

APPLICATION OF EMERGENCY DEPARTMENT SIMULATION MODELING FOR NEW HOSPITAL OPERATIONAL PLANNING

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ABSTRACT

Planning for the operation of Emergency Department in a new hospital is a difficult task because of complexity of patient flows, hospital and provider staffing, space and resource utilization. This case study demonstrates the use of simulation model in a new 29-bed Emergency Department in the state of Nevada. The model evaluates impact of patient flows, staffing model, space allocation, and equipment per level to the Emergency Department average length of stay. Ancillary services including laboratory, imaging, environmental services and patient access are also integrated with the model. This model is utilized as a decision support and communication tool between clinicians, project managers, and engineering personnel. The bottleneck in the system are identified and addressed before the hospital open for the operation. This allows us to identify potential issues in the earlier state. This tool can save time, cost and potential operational challenges down the line.

1 INTRODUCTION TO MODELING APPROACH



Figure 1: Sample Model Screen shot

The simulation model was developed in FlexSim Healthcare 7.5 simulation software tool. The actual CAD file was imported to the model for the floor plan layout. There are two main arrival sources: walk-in and ambulance arrivals. The arrival patterns by hour of the day and the ESI level acuity mix are based on the data of existing emergency department in the same health system. Daily arrival volume is based on the projection from hospital finance department. The resource utilization (EKG, lab test, and imaging tests) is based on the actual data by ESI level. Nursing, ancillary services and provider staffing are based on the plan staffing at the opening time.

The challenge in developing the model is the lack of accurate process time data from the EMR system. We use national emergency benchmarking survey as a source for nursing and provider task process times. The final model has been validated with design and construction team, including ED medical director, ED director, Engineers, and project manager for accuracy.

The sample model screen shots are shown in figure 1.

2 RESULTS

The output of the simulation model is shown in model dashboard (figure 2)

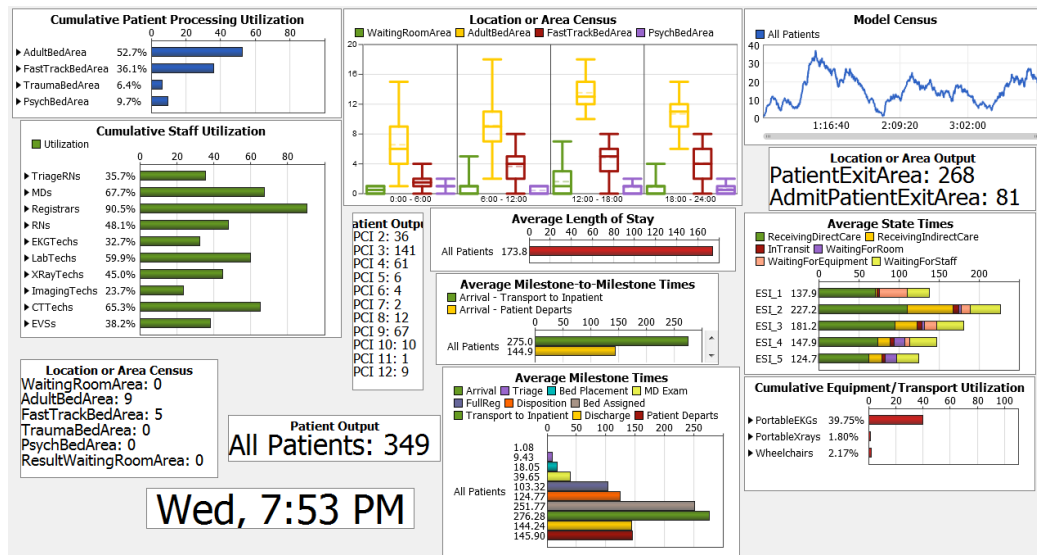


Figure 2: Simulation Model Dashboard

Due to the uncertainty of patient volume the ED will encounter at the opening time, the model was used to evaluate the sensitivity of an increase in patient volume to the space and resource utilization. It is concluded that the existing space will be able to handle up to 140 patient visits per day, which is about two times of the projection volume at the opening month. Each patient care and waiting room area capacity are validated to have enough capacity. The Rapid Medical Evaluation (RME) and result waiting area hours are also determined based on overall model census. The model shows the significant impact of bedside full registration to an increase in the registrar productivity by 30-40%. According to model results, the original nurse, ancillaries, and provider staffing models were adjusted to meet the demand by time of the day, day of the week and overall number of patient visits per day.

3 CONCLUSION

Simulation modeling in healthcare is an effective collaboration tool that bridges the gaps between technical and clinical stakeholders. Using simulation for new Emergency department allows us to evaluate the operational plan before the department actually open for the operations. The model allows us to capture the various factors and variations from the actual emergency department, test various scenarios, and identify potential bottleneck in patient flow. This result is better patient throughput, higher resource utilization, and better patient length of stays.