Accelerating the PDSA Cycle Using Computer Simulation in the ED

Unified Quality Improvement Symposium
March 31, 2017

Timothy Reeder, MD

Brandy Galloway, RN

Taj Nasser, MS 3

Disclosures

- Timothy Reeder
  - Co-investigator with software company for National Science Foundation grant
  - Stock ownership with software company
- Brandy Galloway
  - No disclosures
- Taj Nasser
  - No disclosures

Background

- Scientific, systematic approach to QI has higher success rate
- Tools such as PDSA and rapid cycle improvement have limitations in real-life situations
- Computer simulation useful for large scale efforts
- IOM and AHRQ advocate for use of industrial engineering principles for QI in health care
- Allows for replication of a complex system and comparison across multiple scenarios

Vidant Medical Center's Adult Emergency Department

- 77,000+ annual visits
- Complex staffing needs
- Throughput is a critical quality measure
- Ideal use of simulation to answer complex question

Simulation Software

- Discrete event simulation
- 14 months of existing operational data from EMR
  - Bed spaces
  - Arrival rates
  - Elapsed time for critical processes
  - Staffing
- Proposed input changes
  - Fire up the “cloud”
  - Simulate 52 weeks of ED operations
  - ~ 1 hour later results (eliminated need to experiment and study the results)

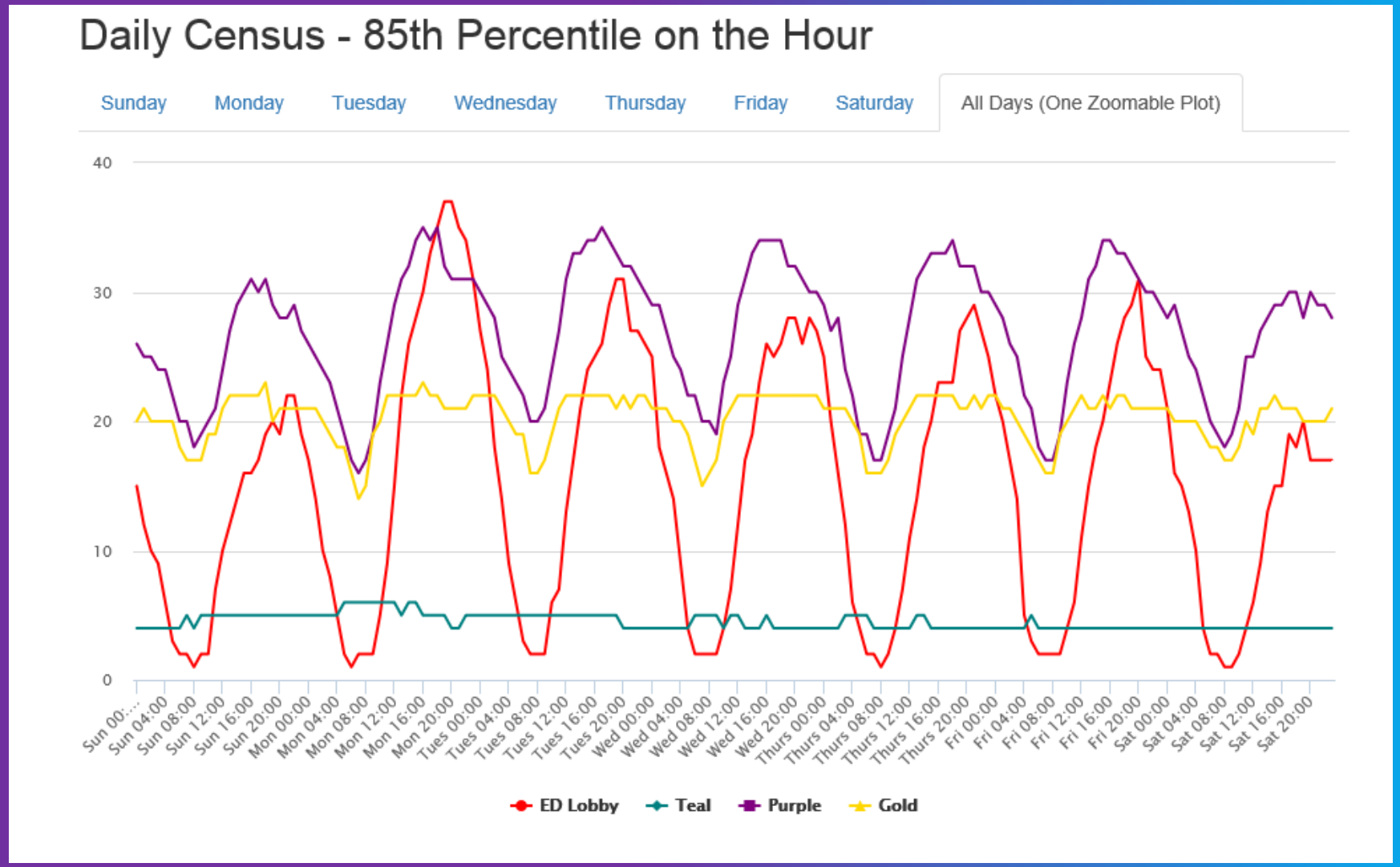
Aim

- Redesign nurse staffing model of the main ED in cost-effective manner using simulation to provide the most efficient, effective, and valuable care.

Will the Change Be an Improvement

- Match staffing to patient demand
- Minimize patients leaving without treatment (LWOT)
- Decrease patient length of stay
- Increasing value of care by decreasing cost

Patient count by hour by day of week



Results of Simulation

Measure	Budgeted	Proposed	Delta
LWOTs	11.69%	2.05%	9.64% decrease
Patients Treated	1,207	1,364	157 increase
Door to Provider	43 minutes	29 minutes	14 minute decrease
Door to Disposition	252 minutes	213 minutes	39 minute decrease
Door to Exit	332 minutes	316 minutes	16 minute decrease
Collections – labor	$34,304,153	$37,527,655	$3,223,502 increase

Challenges

- Data extraction from EMR
- Validating model build
  - Room underutilization
  - Rooming delays
- Hiring RNs to meet model

Next Steps

- Implement nurse staffing model
  - Validation- does the prediction work?
- Redesign staffing models of the minor and children's ED
- Study impact on physician utilization and staffing
- Study impact of improved hospital capacity on ED staffing needs
- Use of simulation to redesign care areas

Conclusions

- Simulation enabled large scale experiment for improvement
- Preformed experiment in short order with better data than in vivo
- Simulation has potential to greatly accelerate the idea of rapid cycle improvement

References

- Günal MM, Pidd M. Discrete event simulation for performance modelling in health care: a review of the literature. J Simulation. 2010
- IOM, Best care at lower cost: The path to continuously learning health care in America technical report the institute of medicine. National Academies Press, Washington, 2012.
- Valdez, R. S., Ramly, E., and Brennan, P. F., Industrial and systems engineering and health care: Critical areas of research–final report (prepared by professional and scientific associates under contract no. 290-09-00027u). Technical report, AHRQ: Agency for Healthcare Research and Quality, Rockville, 2010.

QUESTIONS?