Chapter 22
Managing Emergency Units Applying Queueing Theory

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ABSTRACT

Today managers of health systems must manage the resources at their disposal to ensure that service quality is adequate, this leads at the same time making decisions to ensure that these resources are managed efficiently and effectively. The decision process in healthcare systems is not trivial given the complexity of these systems. The application of tools (like queueing theory) for decision making in hospital systems is an area of opportunity because of the increasing financial pressure and the growing demand for care. This document shows how queueing theory can be applied for analyzing the performance of an Emergency Unit under different capacity scenarios. The analysis shows that increasing the number of servers required to maintain constant congestion(emphasis on efficiency)is more expensive than adding servers to maintain constant the probability that a patient has to wait (emphasis on quality and efficiency). The paper ends with recommendations for future research.

INTRODUCTION

Administration of Health Systems and Hospitals

Hospital systems administrators are responsible for managing resources at their disposal, in order to provide quality service to patients and beneficiaries.

Hospital systems were used to operate without major limitations regarding the available resources, since it was essential to preserve the integrity of the patient, also administration was supported to a greater extent by trial and error, therefore, the application of tools from different areas, as Operations Research have been (at least until recently) ignored; but today health institutions, especially government

institutions suffer from increasing financial pressure from governments, which require that assigned resources are managed effectively and efficiently.

While this applies to all hospitals in the world, it is in the countries known as emerging economies such as Mexico, where the effects of lack of tools to support the decision process have a greater impact. As others, Health systems are not easy to analyze and problems are challenging.

For example: Mexico is among the few OECD countries that have not yet achieved universal or near universal coverage of health insurance. Also, the public share of health care financing in México has increased to 50% in 2012, but it is one of the lowest across the OECD members (the average is 72%) (OECD 2005, OECD 2014), in other words, around half of all health spending is paid by Mexican patients.

Expenditure cuts to the health systems are common and result in the zero generation of vacancies for new doctors and nurses, shortages of medicines, materials and equipment; however it continues increasing demand service. According to OECD statistics, in Mexico the number of doctors per capita raised in the past years moving from 1.6 per 1000 population in 2002 to 2.2 per 1000 population in 2012, which it is just above Korea (2.1), Chile(1.7) and Turkey(1.7). The 34 members of the OECD average 3.2 (OECD, 2014).

It should be noted that one of the priorities of governments should be to ensure greater coverage of health services, ensuring that the workforce (doctors, nurses) have the necessary skills and resources to carry out their tasks.

The question arises about what managers should do before making a decision. According to Litvak, Long, Arroye and Jarillo (2000) the following question is proposed: How much can be cut in spending of a health system without affecting the quality of service?

In Health systems timely access has been identified as one of the key elements of healthcare quality (Green 2005). What kind of tools can be applied to measure the time a patient spends waiting in a queue to receive attention? How many doctors are needed to guarantee a reasonable waiting time and generate the perception of a good quality in the service? How much a "good" policy cost?

This chapter shows a set of relationships derived from queuing theory which are (among many others) very useful for decision-making and enable an administrator to evaluate different decisions and also their impact on the quality of service provided to patients and so to answer questions as the previous paragraph. We present an application example of the emergency system of a public hospital in Mexico where it is necessary to calculate the number of doctors required to satisfy the demand of service and ensuring the quality of service, the costs of different alternatives and the robustness to face scenarios of increased demand.

Emergency Department in Hospital Systems

The Emergency Department at hospitals is the service area with the highest demand of patients, each patient has his respective degree of urgency; however all patients, independent of the degree of urgency, require speed and quality of care (Table 1).

The perception of the quality of service provided by the hospital through their doctors and nurses depends largely on the care provided by emergency department. Today it is recognized that the attention of real and perceived emergencies in a hospital is a problem that must be addressed, appropriate care in the emergency department reduce the effects of trauma in the population, temporary sequels, permanent and secondary to these (Arellano & Martinez, 2012). For example, in México the measured average

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