Chapter 6
Simulation Method to Improve Hospital Service Quality

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ABSTRACT

This article presents the results of a simulation model designed to reduce patient waiting time in the emergency department of a hospital in the United Arab Emirates. The process-oriented simulation model shows how the resources in the hospital are inter-related. The model depicts the hospital operating system and its performance and management issues with regards to allocation of human and material resources. Based on results of the simulation, optimized response surfaces are developed to explain patient waiting time and the total time a patient spends in the hospital for treatment. Results of the study can be used by hospital management to reduce patient waiting time and improve service quality by using a mix of operational strategies and resource allocations.

INTRODUCTION

The competitive nature of the medical sector has forced healthcare institutions to rigorously monitor the costs of their services. While reduction in these costs is beneficial for the health care institutions, it may lead to poor service quality and lower patient satisfaction (Cardeon & Memeulemeester, 2008; Arasli, Ekiz, & Katrircioglu, 2008). Balancing the operational costs and the service level in hospitals is a difficult task because of the complex nature and interrelatedness of the various departments, and the uncertainty of the processes. Increased demand in hospital services is particularly evident within emergency departments. The limited capacity of most emergency departments is evidenced by long patient waiting time caused by poor planning, and limited availability of staff and resources (Fitzgerald & Dadich, 2009; Alhatmi, 2010). Emergency departments are used to meet the need for an immediate response to patients' urgent needs as well as a safe, efficient and rapid assessment of their requirement for hospital admission (Thomas et al., 2007; Fitzgerald & Dadich, 2009).

One approach that holds promise for healthcare services is process modeling and simulation. Since emergency departments constitute an entry point into the hospital system for most patients (Mital, 2010;

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Gomes, 2010), this paper seeks to investigate the service delivery system of the emergency department of a hospital in the United Arab Emirates by using a simulation model. From the simulation study, response surfaces are developed to identify how to use competing resources in the hospital such that bottlenecks in service delivery are improved. Such measures are meant to suggest ways of improving the service quality by reducing the patients waiting time in the hospital. The simulation model provides relevant performance parameters, such as waiting time; time to process a patient, cost per patient, and percentage of patient referrals. The effects of patient diagnostic time on resources, such as, nurses and doctors are also provided by the simulation model. The service levels as percentage of patients served without waiting, and patients who leave the hospital without treatment due to long waiting time are also given. Consequently, this information helps to identify the loss of business to the hospital.

LITERATURE REVIEW

Healthcare organizations need to incorporate quality indicators into their operational strategy in order to increase customer satisfaction and ensure competitive advantage. Long waiting time in a hospital facility is one of the indicators of poor quality assurance. A number of studies have been conducted on how to improve the deployment of hospital resources and enhance service quality. Mital (2010) used queuing analysis to investigate service quality in a hospital in India. Parameters used in the analysis include mean patient waiting time, average queue length, incidence of long and short delays, etc. The study was able to provide a basis for estimating the medical staff size and number of beds needed to provide good quality service in the hospital.

Sambeek, Cornelissen, Bakker, and Krabbendam, (2010) reviewed 68 scholarly articles on decision-making models used in the design and control processes of patient flows in hospitals. The analysis of the studies show that 31 of the decision-making models used computer simulations, 10 used descriptive models, while 27 used analytical models. The review also indicate that descriptive models applied mostly to process design problems, while analytical and computer models applied to all problems at approximately the same extent. However, the review found that most models have not been validated in practice, and are therefore, not used in management decision-making. Mukamel, Glance, Dick, & Osler, (2010) examined the advantages and disadvantages of shrinkage and non-shrinkage estimators used in quality reports of hospitals and health plans. Their studies indicate that although shrinkage estimators may be preferred if the objective is to increase the accuracy of predicted mortality across all providers, non-shrinkage estimators provide better quality measures for patients who are making a choice among local healthcare providers.

Several studies have shown that simulation is an effective tool for investigating complex problems such as the hospital environment, and that the result can be used to enhance quality of care (Umit et al., 2010; Gad et al., 2011). It is shown how simulation, use of simulation results, customer treatment identification and specifications can raise the service quality. Shailesh et al., (2011) show how a simulation study is employed to evaluate the capacity and the optimum service time of a service facility. They design optimal service time to improve the service quality of the service system. William (2009) discusses how to provide excellent medical care and facilities economically, while, Kamrul and Abdullahil, (2010) in their paper suggest using simulation for better planning and analysis in healthcare operational planning facilities. Yeh and Lin (2007) investigated how to improve the quality of service at a hospital emergency department by using simulation and genetic algorithm to appropriately adjust nurses' schedules with-