Simulation and ABC to Improve the Performance of Emergency Department

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ABSTRACT

This study aims at developing an Activity Based Costing (ABC) for the Emergency Department (ED) in a Jordanian hospital to determine associated costs and clarifies the financial practices inside ED rooms. For this purpose, simulation model is built for patients at the current ED activities and determine the costs for each room in ED. The total costs (JD), number of served patients, and profits (JD) are 263562, 10256, and 146677, respectively. Improvement is suggested by studying three three-level controllable factors using simulation. It is noted that focusing on the lowest total costs, B-1 (adding two beds with one added nurse) and B-2 (introducing four beds with two added nurses) provide the two smallest total costs (JD) of 252568 and 253320, respectively. Whereas, for the largest number of served patients is achieved by A-1 (assigning one sharing doctor for Abdominal) and C-1 (adding another room for abdominal with new doctor) of equal number of served patients of 10466. In order to combine these two performance measures, the profit associated with each scenario is considered. It is found that factor A-1 provides the largest profit (= 150,390 JD). The results of this research may provide decision makers valuable cost information that helps them in improving ED performance.

Keywords: Activity Based Costing (ABC), Costs, Emergency Department (ED), Performance Measures, Simulation

1. INTRODUCTION

Healthcare is a complex configuration that provides primary, secondary, and tertiary care. Quality expectations have increased in the healthcare organizations nowadays because of the increased pressure on the service demand. In addition, increasing in the cost of healthcare services plays a role in giving an importance and much discussion worldwide and obligates healthcare providers to improve the quality management, efficiency, and economics of their organizations (Jacobson et al., 2006). Hospitals considered an important tangible sector of the healthcare organizations. Emergency Department (ED) is the most critical department in hos-
hospital considered a direct patient interfacing. ED is one of the most highly densely departments that bears greater pressure loads in comparing with other components of the health care system (Waring & Bishop, 2010).

Simulation in healthcare has been used for a long time to solve bottlenecks related to healthcare in general. Different alternatives depending on the staffing levels and internal processes were studied using simulation to improve the ED performance and reduce patient waiting time (Rakich et al., 1991; Shim & Kumar, 2010; Laskowski & Mukhi, 2009; Badri & Hollingsworth, 1993; Park et al., 2008; Proctor, 1996). Further, activity-based costing (ABC) is a costing technique that links and assigns the cost of each activity resource to all products or either services according to their usage. ABC is an important cost management tool in hospitals and is more accurate compared to traditional accounting method (Yereli, 2009). It calculates services and operations costs for each department inside a hospital and clarifies the financial practices in each department that facilitates the financial decision making and budgeting criteria (Cao et al., 2006). Some of the basic reasons for obtaining cost information are to improve efficiency, increase effectiveness, enhance sustainability, and improve quality. Recently, several studies introduced ABC approach in many real life applications (Werikat & Rawabdeh, 2006; Baykasoglu & Kaplanoglu, 2008; Schulze et al., 2009; Al-Tahat & Al-Refaie, 2012; Tsai, 1998; Kostakis et al., 2008).

Little studies (González et al., 2005; Durgham, 2007; Garattini et al., 1999; Chandra et al., 2011; Robson, 2008) have been conducted in ABC in healthcare and hospitals. For example, Cao et al. (2006) developed and applied a simplified activity-based costing (S-ABC) method to estimate the cost of the laboratory tests. They compared their case study results with ABC and volume-based costing (VBC) methods. They concluded that the S-ABC can obtain accurate results and simpler to perform rather than ABC and VBC.

This paper builds an ABC model to create a cost model that assigns each cost of activity resource to service or operation according to its consumption. Simulation inside a Jordanian hospital was implemented to evaluate multiple scenarios with controllable factors to determine the costs and the cost per patient. Since the ED is a critical department inside any hospital as well as it is the most crowded department among hospital’s departments so, a cost model for the ED inside a hospital is built to find the scenario/scenarios that reduce(s) cost comparing to the current state scenario under several controllable factors. This study focuses on measuring the average patient’s waiting time, and number of served patients, and total costs in ED.

2. CONDUCTING THE SIMULATION MODEL FOR THE CURRENT SITUATION

Patient’s process map in the ED is drawn as shown in Figure 1. The ED layout consists of the reception area, Isolation room (IS), Abdominal Room (AB), Trauma Room (TR), The Dental Room (DE), Gypsum room (GP), Surgery Room (SU), Ear, Nose, Throat room (ENT), Pediatric room (PE), Gynecology room (GN), Cardiac room (CA), CT- scan and or X-ray.

A sample size of 1000 patients is selected randomly by three shifts of ED. Arrival of patients was identified by self-arrival patient. The arrival times were then measured, and the differences between times were calculated in order to provide the inter-arrive rate. The measured times are waiting nurse, the vital signs, waiting the doctor, doctor diagnosis, waiting lab results and imaging process.

3. EVALUATING PERFORMANCE OF ED AND PROPOSING MULTIPLE SCENARIOS

Simulation model is applied to the current state of the ED with a pool of six nurses, where they are specified by units, nurses are considered as a multiple independent operating stations that perform the same operation and are interchange-
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