

Hospital Simulation Confirms New Facility Expenditure Not the Solution

Arena® Simulation Software Utilized to Address Patient Length of Stay Issues

Challenge

- ED waiting room was over capacity
- Every ED bed was full
- Problems in current staffing levels
- Extreme patient Length of Stay

Solutions

Rockwell Software
Arena Simulation Software

Rockwell Consultants developed an Arena hospital simulation model allowing for the user to manipulate process flows, process delays, patient routing as well as resource schedules and bed capacity.

Results

- Verification that the proposed new facility was not a solution to improve the declining ED service
- Adding another staff member would solve process inefficiencies



Background

After many years of failed attempts to improve their current emergency department, a large urban ED in Jersey City, NJ decided to use simulation modeling. Extreme patient lengths of stays (LOS) were a key factor contributing to the declining reputation of the hospital. The hospital executives recognized the value that a simulation study could provide their organization. Rockwell Automation Arena consultants were called upon to develop a hospital simulation model of the current ED and assess various change scenarios. Healthcare simulation software assisted the hospital in making informed decisions regarding the future state of their ED.

Challenge

It would only take a quick visit to this Jersey ED to recognize there was a problem. The waiting room was filled with uncomfortable patients anxious to gain access to medical treatment. Every ED bed was full. Nurses and physicians appeared overworked and stressed. There had to be a way to run this ED more efficiently. Interviews with physicians, nurses and hospital officials provided a deeper more precise view into the ED issues. It was communicated that psych patients were a major problem, making up 25% of the patients and incurring long delays throughout the process.

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The time for specialists to respond to physician calls was also seen as a bottleneck in the process. The current staffing levels needed to also be addressed. How could 1 physician be expected to service all 44,000 patients annually? Improving the up front registration and triage process could help reduce the problem with patients walking out of the ED. The hospital team was also concerned that a new facility was the only solution to improving the ED. In the past, consulting teams had suggested capital expenditures of \$500,000 as the only solution to the failing ED.

The LOS is the time between when a patient enters the ED until they exit. All processes, efficient or not, contribute to the LOS in the ED and had to be addressed accordingly. Healthcare simulation software was the necessary tool to model these system interactions from patient entrance to exit. A hospital simulation model would show how proposed changes would impact the ED and enable better decision making. A hospital simulation model also allowed the hospital to test a proposed patient flow rework where patients were concurrently triaged, treated, tested and assessed. Healthcare simulation software was the best tool to allow complete analysis of the current system and determine the right path forward.

Solution

Once process flows were defined and specifications were finalized, Rockwell Consultants developed an Arena® hospital simulation model allowing for the complete evaluation of “what if” scenarios and experimentation with the system prior to making any significant changes. One of the most difficult issues with predictive modeling in healthcare is the human factor. While a strict process flow had to be defined, the reality was that decisions were made differently by doctors and nurses and patients were likely to deviate from a pre-defined path. Defining a realistic patient flow and collecting accurate data were key factors to the success of the project. In the end, the hospital simulation model had to adequately represent the current ED and hospital officials had to buy into the model in order for successful changes to be made.

The final model consisted of an Excel user interface coupled with the Arena hospital simulation model. The Excel interface enabled the user to easily enter inputs, run the model and view outputs. Numerous scenarios for comparison could be created by changing various inputs in the excel interface. The user could manipulate process flows, process delays, patient routings as well as resource schedules and bed capacity all from the user interface. Once the scenario was run, the user could quantify results by examining multiple pages of output reports. From patient cycle times to resource utilizations, various key outputs for analysis were recorded for each run. Analysis and comparison of scenarios provided key information for making the right decisions. The hospital team was anxious to see how the input factors affected the average times patients were spending in the ED.

Results

The hospital simulation project provided some results that were contrary to the hospital’s initial understanding of the problems. At the beginning of the study there was a particular concern regarding the psych patients. This concern proved unfounded, as psych patients were only 4% of the total patient population. Running the simulation and removing the psych patients provided little process improvement. There was a perception among the staff that these patients made up a larger portion of the patient mix as they tended to be more disruptive when they entered the system. It was also a major concern that the telemetry unit was a significant deterrent in moving patients from the ED. After careful analysis of the telemetry unit, this also proved to be a hospital myth. Additionally, the proposed new facility was not a solution to improve the declining ED service. The hospital simulation proved that by increasing process efficiency, using all available ED beds and adding another physician resource, the ED could operate at an acceptable level. The problems that existed would not be resolved by a new facility. The hospital was advised to first improve their current processes prior to any major capital expenditures. The quantitative data the healthcare simulation software provided enabled decision makers to follow through with the most effective ED changes and avoid investing more than \$500,000 in an unnecessary new facility.

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