SYSTEM DYNAMICS ANALYSIS OF THE FACTORS ON THE SURGICAL DEFERMENT IN ELECTIVE SURGERY

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ABSTRACT

The deferral of elective surgery is an underestimated problem in health care services. Literature reports cancelation as the usual procedure to deal with this, even though patient health is at risk with such decision, since elective does not mean optional, and not enough attention is paid to cancelled procedures and its consequences, this is the problem studied in this article. The main result of this research is a simulation model using System Dynamics, which represents the behavior of elective surgery deferral. This model is used to conduct an analysis of relationship among modeled variables to highlight main reasons of elective surgery deferral. The developed model probed to have potential to become a tool to assist on design and enhancement of surgical service strategies.

1 INTRODUCTION

Operating Rooms(OR) are not enough; a lot of scheduling work is done trying to maximize the use of these resources (Magerlein and Martin 1978) (Erdogan and Denton n.d.) (Cardoen, Demeulemeester and Beliën 2010); The following definition for elective surgery reflects actual practice: "Elective surgery is defined as surgery for patients whose clinical condition requires a procedure that can be managed by placement on a waiting list … The term 'elective' does not mean 'optional' " (Royal Australasian College of Surgeons 2012).

Deferral of Surgery (DoS) is recorded when an elective surgery cannot be performed the day it was scheduled, regardless of DoS source, and must be rescheduled in a short planning horizon.

2 SIMULATION MODEL

The DoS of elective surgery process at Centenario Hospital Miguel Hidalgo (Miguel Hidalgo Centennial Hospital) CHMH was modeled with a causal loop diagram. Causal loop diagram contains five reinforcing loops. The diagram also includes two balancing loops (Medina Ramirez 2013).

As a conceptual model, causal loop diagram helped to explain why elective surgery is so hard to control and why current situation may worsen in short time if no intervention is designed to alleviate such condition.

Surgeries of daily program surgeries stock may flow to deferred surgeries due to patient related deferral or no bed available or if emergency surgeries flow are bigger than surgery department capacity available after patient and no bed available deferral.

Emergency surgeries are modeled as a normal distributed variable and add to urgent surgeries stock. If urgent surgeries level are bigger than surgery department capacity, urgent surgeries transfer rate will deplete stock representing patients being transferred to another hospital due to OR saturation. This assures every urgent surgery is perform the day it flows into the system.

Deferred surgeries stock increases its level through deferred surgeries rate. This rate is composed of patient related deferral which is withdrawn from daily program of surgeries; difference is called feasible elective surgeries, if this value is less or equal to available beds, then all are performed, otherwise difference is deferred. Once feasible elective surgeries value is adjusted, it is compare against urgent surgeries, if this number exceeds surgery department capacity available because of patient and bed available deferral, then additional elective surgery deferral is computed to assure urgent surgeries performance. Urgent surgeries are not conditioned to bed availability since these cases usually are conducted after surgery to an emergency bed or intensive care unit bed. Once deferred surgeries stock level grows, it may flow through cancel rate, if patient related deferral is acute enough to a definitive cancellation of the procedure; most of deferred surgeries flow back to scheduled surgeries stock.

3 MAIN RESULTS

The modeling process demanded new hypothesis to reach convincing results. At some point model showed that scheduled surgeries stock tended to grow without boundaries. Analyzing model structure, output seems to be logic, but was an unrealistic outcome. Additional research was conducted and Hall pinpointed the fact that the only phenomenon that keeps waiting health lists from growing infinitely was people reneging (Hall, 2006). A renege rate flow was implemented which tends to accelerate based on expected wait for a scheduled surgery to be performed. Running the model a period equivalent to ten years (considering for modeling purposes the 201 documented days as a year) it turns obvious that reneging equilibrate scheduled surgeries level close to 7,000 surgeries, and expected wait time for a surgery to be performed close to 300 days (a year and quarter simulated time).

Surprisingly renege rate is not as high as may be expected, it reaches 9 renege a day (8.8/6,500 = 0.13%) which seems fair enough and is effective. Additional results are available at (Medina Ramírez 2013).

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