Reducing Patient Transportation Times through Improved Staff Scheduling using Simulation

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Baptist Memorial Healthcare Corporation is a network of hospitals located throughout the central-south of the United States that offers patient treatment and medical care with various specialties. Our interest is in patient transportation at Baptist's flagship hospital in Memphis, Tennessee. Transportation refers to team members, called transporters, who pick up and move patients between different areas of the hospital. Baptist is concerned with excessive patient transportation times. We identified that Baptist's is not meeting its 35-minute transportation goal.
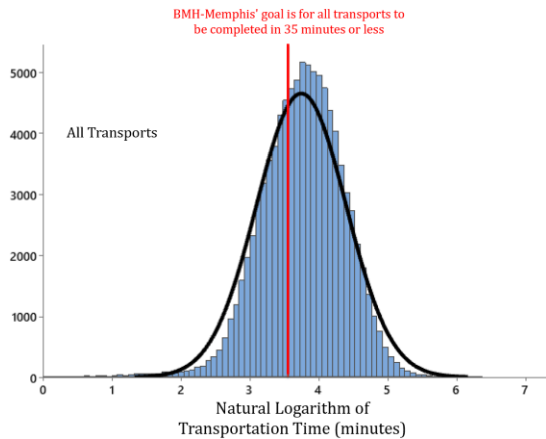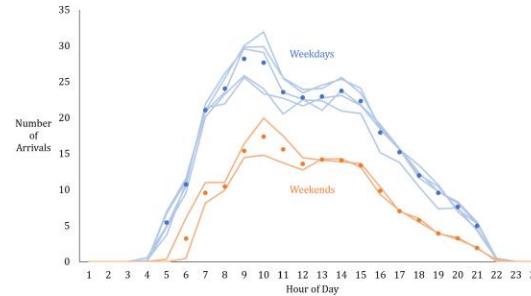

Transportation at BMH

There are three phases in the transportation process. The first phase, pending, begins when a patient requires transport. The transport request is entered into Teletracking, the software used to document transports. Pending ends when the request is accepted by a transporter. Dispatch begins when the transporter begins moving to the patient's origin location and ends when they begin to move the patient. In progress begins when the transporter begins moving the patient and ends when the patient arrives at their destination location.

Transportation Data Analysis

To dig into the question of why transportation times are taking so long, a year's worth of data was provided for us. We tried to model this data as a normal random variable which was unsuccessful, so we performed a logarithmic transformation, and we were able to fit a lognormal distribution to transportation time. We found that 63% of transports are not meeting Baptist's goal of 35 minutes.

Extensive data analysis was performed to determine an arrival rate for the purpose of building a simulation model. Arrival rates change over time, but a trend was identified between weekdays and weekends.

Simulation of the Transportation System

To give us the ability to experiment with different staffing policies, we used Arena to build a discrete event simulation model of the transportation process. In Arena, we used entities to model patients and Arena's transporter functionality to model transporters.
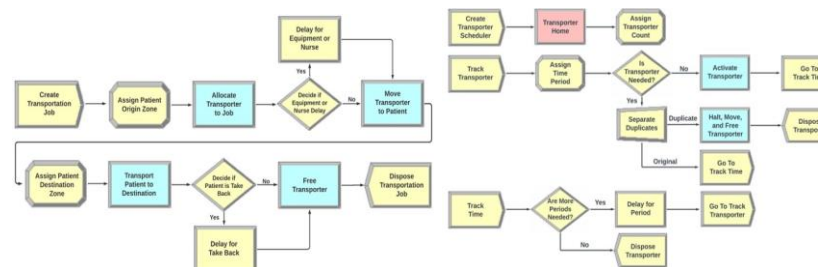

Transportation Staffing Improvements

Based on our historical data, only 37% of jobs are meeting Baptist's goal of 35 minutes or less. When we use their current staffing schedule in the simulation model, we receive numbers that are like their historical data. This allows us to be sure that our simulation is accurately representing the current system.

	Pending to In Progress Average Time (minutes)	Total Transportation Average Time (minutes)	Percentage of Transports Completed in 35 Minutes
Historical Data	42	50	33%
Simulation Based on Current Staffing	42	51	33%
Simulation Based on Our Staffing with the Current Number of Transporters	29	40	55%

We used transporter demand to develop a weekday staffing schedule that more closely meets Baptist's needs without increasing the number of staff.
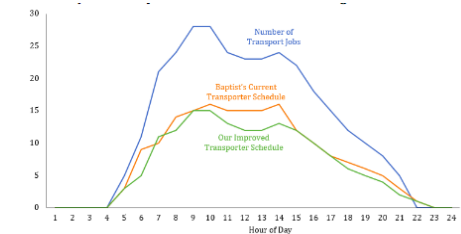
We found that by increasing the number of staff, Baptist could reduce their average transportation time to 32 minutes with 74% of transports completed in 35 minutes or less.