Reducing Emergency Department Wait Time by Improving Nurse Scheduling using Simulation

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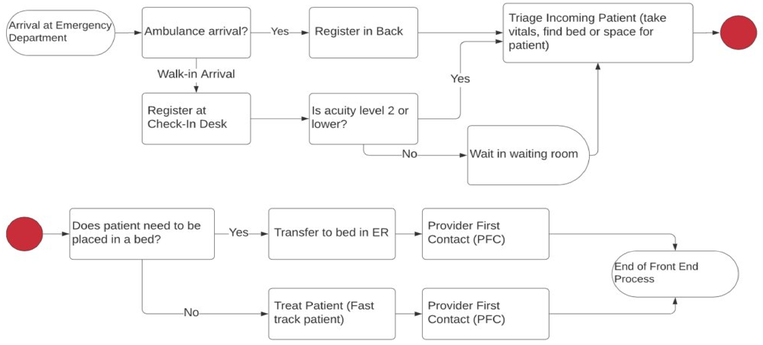
Baptist Memorial Healthcare

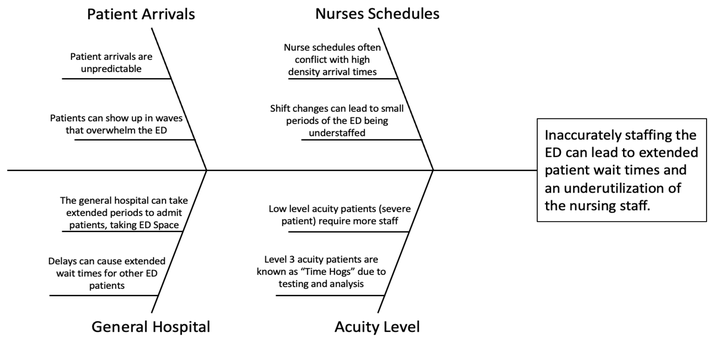
Baptist Memorial Healthcare System (Baptist) is a large hospital system, operating 22 hospitals across parts of Tennessee, Mississippi, and Arkansas. These hospitals include children's hospitals, women's hospitals, and rehabilitation hospitals. Baptist also operates several clinics and other specialty facilities. Our team is focused on Baptist's main hospital campus. Located in Memphis, Tennessee, this flagship hospital campus sits upon 80 acres and is home to three separate hospitals, a women's health center, and five physicians' office buildings. The hospital offers a variety of inpatient, outpatient, and emergency services. The Emergency Department (ED) sees more than 65,000 patients per year.

Front-End Process

Upon arrival to the ED, patients go through the front-end process. The front-end process begins with the assignment of an acuity level. Acuity is a ranking system that determines a patient's severity level on a scale of 1 to 5 with 1 being the most serious, and 5 being the least. After this, the patients go through registration and triage. In triage, it is determined whether they can be fast tracked or if they need to be placed in a bed. Finally, the front-end concludes with Provider First Contact (PFC).



Problems Staffing the Front-End



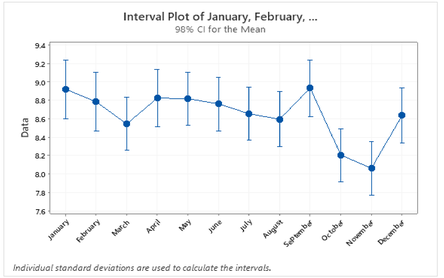
Data Analysis

The data given to us is very seasonal. We broke down arrivals by season of the year. Through running a Games Howell test, we were able to divide the arrivals into five different seasons.

Grouping Information Using the Games-Howell Method and 98% Confidence

Means that do not share a letter are significantly different.

Factor	N	Mean	Grouping		
September	1440	8.934	A		
January	1488	8.921	A		
April	1440	8.825	A	B	
May	1488	8.819	A	B	
February	1344	8.786	A	B	
June	1440	8.762	A	B	
July	1488	8.656	A	B	C
December	1488	8.636	A	B	C
August	1488	8.596	A	B	C
March	1486	8.546	A	B	C
October	1488	8.207		B	C
November	1442	8.062			C



January	February	March	April
May	June	July	August
September	October	November	December

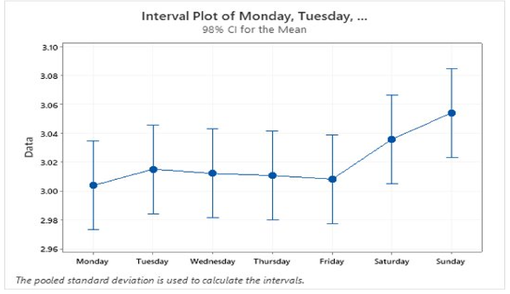
Acuity level was then broken down by day of the week and hour of the day. Days were broken up into 3 spans: Mondays, Tuesday through Friday, and Saturday through Sunday. There are 72 separate distributions in Arena breaking down Acuity.

Fisher Pairwise Comparisons

Grouping Information Using the Fisher LSD Method and 98% Confidence

Factor	N	Mean	Grouping					
9	7	3.0759	A					
10	7	3.05314	A	B				
1	7	3.0449	A	B	C			
8	7	3.04269	A	B	C	D		
11	7	3.0307		B	C	D	E	
24	7	3.02820		B	C	D	E	F
3	7	3.02670		B	C	D	E	F
23	7	3.0241		B	C	D	E	F
12	7	3.0161		B	C	D	E	F G
20	7	3.0128		B	C	D	E	F G
7	7	3.0068			C	D	E	F G
22	7	3.0047			C	D	E	F G
19	7	3.0021				D	E	F G
13	7	3.0012				D	E	F G
5	7	3.0005				D	E	F G
21	7	2.99595					E	F G
6	7	2.9940					E	F G
18	7	2.99206					E	F G
4	7	2.9907					E	F G
2	7	2.99013					E	F G
16	7	2.9857						F G
17	7	2.9813						G
14	7	2.9807						G
15	7	2.9761						G

Means that do not share a letter are significantly different.



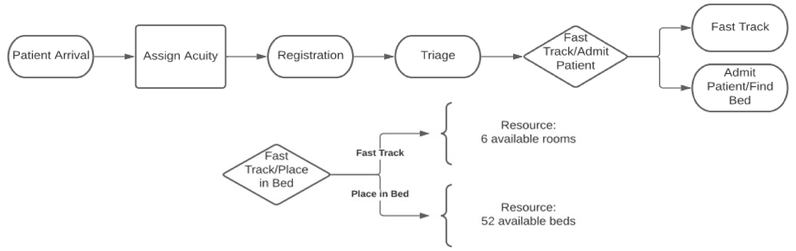
Grouping Information Using the Fisher LSD Method and 98% Confidence

Factor	N	Mean	Grouping	
Sunday	24	3.0541	A	
Saturday	24	3.0359	A	B
Tuesday	24	3.0151	A	B
Wednesday	24	3.0121	A	B
Thursday	24	3.0106	A	B
Friday	24	3.0081		B
Monday	24	3.0037		B

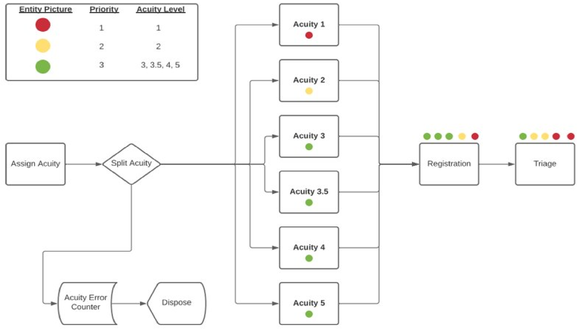
Means that do not share a letter are significantly different.

Simulation Model

Using the created distributions, arriving entities flow through the simulation model as a patient would flow through the ED. After flowing through the front-end, they then stay in the back-end for a variable amount of time depending on if they are placed in a bed or if they go through the fast track process.



The entities are assigned an acuity directly after creation. This acuity level gives preference to both acuity level 1 and 2 patients. This means that they will travel to the front of the queue for both registration and triage because of their severe condition.



Conclusions and Recommendations

Our model can provide detailed reports of queue length at any given hour that the simulation is run. This allows our industry partner to analyze where extra staff is needed within the ED at any given time. The model is also able to estimate wait times of patients to determine how long patients are spending in the system. This will help the ED minimize the number of patients that leave without being seen (LWBS) as these two statistics are directly correlated.