

Evaluating Patient Triage Strategies for Non-Emergency Outpatient Procedures Under Reduced Capacity Due to the COVID-19 Pandemic

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Introduction

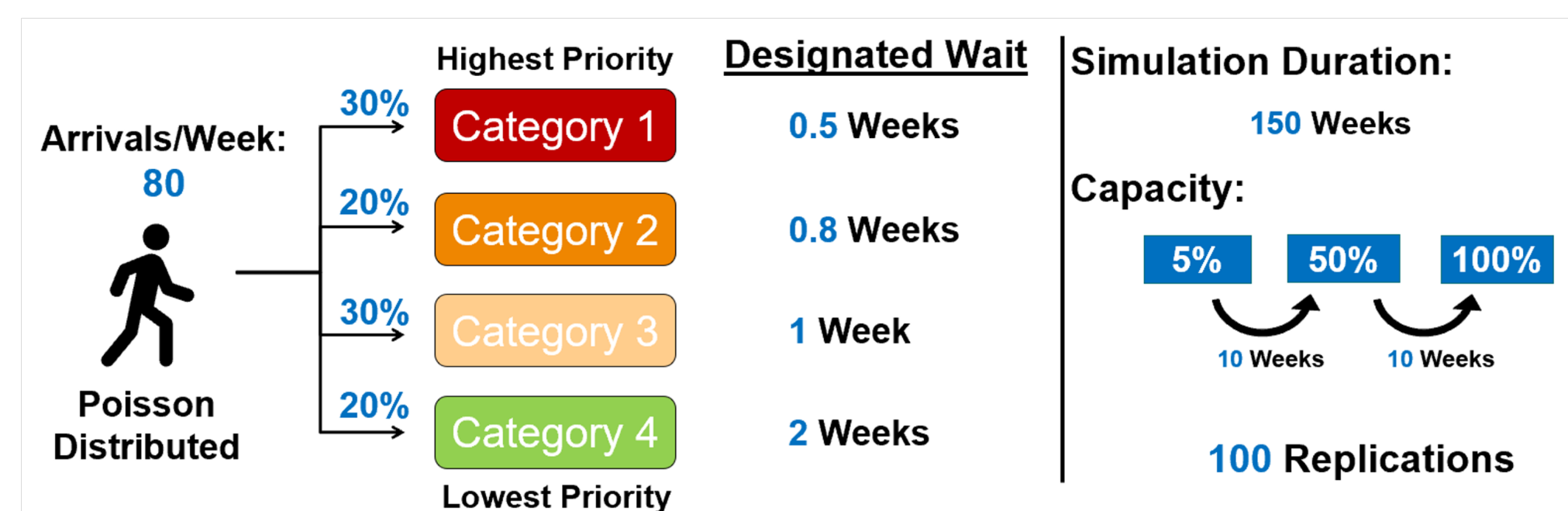
- The COVID-19 pandemic provoked the cancellation and deferral of several non-emergency medical procedures
- Prioritization of COVID-19 care and governmental safety restrictions shrunk capacity for non-urgent appointments

We develop a discrete-event simulation to model how clinical facilities under such circumstances may:

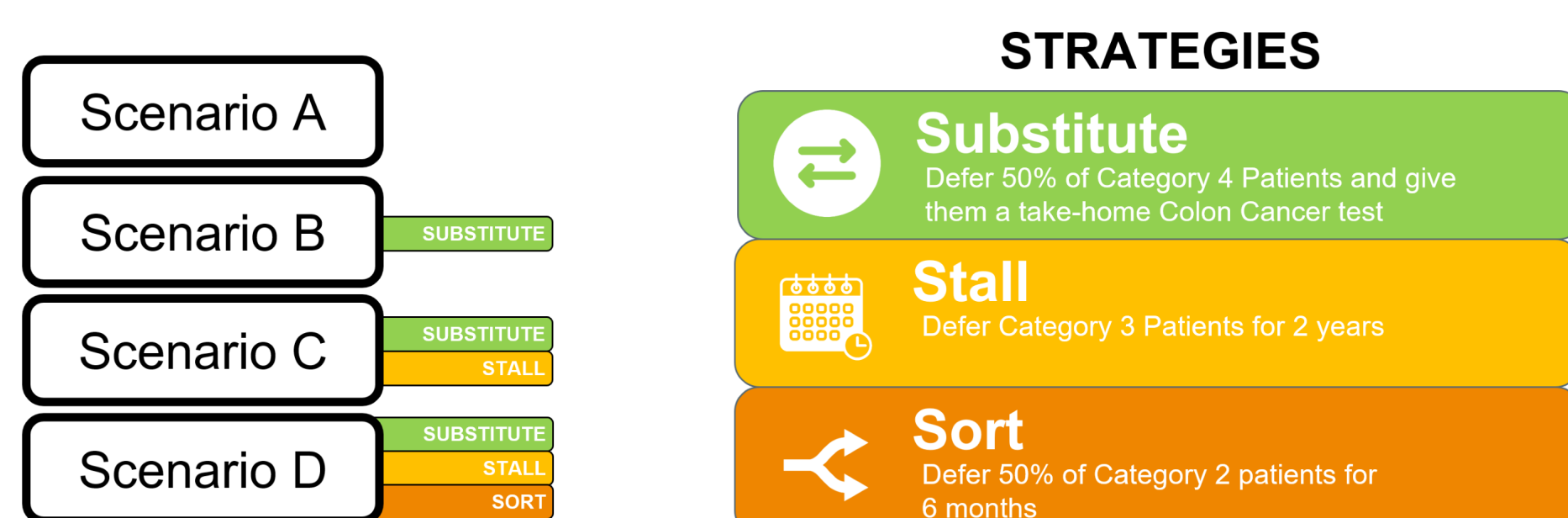
- (1) Triage patients to alternative or delayed appointment options without significant health risks
- (2) Consider tiered reopening stages to incrementally add back capacity as governmental restrictions are loosened
- (3) Explore how combining various patient triage strategies will impact patient-centric metrics, such as wait time and the number of patients reaching a designated wait time

Methods

Our simulation, built in C++, is applied to model outpatient colonoscopy procedures at a Veterans Affairs (VA) clinic in Ann Arbor, Michigan. Patients in different risk categories arrive each week and are seen by providers, with the highest priority patients seen first and lower priority patients waiting in a queue. All blue inputs defined below are user-adjustable, but we have selected values deemed relevant by clinical collaborators.



We also define three triage strategies and develop scenarios of how they may be integrated.



Logical Flow

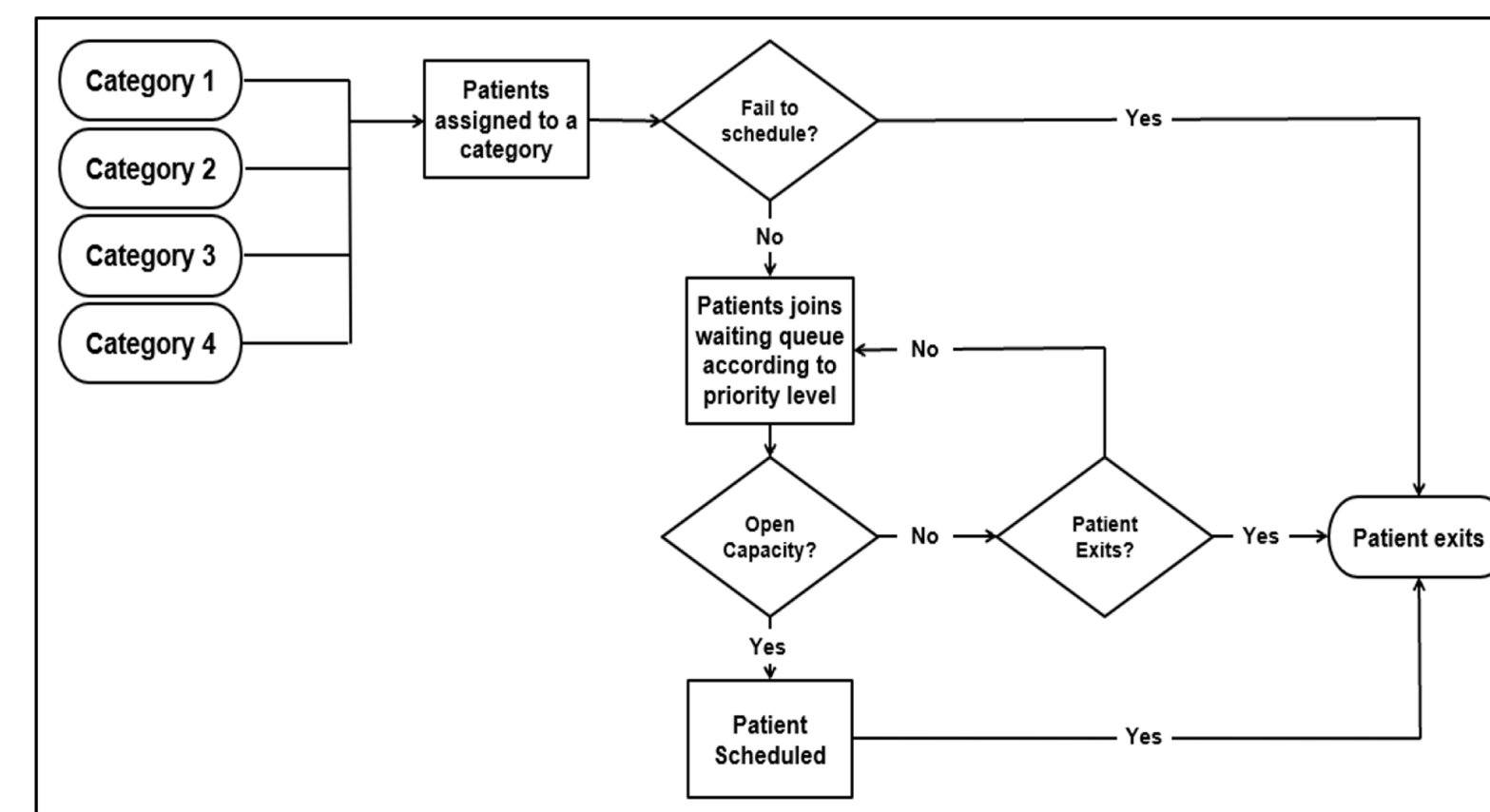


Figure 1: General flow of patients through the simulated scheduling system.

Open capacity is given to patients with the highest priority and longest wait time. Deferred Category 4 patients may re-enter as Category 1 within the Substitute strategy if they test positive. Patients exit after they are scheduled.

Results: Overall Impact

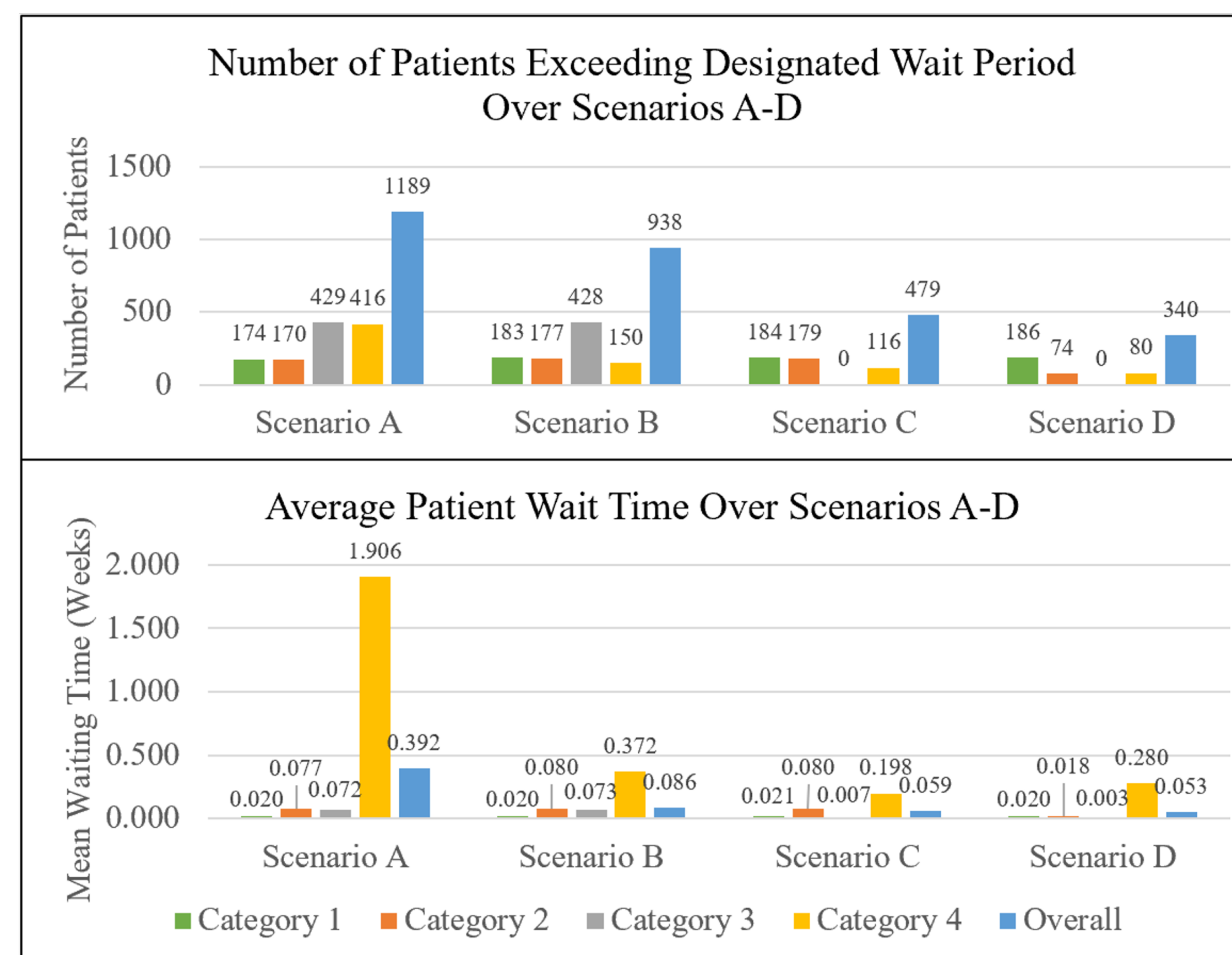


Figure 2: Number of patients waiting longer than the designated wait period (top) and average patient wait times (bottom) over Scenarios A-D.

Key Points:

- Fewer overall patients reach their designated wait time as more triage strategies are implemented
- Under Scenario C, this number is almost halved, primarily due to Category 3 patients deferred for appx. two-thirds of the simulated time
- Average waiting time, especially for Category 4 patients, reduces in scenarios beyond Scenario A
- Note that this figure indicates average waiting time among patients assigned a colonoscopy (not including those who exit)

Results: Weekly Basis

Our simulation also tracks metrics on a weekly basis, allowing us to visualize trends over the full simulation period for each scenario. We see that in both Scenarios A and B, wait times begin to stabilize ~36 weeks in. However, in Scenario B, average wait time declines faster because half of Category 4 patients are deferred.

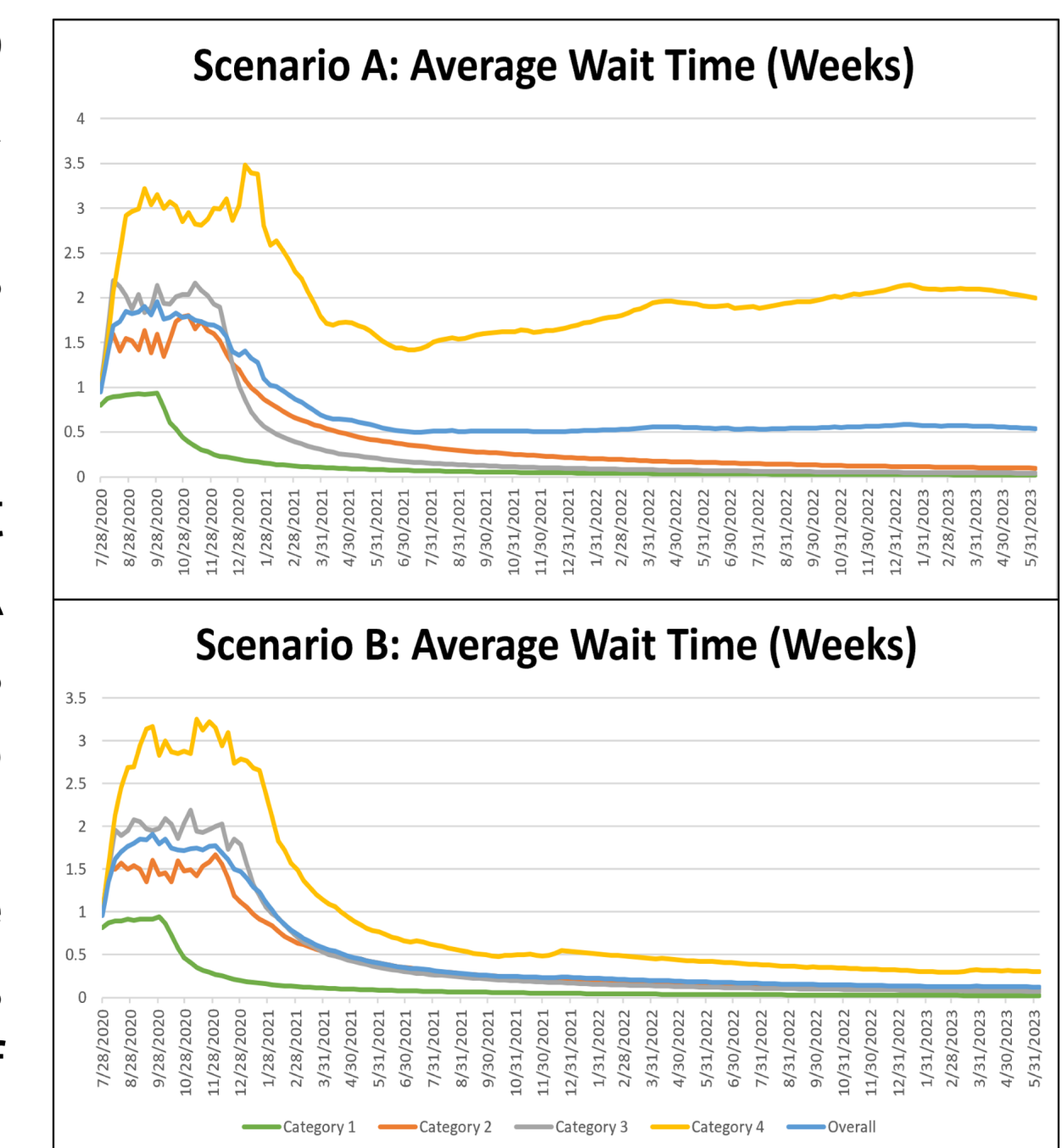


Figure 3: Trends in average wait time over the simulation period for Scenario A (top) and Scenario B (bottom).

Conclusions

We developed a clinical decision-making simulation tool for healthcare facilities to safely defer non-emergency appointments during pandemic-induced capacity reduction. We see that implementing more triage strategies both **allows more patients to be seen** and **reduces average waiting time**. In the future, we look to dynamize capacity stages and incorporate overstaffing policies. We are currently expanding to other VA clinics.

Acknowledgements



References

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- Joshi, A. U., and R.E. Lewiss. 2020. "Can Telehealth Save the American Healthcare System from an In-Person Patient Care Collapse?" European Journal of Emergency Medicine 27(4):249-250.