USING SIMULATION TO DESIGN AN EMERGENCY DEPARTMENT — ARCHITECTURALLY, OPERATIONALLY, & CLINICALLY

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Introduction:

Healthcare clients capture patient data in every department and with every process. However, hospitals often struggle with using this data analytically to improve their systems. In this presentation, we will discuss how one community hospital used analytics to influence the architectural, clinical, and operational design of its new emergency department.

The existing hospital system was struggling with its volume of patients. The predicted increase in volume was going to push the existing system past its breaking point [1]. Our team was tasked with not only designing a new emergency department with the appropriate capacity but, more importantly, seeing how various clinical and operational changes would affect the new system.

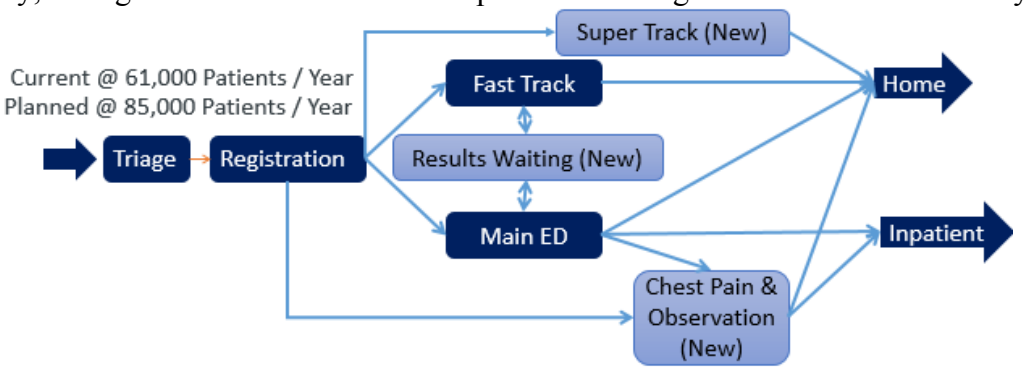

Figure 1: Current System (dark blue) and Proposed System (light blue).

The existing system included the Fast Track and Main ED. Some of the potential changes that needed to be evaluated included adding a Super Track and Results Waiting as well as expanding the Chest Pain & General Observation area. This is illustrated in Figure 1.

Methodology

The project kicked off with a thorough study of the existing system. This included interviews with the staff, observations of the patient flow, and understanding how the connecting departments interacted with the ED.

To accomplish this task in an evidence-based way, a simulation model was developed using ExtendSim. The model was populated with statistics derived from one year of retrospective patient data. This included the daily patient volume, arrival profiles, ESI probabilities, diagnostic probabilities by ESI, treatment area probabilities by ESI, disposition probabilities by ESI, and service times (by ESI, treatment area, and disposition).

This approach helped the clinical, managerial, and facility staff to not only understand their existing department workflow but also provide them the opportunity to test trans-disciplinary scenarios to guide the design of the new emergency department. Furthermore, it provided the client with the analytics to evaluate the impact that a new Results Waiting Lounge and Super Track and an expanded Chest Pain & General Observation Center would have on their entire system.

In a nutshell, the simulation model gave the client the ability to experiment with various aspects of the new ED as it was being designed.

Results & Conclusion

The first study used a 20-year projection, which corresponded to a 30-percent increase in patient volume [1]. The initial results provided to the architects showed that the ED needed three triage rooms, 16 Fast Track rooms, 40 Main ED rooms, and eight Chest Pain & General Observation rooms. The architects used this information to design the ED.

During the initial study, hospital staff wanted to test the effect of changing their triage system [2]. This change would allow a small portion of ESI 3 patients, which were currently going to the Main ED, to be triaged differently, so they would instead be treated in the Fast Track area. The model reported that as many as 20 percent of the ESI 3 patients could be treated in Fast Track, freeing up some capacity in the Main ED.

In a follow-up discussion with the client, unexpected budgetary cuts dictated that a further reduction of rooms was necessary. The simulation model was used for a second study to further prioritize the capacity and type of rooms. This second study included construction phasing, so that it was more closely aligned with the short-term annual projections. This study showed that the hospital would need 34 Main ED rooms and 10 Fast Track rooms while shelling out the additional space to be built out when patient volume increased. This could both satisfy the initial patient volume when the new ED opened and postpone the construction costs of additional rooms until later.

References

1. Mielczarek, B, 2013, “Estimating Future Demand for Hospital Emergency Services at the Regional Level.” 2013 WSC, Edited by R. Pasupathy, S. H. Kim, A. Tolk, R. Hill, and M. E. Kuhl, 2386-2397, Piscataway, New Jersey: IEEE
2. Peck, J., and S. G. Kim. 2009. “Improving Patient Flow through Axiomatic Design of Hospital Emergency Departments.” Proceedings of the 19th CIRP Design Conference–Competitive Design Edited by R. Roy and E. Shehab, 255–260. Cranfield University Press.