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Combined tools for Surgical Case Packages contents and cost optimization: a preliminary study

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Abstract

This paper presents a solution proposal based on mathematical and statistical tools to optimize Surgical Case Packages of an Operating Room (OR) in a Portuguese public hospital that it is the most complex environment in a hospital. In this particular hospital, more than 27000 surgeries/year are performed, employing, sometimes, misadjusted composition of standard surgical packages and non-optimized grouping of surgical instruments. Problem consequences are, among others, high transport of various surgical cases packages; high number of open cases and delays in surgical times following surgery. These type of problems are waste that do not add value to the service in the context of Lean Healthcare and must be eliminated using the most suitable tools. After the analysis, different tools were used: combinatorial analysis to optimize surgical cases composition and statistical analysis to identify the instruments usage and surgical basic case patterns. An optimization model was developed which produced a sterilizing initial solution of 135.24€. By identifying the most commonly employed instruments, it was concluded that some instruments have never been used and others rarely and some patterns were identified. The results achieved were based on minor sample and in a form of data collection that needs some adjustments.

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1. Introduction

In the context of the National Health for Patients Safety[1] the safety assurance increase is a strategic objective and a world concern. The World Organization of Health estimate that, at least, half of the incidents deriving from the health care occur during the surgical act. Also, estimates, that 50% of the practice associated complications are avoidable[1]. The operating room (OR), where the surgical acts occurs, is considered one of the most complex environment in the health care services units because it implies sophisticated technology and multidisciplinary teams[1]. Additionally, the work conditions and team communication are fundamental for the service quality. Beyond the sophisticated technology also exist the surgical instruments smaller and simpler, most kept and transported in boxes, used in the surgical acts but which cut quality and sterilization must be assured as well their delivery after the surgical acts.

It was in this context that a Portuguese public hospital presents its objectives to an academic multidisciplinary team that was joined for a week in the framework of a European initiative called “European Study Group with Industry”. The objectives were to analyze the instruments usage pattern of the surgical cases: 1) grouping of surgical instruments comprising each case taking into account the maximum advantage of the available equipment and 2) minimization of material sterilization cycles. Additionally, they also wanted to identify groups of materials to be included in surgical packages or boxes: 1) minimum difference in usage profile (high internal consistency); 2) significant differences between different groups of boxes (high external heterogeneity, i.e. between groups of boxes).

The team formed was constituted by six members from different disciplinary areas: Mathematics; Statistics; Numerical Methods and Industrial Management that resorted to their knowledge and scientific (mathematical and statistical) tools to reach to a suitable solution for the objectives proposed. The data was provided by the hospital staff and were collected during a short time frame (March, 30 to May, 8) and only for 41 episodes of two types of processes: hernias reparation and laparoscopic (gallbladder reparation).

This paper is divided in five sections. After this first section, the second section presents the problem description, the third presents a brief literature review and the fourth the research methodology. In the fifth section the preliminary results are presented. Finally, the last section presents the conclusions and recommendations of the study.

2. Problem description

The problem presented was related with the basic surgical case packages that contents all instruments needed to all surgery types. Each basic case package should have in number and in type all instruments needed for surgeries types, e.g., for the general surgery exist 43 basic case packages. One of these surgical case package is the hernias and gallbladder reparation (laparoscopies) which have 19 different instruments in a total of 45 instruments. If there is a need for more and different instruments to a specific surgical procedure, surgery team opens a new case package or pick up an individual package material. When a new case package is open, all instruments must be sterilized which represents a high cost in OR that perform more than 27000 surgeries by year.

So, the misadjusted composition of standard surgical packages and the non-optimized grouping of surgical instruments that make up each box according to the surgical specialty brings consequences for the hospital, professionals and patients, referred as operational flaws: 1) transport of various surgical cases packages, probably avoidable; 2) high number of open cases, possibly preventable; 3) instrumental lack for other teams and surgery postponement risk; 4) early and excessive wear of the materials by successive decontamination/sterilization, possibly preventable; 5) difficulty in systematization of care provided with constant interruptions and material requests; 6) delays in surgical times following surgery, with the possibility of postponing surgery; 7) waiting for the surgical team, and loss of concentration for surgery; 8) successive occurrence of these situations, that may trigger anxiety to the different team elements, and suffering by anticipation; 9) physical & emotional fatigue/stress by the constant "search for materials"; 10) increased irritability/team voltage for failures.

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