

## **CREATING AND TESTING HEALTHCARE SPACES FOR OPTIMAL WORKFLOWS**

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### **ABSTRACT**

Desiring significant growth, an outpatient spinal surgery institution needed to reconsider their operational model to fulfill their business goals. They wanted to enhance the patient and family experience and increase staff efficiency – two sometimes conflicting goals. As amenities were added to increase patient privacy and comfort, nurse travel time increased. Revised departmental flow was mapped, simulation studies proved recovery position reduction was possible, and consensus was reached around the new approach. The simulation model, built with Arena software, was developed using process time data from the headquarters facility as a baseline. Scenarios were added to test different operating flows and staffing requirements. The simulation results revealed unexpected room usage data, and provided additional insight to how incremental construction variations could lead to long-term revenue generation by the client. Further research involving optimal patient scheduling, personnel utilization, and cost analysis is recommended

### **1 PROBLEM STATEMENT AND OBJECTIVES**

In the current state of the surgery center, patients moved from PACU rooms to discharge recliners once they transitioned out of phase 1 recovery. The desired future state hopes to see patients recover completely in PACU rooms with overflow available, allowing patients to move out of the OR as soon as they are finished in surgery. Prior to the start of this project, information about the current operating state of the surgery center was gathered. Additional site visits were arranged to allow for process map validation and to give the industrial engineer an opportunity to speak with front-line employees.

The three primary objectives of this study are as follows:

1. Optimize the number of PACUs needed for an outpatient spinal surgery center while minimizing the amount of time a patient must wait for a PACU.
2. Determine if this optimal space program will be adequate if an additional surgeon is hired.
3. Confirm that full recovery (phase 1 and phase 2) can take place in the PACU.

### **2 MODEL DEVELOPMENT**

#### **2.1 Input Data and Simulation Logic**

Using Arena Simulation Software, a model was developed to represent the actual system at a level of detail that matched the primary objectives. Process times were modeled using empirical distributions based on the distributions of actual patient process time data from EMRs and one time study done previously. A process flow chart was created and reviewed during the observation periods at the surgery institution.

## 2.2 Validation and Verification

Verification techniques (Law 2007) confirming the proper application of assumptions to the simulation model include creating the simulation in modules with increasing complexity, observing animations of the output, and reviews by an unbiased colleague familiar with simulation modeling. Validation techniques (Law 2007) confirmed the accuracy of the model, which was based on a similar existing system. A paired-t confidence test helped determine, with approximately 99.9% confidence, that there was not a significant difference between data collected from the existing system and output data from the simulation model. Additionally, a written assumptions document was kept, the system was observed, the modeler had conversations with nurses, physicians and other support staff, and existing theory regarding patient procedure and waiting times was explored (Faddy, Graves and Pettitt 2009).

## 2.3 Scenarios and Options

After confirming accuracy, the simulation model was varied to address the three objectives of the study. Three scenarios were tested to determine a feasible overflow pattern and four options were added to test the capacity of the system. The scenarios and options were combined in every way possible, resulting in 12 different simulation models. Each scenario and option is listed below:

### Scenarios

1. Complete recovery in PACU; no overflow
2. Complete recovery in PACU; overflow directly from surgery to PRE-OP
3. Complete recovery in PACU; overflow to discharge chair for phase 2 recovery

### Options

- A. No changes
- B. Add a surgeon
- C. Add a PACU bay
- D. Add a surgeon and a PACU bay

## 3 RESULTS

It was determined that the desired future state, which sees patients recover completely in the PACU, could be achieved. Four PRE-OP rooms and four PACU rooms provide adequate space for up to ten patients to be treated in this future state with no non-value added use of the operating room. Adding one surgeon resulted in a negligible increase in time spent waiting for a PACU room and a reduced overall waiting time. Multiple solutions to this problem exist. The client will need to make the final decision about the ideal layout and space program based on existing and expected capital. This simulation will be a useful aid for the decision-making team.

## REFERENCES

- Faddy, M. , N. Graves, and A. Pettitt. 2009. "Modeling Length of Stay in Hospital and Other Right Skewed Data: Comparison of Phase-Type, Gamma and Log-Normal Distributions." *Value in Health* 12.2:309-14.
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