ABSTRACT

This paper presents a simulation study carried out within a private healthcare facility with the aim of understanding whether or not it is able to handle a greater flow of incoming patients as well as the related impact on the overall efficiency. As a result, the simulation outcomes have pointed out the need for an internal work re-organization that has been devised through Lean Management tools and methodologies. The simulation model has, then, been used to predict the intended changes effects as well as their feasibility. Particular attention has been paid on the care administration process, provided that research activities are still ongoing to investigate other processes in the patient value chain where there is still substantial room for improvement. The proposed research work is grounded on an in dept analysis of the main processes and activities taking place in the healthcare facility as a starting point for the simulation model development. Afterwards, simulation has been used for “as-is” analyses and, in combination with Lean Management approaches, for “what-if” studies whose results and findings are discussed.

Keywords: Efficiency, Healthcare Facility, Modeling, Patients’ Flow, Simulation

1. INTRODUCTION

Nowadays most of the healthcare facilities are suffering the pressure of higher service demand rates, experiencing – at the same time – a strong reduction in resources availability in contrast with the need to reduce healthcare costs while keeping even higher patients service levels (Jun and Jacobson, 1999; Jacobson et al. 2006). In addition, as a common practice in many hospitals and healthcare facilities worldwide, subject matter experts (head physicians) are also in charge of administrative issues and as a result less time is spent on patients’ care due to administrative burdens (Swisher et al. 2001).

In this framework, over the past few years, Modeling & Simulation (in particular discrete event simulation) has been increasingly used as a mitigation tool to overcome such difficulties. The possibility to recreate processes, activities, procedures and their inherent complexity, indeed, paves the way for new support tools in decision making and operational processes (Bruzzone et al., 2013).

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As a matter of facts, a quick review of the existing literature in this area shows that, since 60’s, simulation has established as an effective tool for problem solving in the healthcare domain (England and Roberts, 1978). Moreover, over the past 40 years, the literature is plenty of surveys that testify how simulation has become increasingly pervasive in the healthcare domain. Meaningful examples can be found in England and Roberts (1978), Smith-Daniels et al. (1988), Lehaney and Hlupic (1995), Jun et al. (1999), Flagle (2002) as a proof that simulation is widely accepted as problem solving methodology and decision support tool in healthcare facilities. However, using simulation in healthcare management may entail a great deal of complexity due to the modeling effort required to capture and recreate the system behavior as well as the main roles involved in it (i.e. head physicians, professional nurses, healthcare workers, administrative personnel, etc.). In addition, the lack of computational capabilities (above all in the early years), the lack of funding, the excessive costs of simulation software and the difficulty in using it, are factors that could prevent simulation from being successfully applied. Aside from enabling factors when simulation is applied to healthcare facilities, interesting classification frameworks, based on the goals the simulation study is meant for (such as hospital scheduling and organization, communicable disease, screening, costs of illness and economic evaluation), can be found in Fone et al. (2003), Brailsford et al. (2009), Gunal and Pidd, (2010) and many others. Different examples of simulation applications in health care can be found in Holm et al. (2013), Weerawat et al. (2013), Wang et al. (2012), Bruzzone et al. (2011-a), Bruzzone et al. (2011-b), Diaz et al. (2013, 2012-a, 2012-b), Brandeau et al. (2004), Winkler et al., (2011).

As pointed out by Gunal and Pidd (2010), the attempts to model entire hospitals or healthcare facilities are limited (mainly because of the complexity of such systems) while there are many applications that consider self-contained parts.

In this perspective the ambition of the proposed research is to overcome such limitation proposing a simulation model where an entire healthcare facility and its behavior are depicted. Even if the healthcare facility considered in this paper can be classified as a small facility, the proposed simulation model includes both inpatients and outpatients flows as well as different professionals working in it (including different types of head and senior physicians, medical assistants, head and professional nurses, healthcare and auxiliary workers and administrative staff) and all the healthcare services delivered. The simulation model is used to understand whether or not the healthcare facility is able to handle a greater flow of incoming patients pointing out the need for an internal work re-organization. To this end, Lean Management tools and methodologies have been used to devise possible changes that have been tested through the simulation model to assess their outcomes before the implementation in the real facility.

Before getting into details, the structure of the papers is briefly summarized as follows: section 2 presents the healthcare facility and the processes mapping carried out as part of the simulation study. Section 3 provides an overview of the conceptual models. Section 4 presents and simulation model and its main features while section 5 discusses analysis and simulation results. Lastly, conclusion summarizes the main contribution of the work.

2. THE HEALTHCARE FACILITY

The healthcare facility that has been investigated in this research work is located in the South of Italy. It has acted as a private facility accredited to the National Health Service since 1980. In its actual configuration it has 4 fully functional units, namely urology, gynecology, ophthalmology and surgery. Moreover, one day surgery services (that do not require overnight hospitalization or maximum one night hospital stay) and outpatient cares (i.e.
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