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A Report on Scope of Implementation of Queuing Model of Operation Research at Hospital with specific reference to IGIC

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Abstract : *The study was undertaken for one week at a hospital, Indira Gandhi Institute of Cardiology (IGIC), to observe the server utilization factor. It also provide case study of the use of several OR methods, including Markov decision process, and simulation to optimize the scheduling of patients with multiple priorities. Data was collected by observing and analysis. Patient utilization factor (r) is 0.58. The research reveals that the inter arrival times of patients follows the exponential distribution and the service time follows normal distribution. The mean arrival rate of patients is 3.15 and the mean service rate of patients is 5.38.*

Keywords: *Hospital, inter-arrival time, service time, utilization factor, distributions.*

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Introduction:

Queuing theory had its beginning in the research work of a Danish engineer named A.K. Erlang. In 1909 Erlang experimented with fluctuating demand in telephone traffic. Eight years later he published a report addressing the delays in automatic dialing equipment. At the end of World War II, Erlang's early work was extended to more general problems and to applications of waiting lines (Shyfur and Chowdhury, 2013).

A queuing system consists of the customers and servers. Waiting line or queues are in the schools, hospitals, bookstores, libraries, banks, post office, petrol pumps, theatres etc., all have queuing problems. Queues are very familiar in our daily life. Queuing theory is a branch of operation research because the results are used for making decisions about the resources needed to provide service (Shanmugasundaram and Umarani,2015).

Queuing theory is the mathematical study of waiting lines, or queues. Queuing theory examines every component of waiting in line to be served, including the arrival process, service process, number of service channels, types of queuing discipline and number of customers. In general, a queue or waiting line is formed when the numbers

of customers exceeds the number of service facilities or when the service facilities do not work efficiently (Salimath and Parashar, 2014).

Long waiting list or waiting time in public health is an infamous problem in most of the countries all over the world. Sometimes these waits may have little medical impact, but excessive delays may be detrimental to patients' health. As a result, there is a growing public and patient pressure to reduce the wait times to acceptable levels. This requires a systematic approach in planning.

Queuing theory describes the inter arrival time and service time of the patients coming to the hospital with a suitable distribution. The primary inputs of these models are arrivals and service patterns. These patterns are generally described by suitable random distributions (Lade et al.,2013).

Materials and Methods:

The research was undertaken for one week at IGIC. The arrival time and service time of the patients are recorded. The system was considered to be in steady state, which means that the system has been running for so long that the current state doesn't depend on the starting condition.

This research was focused on M/M/1 queuing model.

Queue discipline used in this study is 'First-come, First-served'. Arrival time of patients are described by Poisson probability distribution and come from an infinite calling population.

Single server or channel and service times of patients follow exponential distribution. The utilization factor(r), average number of customers in the system (L_S), average number of customers waiting in the queue(L_q), average waiting time in the system(W_s) and average waiting time in the queue(W_q) were calculated.

It is found average service rate is more than the average arrival rate.

In this study, different documents have been used such as books, reports and electronics sources. All these documents helped us to make the conceptual and theoretical framework of the work as well as to analyze the data and interpret the results. Also, a register is used to record discrete time for patient arrival and service.

Results and Discussion:

Table 1 shows the inter-arrival rate and service rate of the patients for 6 days.

Table 1. Arrival rate and service rate of patients

	Arrival Rate (in hr.)	Service Rate (in hr.)
DAY-1	3.13	4.42
DAY-2	2.81	5.97
DAY-3	2.85	3.985
DAY-4	3.04	6.54
DAY-5	3.875	5.375
DAY-6	3.19	5.96

The basic performance measures i.e., utilization factor (r), average number of customers in the system (L_S), average number of customers waiting in the queue(L_q), average waiting time in the system(W_s) and average waiting time in the queue(W_q) were calculated.

The utilization factor(ñ) is 0.5.The average number of customers in the system (L_s) is 1.41.The average number of customers waiting in the queue (L_q) is 0.827. Average waiting time in the system (W_s) is 0.447 hours. Average waiting time in the queue (w_q) is 0.262 hours.

Conclusion:

The main objective of this research was to apply a queuing model for healthcare services in IGIC. The study was undertaken following patients complaints regarding long waiting time for registration. At the outset, a pilot study was done for one week to identify the main bottlenecks in the system. The bottlenecks identified during the pilot study were validated scientifically in the main study using standard statistical techniques, and contributing factors were identified simultaneously.

Multiple factors such as lack of synchrony between arrival rate and net service rate, lack of soft skills in staff, initial pooling of patient etc. were responsible for waiting time for registration in IGIC leading to patient dissatisfaction.

Average waiting time in the system (W_s) was 0.447 hours. Average waiting time in the queue (w_q) was 0.262 hours. This means that the average waiting time in the queue was less as compared to the waiting time in the system. The patients need to wait more under the system as compared to the queue.

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References:

Lade Ishan P, Chowriwar Sandeep A, Sawaitul Pranay B (2013). International Journal Of Mechanical Engineering And Robotics Research, 2(3): 122-128.

Salimath Chandrasekhar, Parashar Bhupender (2014). Operations Research Models and Methods. Published by University Press, pp.334-350.

Shanmugasundaram S., Umarani P.(2015). International Journal of Scientific & Engineering Research, 6(4) : 534-541.

Shyfur Mohammad, Chodhury Rahman (2013). Asian Journal Of Social Sciences & Humanities, 2(3) : 468-478.