

# Analysis and Modeling of Patient Flow Through Emergency Departments

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## Abstract

As health systems become more complex and demand for healthcare services increases, healthcare providers such as hospitals are increasingly looking for ways to optimize their processes, especially in the emergency department. Increasing patient loads and overcrowding conditions in emergency departments have caused hospitals to increase their focus in managing patient flow through the department in order to increase safety and responsiveness (Saghafian, Hopp, Van Oyen, Desmond and Kronick). While hospitals previously had excess capacity in their emergency rooms, many hospitals now feel strained in their attempts to manage patient flow (Bazzoli, Brewster, May and Kuo). Healthcare systems have also been setting higher standards for responsiveness and in trying to reduce the amount of time a patient needs to spend in the hospital or emergency room system, again highlighting the focus on process improvement (Fletcher, Halsall, Huxham and Worthington). I focus on analyzing and modeling ways in which hospitals can improve patient flow.



## Background

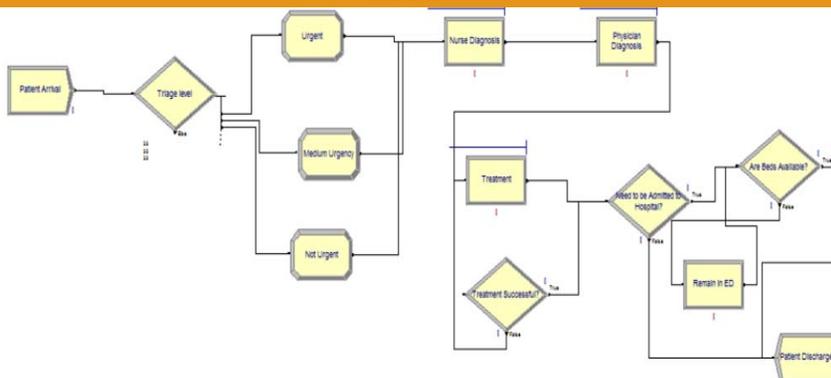
To gain insight into how to model patient flow through emergency departments, I visited Buffalo General Hospital, a hospital with one of the largest emergency departments in Buffalo that handles about 65,000 patients annually by the estimate of a physician in the Emergency Department. I was able to visit Buffalo General during a time when patient volume is high, so as to observe the patient flow process when there is congestion.



I then modeled the patient flow process, as I best understood it, using Rockwell Automation Arena Software.

At Buffalo General, I was fortunate enough to be able to observe physicians and nurses in the Emergency Department, and I was able to interview them about how they handle patients, how patients flow through their department, and what they believe are the most vexing obstacles to efficient patient flow. I was also able to ask for their suggestions on what would best improve patient flow.

## Model



## Discussion

- ❖ In my model, patients first arrive at the Emergency Department. Patients may arrive by walking into the Emergency Department or they may arrive via ambulance. There is a triage nurse at both the main entrance to the Emergency Department and at the entrance for ambulatory patients. These nurses assess the severity of the condition of the patients and assigns them a triage level. Patients are seen in order of highest triage level, meaning that patients of a higher triage level are seen before patients of a lower triage level, regardless of arrival time.
- ❖ At the Buffalo General Emergency Department, there are four "pods", or sections divided by the type of patients that each focuses on. Patients are assigned by the triage nurse to either the Vascular Care pod, the Critical Care pod, the Urgent Care pod, or the Sub-Acute Care pod. This is not seen in my model, as the process for patient flow is the same regardless of which pod a patient is assigned to.
- ❖ After a patient is assigned to a pod, the patient is seen by a nurse or physician's assistant, who checks the patient's vital signs and provides an initial check on the patient. After this, the patient is seen by a doctor, who formally diagnoses the patient and prescribes treatment.
- ❖ If the treatment is not successful, the patient's condition will not improve and the medical staff must reassess the patient's treatment, and so my model returns the patient to the "Treatment" process if treatment is unsuccessful. If treatment is successful, the patient will either be discharged or will be admitted to the hospital. If the patient is discharged, they will leave the Emergency Department and the model. If a patient needs to be admitted to the hospital, they must stay in the Emergency Department until a bed is available in the hospital for the patient. When a bed is available for the patient, they are discharged from the Emergency Department and leave my model.
- ❖ From my discussions with physicians and nurses at Buffalo General, by far the largest obstacle for patient flow is the fact that patients must wait for beds to be available before they can leave the Emergency Department. Attending physician Dr. Robert McCormack stated that patients can be delayed up to 36 hours in the Emergency Department waiting for a bed to become available. This means fewer beds available for the Emergency Department to utilize in patient care, which hinders patient care. Other major factors that can delay patient flow include understaffing of nurses for financial reasons and inefficient communication between different hospital departments, which can delay patient admission into the hospital.
- ❖ To best improve patient flow through Emergency Departments, areas a hospital should focus on include increasing the availability of hospital beds, decreasing the understaffing of nurses as much as possible, and focusing on increasing the efficiency of communication between hospital departments.

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