



# Simulation and analysis of outpatient endoscopy scheduling policies

Trevor Hoffman<sup>1</sup>, Victoria Glunt<sup>1</sup>, Jakob Kiel-Locey<sup>1</sup>, Jake Martin<sup>1</sup>, Pushpendra Singh<sup>1</sup>, Carolyn Wu<sup>2</sup>, Dr. Amy Cohn<sup>1</sup>, Dr. Karmel Shehadeh<sup>1</sup>, Julia Warner<sup>1</sup>, Dr. Jacob Kurlander<sup>3</sup>, Dr. Sameer Saini<sup>3</sup>

<sup>1</sup>Department of Industrial and Operations Engineering, University of Michigan, Ann Arbor, MI, <sup>2</sup>Department of Statistics, University of Michigan, Ann Arbor, MI, <sup>3</sup>Department of Internal Medicine, University of Michigan, Ann Arbor, MI

## Motivation & Background

- Colorectal cancer is the 2<sup>nd</sup>-leading cause of cancer death in the U.S. [1]
- Colonoscopy may reduce colorectal cancer incidence by up to 40% and reduce mortality by up to 50% [2]
- Simulating patient scheduling and daily operations for colonoscopy procedures in the Medical Procedures Units at Michigan Medicine
- Scheduling variability sources: patient demand for appts., preferences, arrivals, procedure durations
- Scheduling requires trade-offs in patient access, quality of care, resource utilization, and patient and provider satisfaction



Figure 1: Patient Flow Details

## Methods

- Inputs → Simulation → Metrics

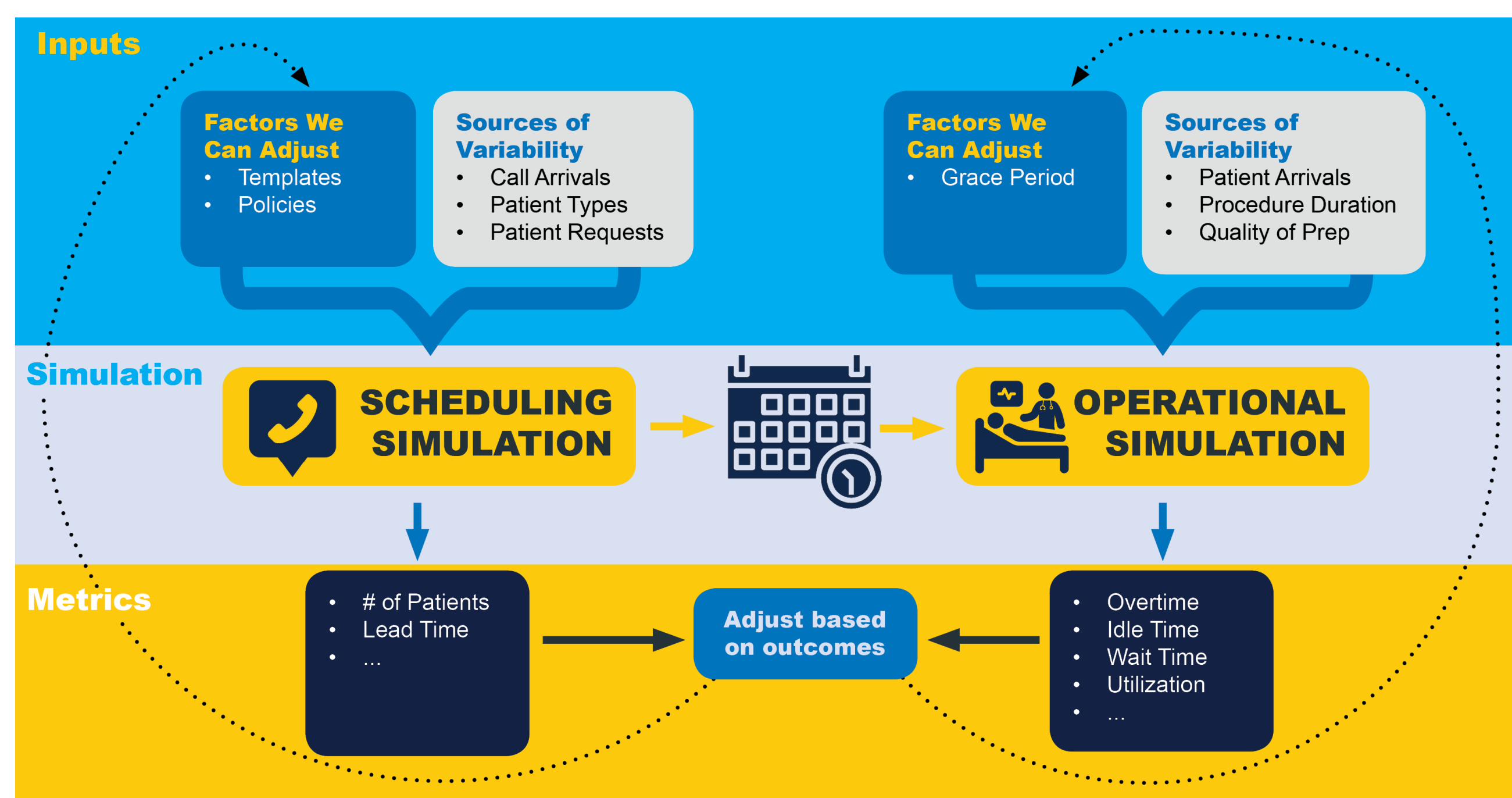


Figure 2: Simulation Framework

- Scheduling: Template → RNG → Randomly Filled Template

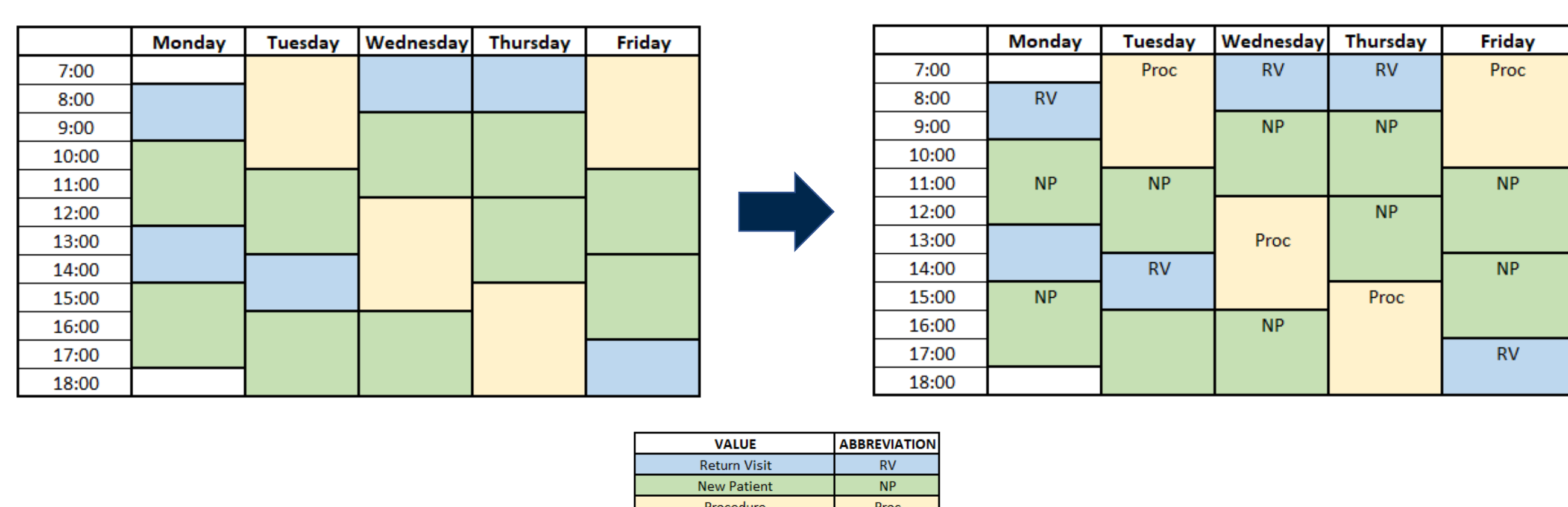


Figure 3: Scheduling Methods

- Operational: Randomly Filled Template → RNG → Randomly Operated Clinic Schedule

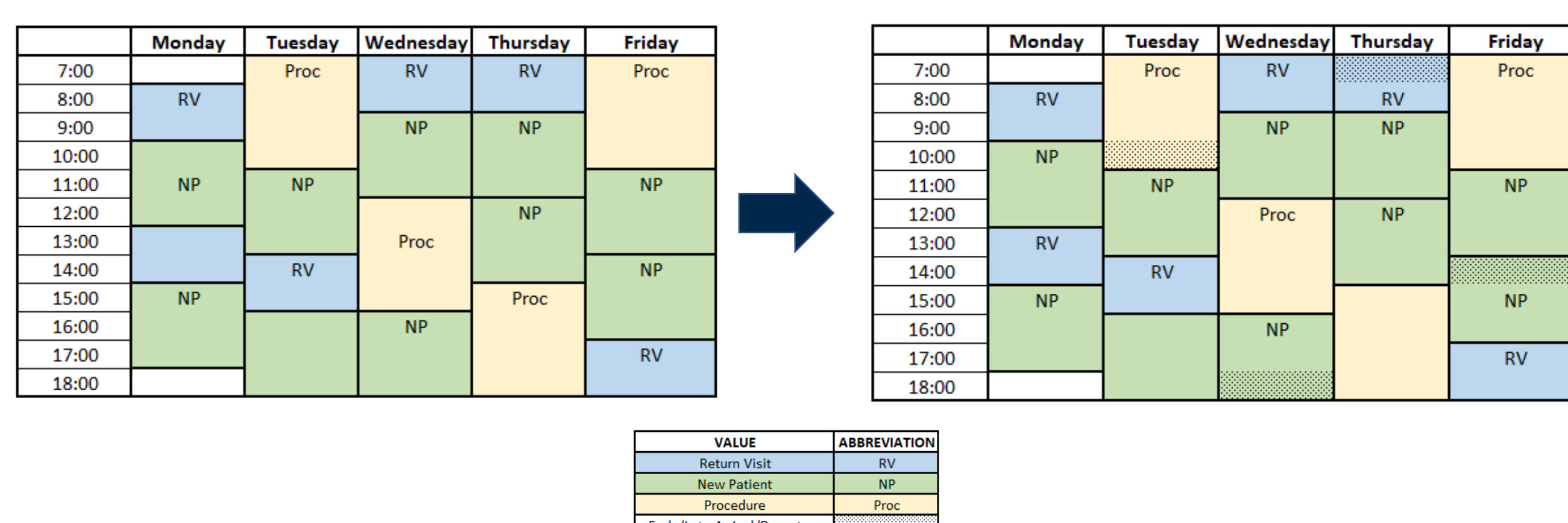


Figure 4: Operational Methods

## Results and Discussion

- Key Takeaway 1: Benefits of custom appointments

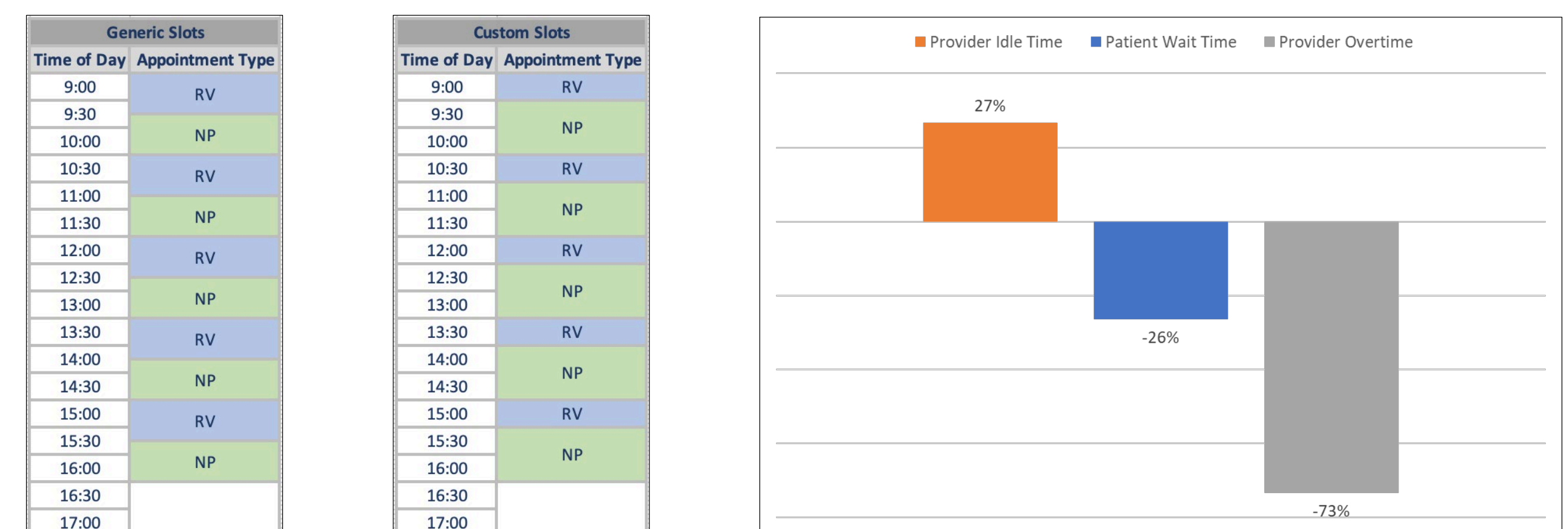


Figure 5: Custom appointment schedules and metrics

- Key Takeaway 2: High impact of small buffers

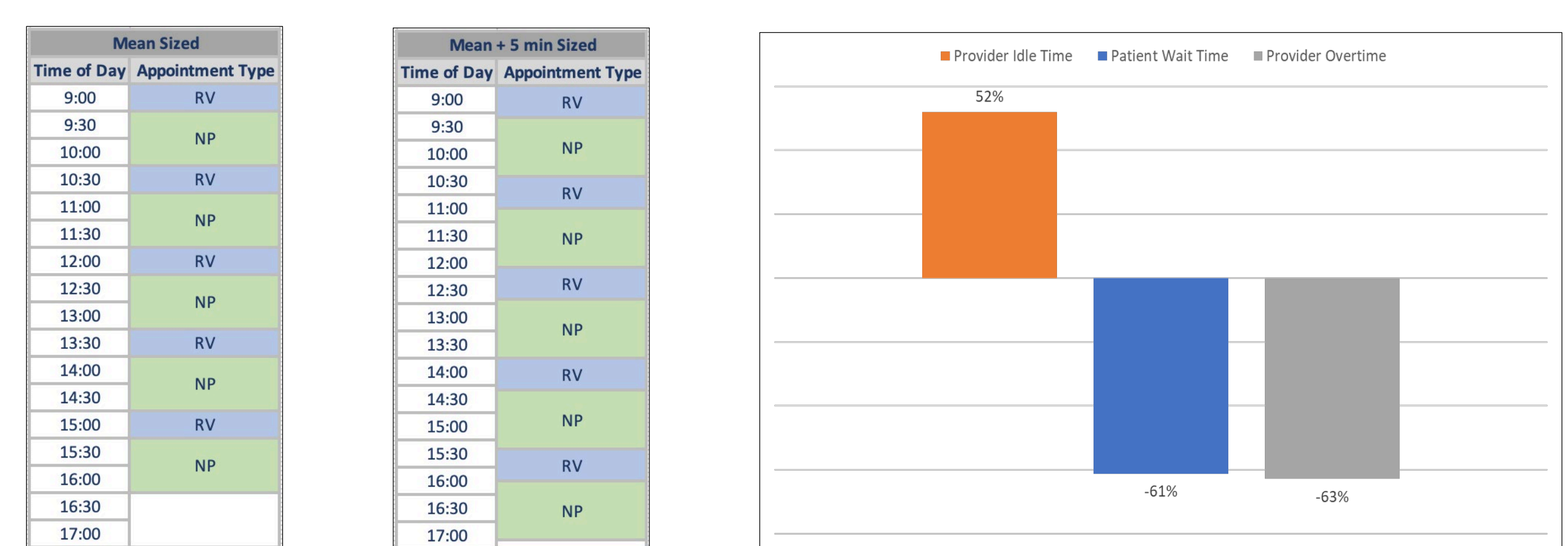
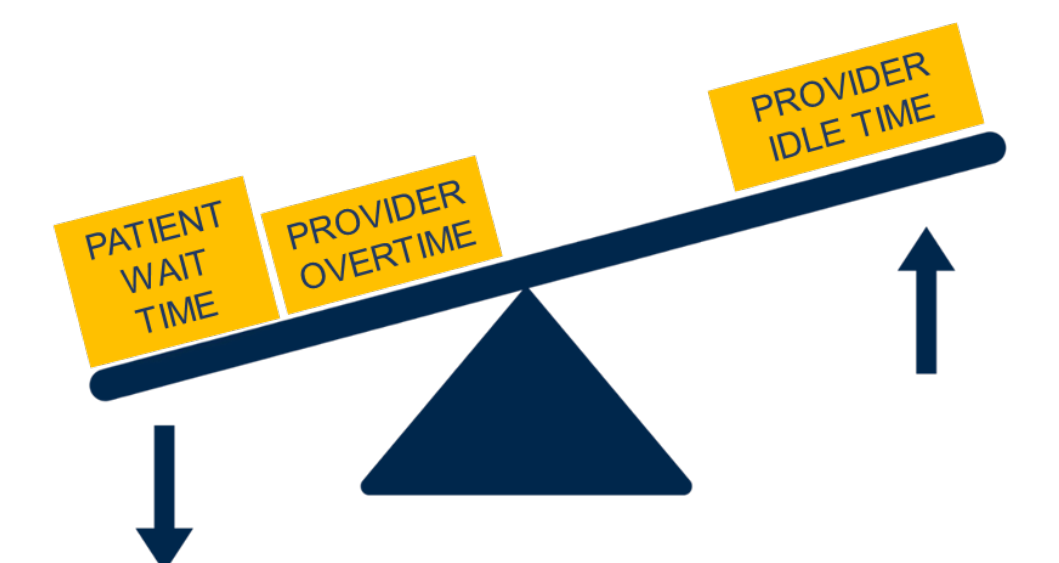


Figure 6: Small buffer appointment schedules and metrics

## Conclusions

- Simulating clinic scheduling and operations allows new policies to be tested robustly at low cost
- Simulation is useful in communicating the role random variability plays in clinical operations to clinical collaborators
- Trade-offs must be made between patient access, provider utilization, and patient wait time



## Acknowledgements



## References

- [1] Cancer Prevention & Early Detection | American Cancer Society. (n.d.). Retrieved July 16, 2019, from <https://www.cancer.org/research/cancer-facts-statistics/cancer-prevention-early-detection.html>
- [2] Colorectal Cancer Facts & Figures | Facts About Colon Cancer. (n.d.). Retrieved July 16, 2019, from <https://www.cancer.org/research/cancer-facts-statistics/colorectal-cancer-facts-figures.html>