

BACKGROUND

- ❖ Emergency department microsystems across the nation have been strained due to a decrease in access to care.
- ❖ Patients who leave without being treated (LWOT) represent the failure of an emergency care delivery system to meet its goals.
- ❖ Simulation modeling and other analytical methods have been used in other industries and with limited application in health care.

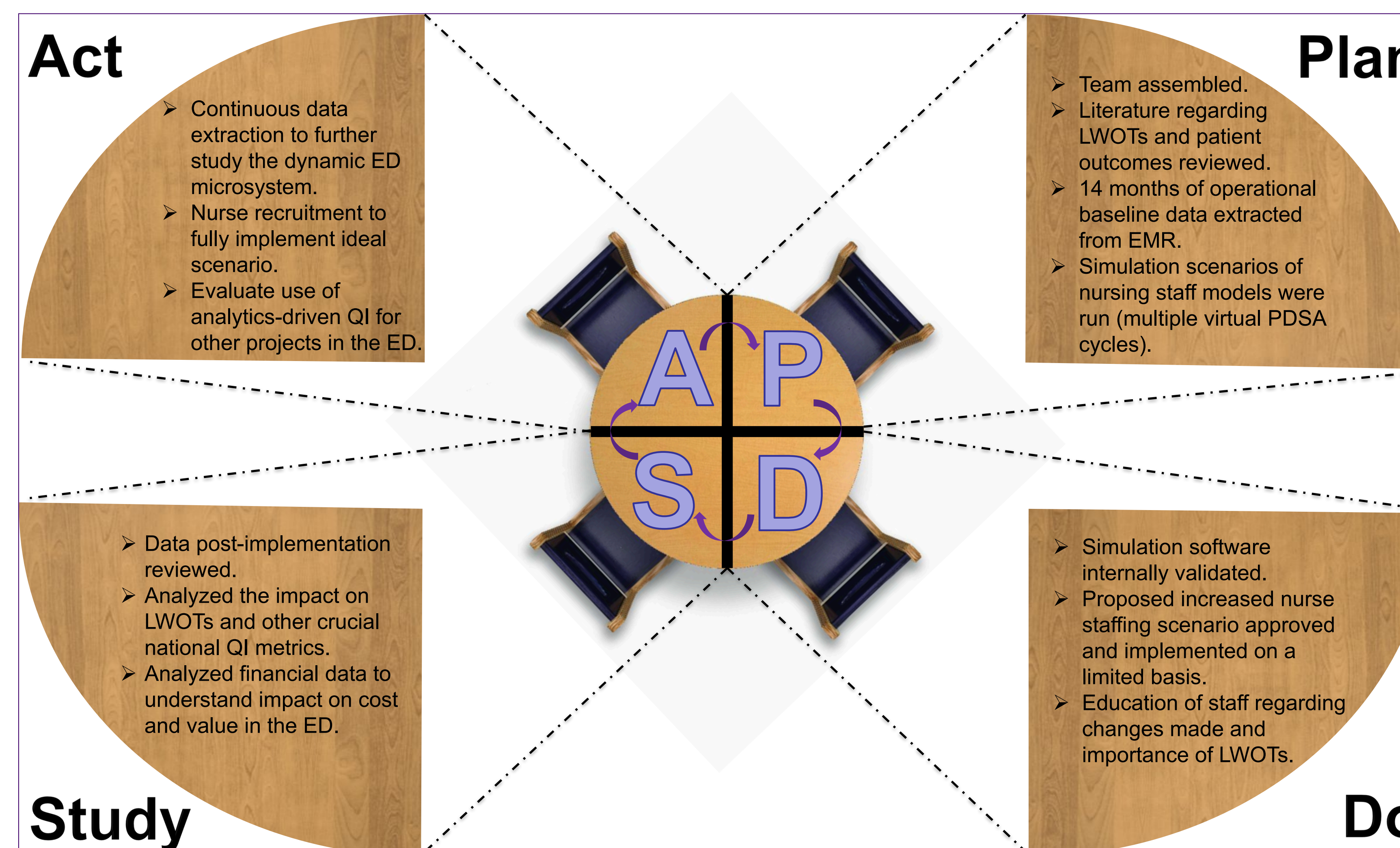
PROJECT AIM

- ❖ Analyze the impact of enhancing nurse staffing on LWOTs at Vidant Medical Center using a novel simulation software.
- ❖ Improve patient experience by reducing LWOTs.
- ❖ Demonstrate the effectiveness of applying analytical and engineering technology to increase value in healthcare.

PROJECT DESIGN/STRATEGY

- ❖ Late in 2016, an exploration of RN staffing was conducted using the simulation software to identify a more effective model. This customized, commercially available simulation software allows for the acceleration of process improvement cycles.
- ❖ Software was validated internally using the simulation of 52 one-week periods (Monte Carlo runs) from data extracted from the EMR.
- ❖ Financial data was extracted from the billing database.
- ❖ From January-May 2017, the ED was able to add nurse shifts on a limited basis as additional RNs were being recruited and hired.
- ❖ We compared the ED's performance on days with minimal vs. enhanced RN staffing.

CHANGES MADE (PDSA CYCLES)



LESSONS LEARNED

- ❖ Several assumptions are involved with the specification of the simulation model, namely parameters and processes not estimated directly from data. These processes were integrated into the simulation model based on interviews, analysis of publicly available data, or previous research conducted by our team.
- ❖ The simulation model assumes a full staff each day. In the actual ED environment, call-outs or other changes to realized staffing present challenges to management and will limit the precise fit of the simulation. The simulation model, however, can be used to understand the impact of these unintended staffing changes on overall productivity. Reality of the actual environment will also be impacted by changes in the other inputs in the model such as ancillary turn around time or boarding delays.

NEXT STEPS

- ❖ Simulation technology will enable ED leadership to more quickly develop, study, and implement changes to improve their operational measures.
- ❖ This project highlighted that nurse staffing is an important bottleneck of the system and definitely has an impact on many QI measures, including LWOT, which significantly impacts patient outcomes.
- ❖ Implementing analytical and engineering technology into several other departments in the hospital has the potential to accelerate patient safety and quality improvement efforts.

RESULTS/OUTCOMES

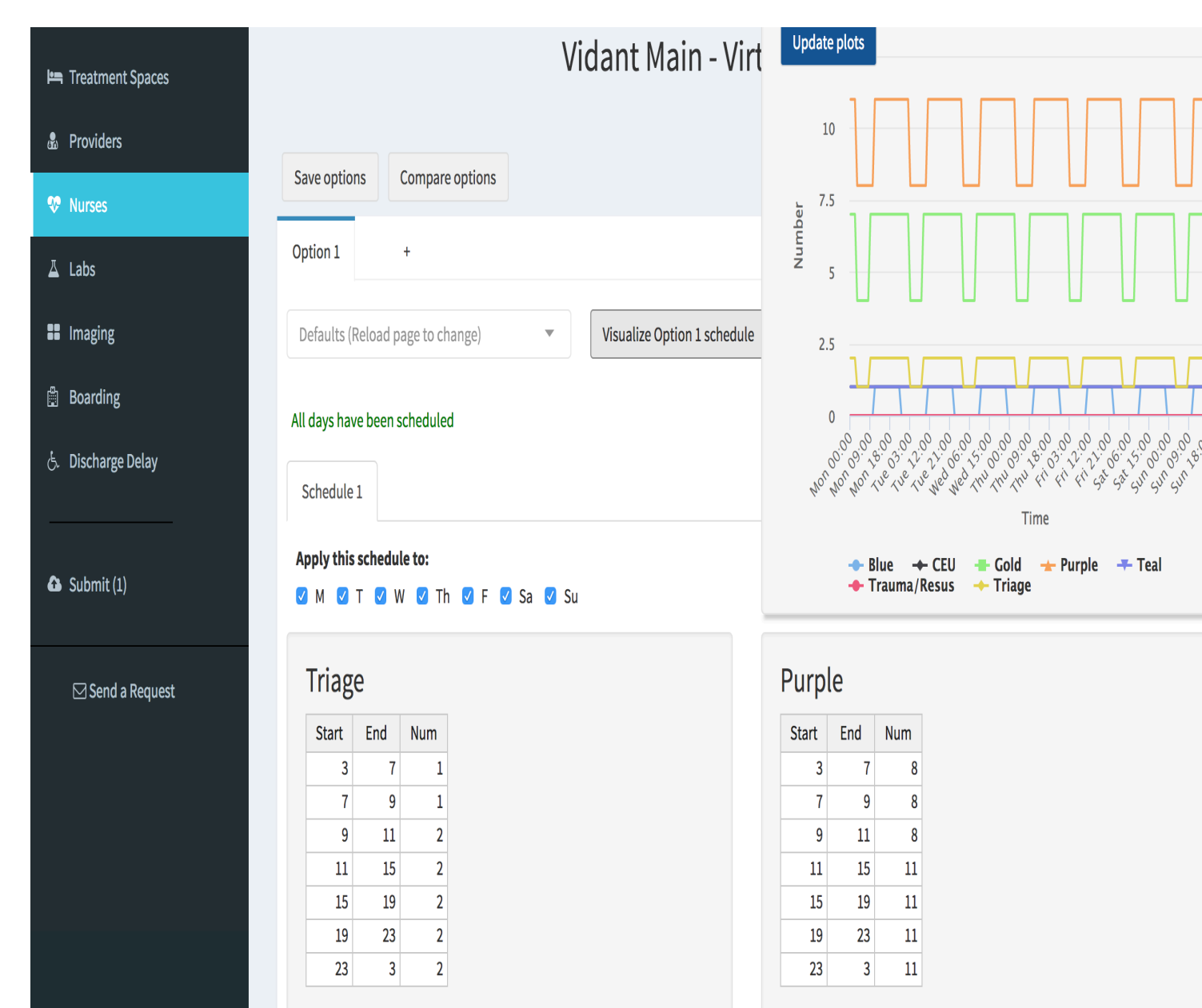


Figure 1. Simulation "Builder" interface where ED management variables (left side) are used to specify potential changes for simulation. Here the user has specified nurse staffing scenarios of each section in the Vidant main ED. Specific shifts and days are also customizable.

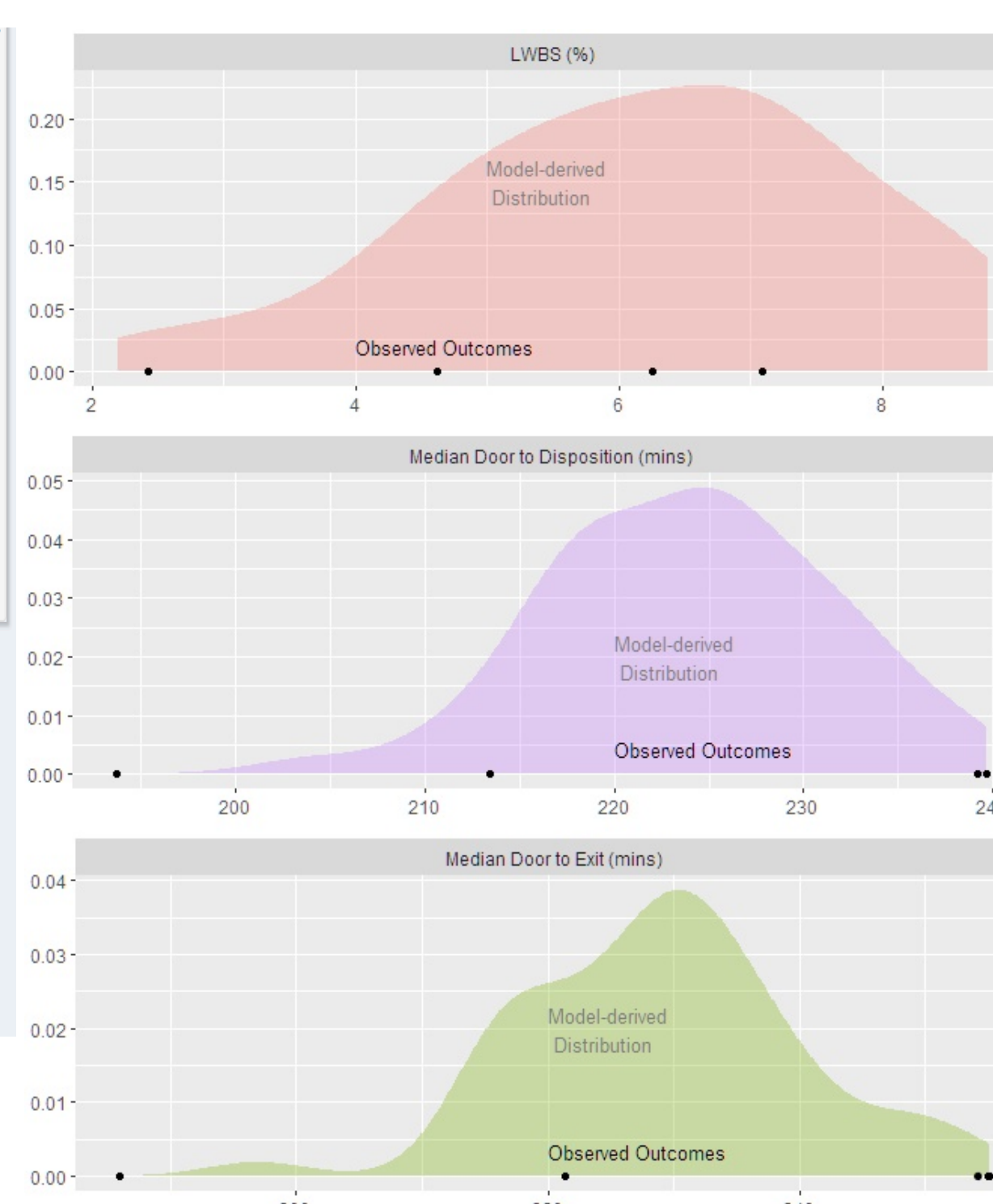


Figure 2. Comparison of model-derived simulated distributions (colored, based on 52 one-week Monte Carlo runs) and observed metrics for four validation weeks (black dots). Metrics include LWOT percentage, median door to disposition time in minutes, and median door to exit or total length of stay in minutes.

Volume Bin	Baseline LWBS	Enhanced RN LWBS	LWBS Improvement	Number Baseline Days	Number Enhanced Days
185	5.0%	1.9%	3.1%	6	2
195	4.5%	4.0%	0.5%	12	5
205	5.7%	3.3%	2.4%	13	6
215	6.0%	5.6%	0.4%	11	4
225	7.8%	5.6%	2.2%	9	2
235	10.2%	8.9%	1.3%	4	7

Table 1. Comparison of LWBS percentages for baseline RN staffing days versus enhanced staffing days, by arrival volume bin. Table also demonstrates the number of days included in each category for this analysis.

- ❖ This project demonstrated that the enhanced model closely matched the predicted outcomes. The core simulation model was demonstrated to accurately depict status quo operations and throughput metrics for the ED.
- ❖ Days with the enhanced staffing model demonstrated a substantial improvement in ED operational performance measures. Every day of the week showed an increase in the volume of patients who are treated in the ED.
- ❖ Days with enhanced staffing demonstrated an average 20% lower LWBS rate.

- ❖ The enhanced staffing resulted in approximately \$350,000 in additional facility fees. Using an average of \$25/hour for nurse labor cost, the 54 additional RN hours per day cost \$97,200 (72 days x 54 hours x \$25) for the time period. The gross return on investment for the hospital is more than 3.5x.
- ❖ The concurrent improvement in LWBS rate along with the realized increases in patient throughput highlight the additional capacity for the ED to treat patients under an analytics-driven RN staffing model

ACKNOWLEDGEMENTS

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