Discrete Event Simulation Modeling: A valuable tool to optimize endoscopy unit efficiency

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Introduction

- Increasing demand for endoscopic procedures, coupled with decreasing reimbursement, has necessitated endoscopy unit leadership to change the way business is done in order to accomplish more without increasing cost or sacrificing quality. This requires the consideration of developing alternative staffing models and patient schedules while improving unit efficiencies.
- Discrete event simulation is a modeling methodology which has been used to improve manufacturing processes for several decades.

Objective

- To demonstrate the value of discrete event simulation in evaluating alternative solutions and improving endoscopy unit efficiency

Methods

- We developed a conceptual model of patient flow in the seven room endoscopy center at Duke University Medical Center
- Endoscopy unit staff electronically captured time data for key tasks using ProVation® Medical
- We then built an animated discrete event simulation model using Simio® Simulation Software (Simio LLC)
- We compared the average performance metrics of the baseline model with the results from alternative configurations of unit flow over 50 simulated days
- Key outcomes included: Patient flow time, staff utilization, first case start time, capacity without overtime

Simulation Model

Model Validation & Initial Results

Scenario 1: Prep Staffing Levels

- The model was run to understand the impact on patient throughput based on staffing 4 versus 3 nurses in prep.

Scenario 2: Recovery Staffing Needs

- The model was run to better understand the resource needs for recovery by time of day.

Scenario 3: Staggered Start Times

- Model impact of staggering procedure as well as staffing schedules

Conclusions:

- Staggered appointment schedule unlikely to improve unit flow or decrease overtime
- Staggered nurse schedules more likely to result in measurable decrease in overtime/hostage

Conclusion: Peak staffing needs between 1pm – 3pm. Identified need for flexing staff to recovery to meet appropriate staffing ratios to insure a patient safe environment.

Conclusion: No noticeable difference in the number of patients in the unit at 5pm when staffing 4 vs 3 RNs in Prep. Opportunity for flexing staff during peak hours between prep and recovery.