policy such as the implementation of a fast track system.

In order to have better quality decision maker, emergency room managers need to turn to computer simulation to guide them in their decision making process. By using simulation in health care, managers have been able to evaluate either predictable or unpredictable scenarios without actually having to interrupt the daily

operations of the facility. This paper will present a simulation model of an emergency room system in terms to analyze patients flow and to study the impact of bed availability on waiting time of admitted patients in emergency room before being transfer to assigned beds in other units of the hospital.

2. SIMULATION IN HEALTCARE

Compared to other industries such as manufacturing, healthcare industry had taken simulation ahead. There were some principal reasons for this. One of the them is managements were reluctant to reduce complex processes to a model representation [1]. Furthermore, the resistance to change also might be another obstacle for them, especially when such change requires the use of unfamiliar technical and statistical concepts. In healthcare systems, simulation has been often used to solve problem in many areas of facility design and development, staffing levels and scheduling, new policy evaluation, scheduling of patient admission, disease and epidemic control.

The well known objectives of these studies have included the reduction of patient's time in the system (ER, Outpatient clinic), improvement on customer service, better resource utilization and reduction of operating cost. Next will be given some example about simulation being used as appropriate tool in several hospitals. At the Washington Adventist Hospital, simulation was employed to evaluate an expansion in the number of beds in ER, which resulted in a reduction of 0.6 hours for average length of stay. At the Mercy Hospital in Miami Florida as another example based on Kittell and Pallin (1992) investigation [3]. Their studies evaluated several alternatives with the intent of getting more patients through ER while making more efficient use of department's resources and still provide good quality services. The study showed that a 50% reduction of resources could be accomplished by implementing a fast tract policies without risking the quality of service provided to its customers.

3. MODEL BUILDING

This project will use the simulation Promodel software. First step while doing the simulation on this software is to determine every parameter of the Promodel software. The project considers the emergency room and other units of the hospital as locations and patients were defined as entities. The model will run when the patient coming through emergency room are treated in different units of ER or admitted to one of the unit of the Hospital. There would be also another option when the patients coming through the main hospital entrance are admitted and after treatment they are discharged.

The flowchart will be given in order to show the simulation model of emergency room at the hospital focusing on the general in patient flow. Care must be taken when determining what data was needed for modeling in patient flow analysis. After determining the data needed, information systems database was used to gather the data for the selected time period. First of all, data pertaining to daily volume of ER and other units of the hospital were collected. Based on this data, the percentages of admitted and discharged ER patients were determined. The distribution of the arrivals was determined as Poisson using the statistical software package STAT:FIT TM.

The daily volume (total number of arrivals) was segregated into percentages for each two-hour periods of day and then arrival cycles were

defined for each patient type. As in actual operation, the patients (entities) of ER were classified into six level-of-care (Levels 0-1-2-3-4-5) patient types. A patient who is classified at a higher-level of-care will stay longer in ER and will have a higher probability of being admitted to the main hospital. The average length of stay per level-of-care per patient was determined for both ER and other units of the hospital. In order to include the transfers among the hospital units into simulation model, daily percentage of transfers was determined for each hospital unit. After determining the arrival data and entity data, model building was started by defining the locations.

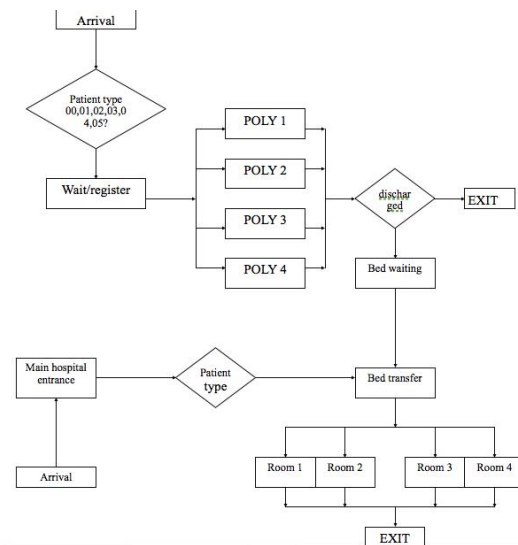


Figure 1. Patient Flow Throughout The Hospital

4. PATIEN ARRIVAL

This process will start with a patient arriving at the Emergency Room via ambulance, car or direct-admit. A direct-admit is considered to be a patient that is coming from a physician's office, a nursing home or another hospital. A direct admits patient will go through the Emergency Room when the Medical Telemetry Unit does not have a bed available for a patient. At this time, the patients arriving via other means to the ER will not be shown in the model.

The process for each of these arrivals is different until the time a patient is taken to a room in the ER. The patients arriving via car are first seen at the information desk by either the registrar or a volunteer. A call is placed into the ER to notify a nurse of an arrival. Once a nurse has come to the information desk, the patient is triaged and the type of patient is categorized as a 1, 2, 3, 4, 5, or 6. The registrar or volunteer can

also send a patient directly back into the ER if they have determined the patient to be in need of immediate care.

If the patient is not sent directly to a treatment room, and has been triaged by the nurse the patient goes to registration. Once registration is complete in the registration area, the patient then returns to the waiting room and waits to be taken to a treatment area.

A nurse or a Patient Care Technician (PCT) takes the patient to a treatment area. If a patient arrives via ambulance, the nurse may determine that the patient is not in need of immediate emergency care, but is directed to a treatment area. The nurse or paramedic takes the registration information to the registrar.

The registrar must then enter the information into the registration system. If the patient has been accompanied to the ED by a family member, the family member meets with registration to provide the necessary information.

Once a patient is in the room, a pre-assessment process takes place. At this time, the patient is given initial instructions by either a PCT or nurse. The patient is then seen by a nurse within the ER for the initial assessment. If a test is needed, an order is created and entered into the system. The entry of the order into the system is done either by the ER Secretary, a nurse, or a PCT. Once an order for a test is entered into the system, the patient is administered the test. If the test is X-Ray, the test can be performed in the ER or outside the ER. If the patient is having a lab test, and any time of the day, a lab technician is sent to the ER. If the lab test is needed outside of this timeframe, a nurse or PCT from the ER performs the collection of specimens needed for the lab tests.

Once the specimens are gathered, a period of time elapses before the results are ready for review. If the nurse did not initially order tests, the next step is for a doctor examination. If at the time of the doctor examination, it is determined that tests are needed, the same logic described above is executed. It is then determined whether the patient will be admitted or discharged from the ER.

If the patient is admitted, they will then go through the admissions process. If it is determined that the patient will be transferred to another facility, the patient will be processed

through the transfer procedure. If it is determined that the patient will be discharged, they are sent through the discharge procedures which are administered by a Nurse. See Figure 2 below.

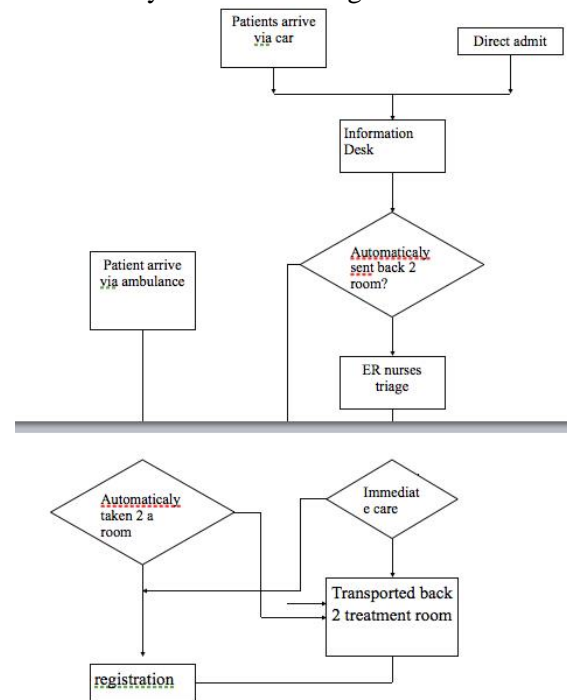


Figure 2. Emergency Room Process Flow

5. CONCLUSIONS

From the discussion we can determine that the participants involved in this project are patients at the hospital and the hospital staff for instance nurses, doctors, and even administration. The researcher so far has done survey only at two hospitals in Western Australia which are Charles Gardener Hospital and Fremantle Hospital. For the report of this project, the investigation might be more widely applied to another hospital in terms to get more data and information that are relevant to this project.

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