Priority and Predictability: The role of predictability and own patient prioritization in surgeon decision-making

In hospitals, there is high variability in demand and treatment times (Eddy 1984, Green and Nguyen 2001), which can result in very high workloads and potential delays. During these periods of high workload, two operational levers for clinicians to manage the excess demand are early patient discharges and canceling elective surgeries. Understanding clinicians’ behavioral responses under load is necessary for designing an efficient system. In this study, we explore the behavior of surgeons in an inpatient hospital setting to disentangle and quantify how unpredictability and own patient prioritization moderate the response to high load by studying early patient discharges and postponed elective surgeries.

We study surgical patients admitted to the hospital as these patients can either by emergent (unscheduled) or scheduled. By definition, emergency admissions require care as soon as possible, and thus have greater clinical priority than scheduled admissions. There is an assumption that if there are patients competing for resources, the emergency patient will have priority, and if necessary, scheduled patients will be postponed. However, in practice, there is evidence this may not occur (Jonnalagadda et al. 2005). We hypothesize that both predictability and own patient prioritization may be contributing to these decisions.

We use two empirical methods—a laboratory experiment and retrospective patient-level analysis—to explore how surgeons react to emergency and scheduled surgical patients competing for resources to answer these questions. We first conduct a set of laboratory experiments based on a two-by-two design (predictability x own patient prioritization) with 217 Mechanical Turk (MTurk) participants acting as surgeons¹ to identify the conditions under which surgeons are more likely to (appropriately) prioritize emergency patients. The experiments present participants with a scenario where there are more incoming

¹ We will be repeating the experiment with surgeons as we have recently received approval from the American College of Surgeons to reach out to all 80,000 members.
surgical patients (both scheduled and emergent) arriving at the hospital tomorrow than beds available. The participants must decide how they will handle this excess demand through a combination of early discharge and postponement of scheduled surgeries. These experiments are designed to test the relevance of our two behavioral operational concepts to explain their choices by altering the predictability of the number of incoming patients and if it is a surgeon’s own patient who is emergent.

In all experiments, the optimal course of action is to reduce demand by two patients via early discharge and postponing scheduled surgery, with our outcome measure being the total number of discharged and postponed (DC/Post) patients. Our experiments show that under no circumstances, even when demand is known, do all participants DC/Post two patients (the highest probability is 78%). These results suggest that even under the best circumstances, there is a belief that either demand will not materialize, or if it does, some other solution will be found by others (e.g., delaying emergency surgeries). Comparing experimental scenarios using a generalized ordered logit model (Williams 2006), we find that when demand is uncertain, there is a reduction in the number of DC/Post patients (OR: 0.39, p<0.05). Own patient prioritization, does not statistically change the number of DC/Post patients when demand is predictable, however, it does counteract the effects of unpredictability, increasing the odds that two patients will be DC/Post compared to when there is unpredictability and no prioritization, bringing it back to the probabilities associated with predictability and no prioritization.

We follow up our experiments by analyzing data from 34 similarly sized hospitals (between 200 and 250 medical-surgical beds and between 80 and 140 surgical beds) in California for the years 2008-2009. We have patient-level data, by day, which we aggregate so that our unit of analysis is hospital-day. We utilize the fact that hospitals have differences in their coefficients of variation (COV) in demand for surgical patients as a measure of predictability. We restrict our sample to days when there are 10 or fewer available surgical beds at the start of the day (approx. 90% occupancy) to account for high workload. We
find that as unpredictability (i.e., the COV) increases, there are fewer early discharges and/or postponed surgeries: a 10% increase in the COV results in 5.7 fewer DC/Post (p<0.01). As discussed in the experiment, the number of DC/Post patients is not enough to compensate for very high demand which we show by analyzing the effects of unpredictability on the probability that an emergency surgery will be delayed to the next day. As the COV increases by 10%, the proportion of emergency surgeries delayed to the next day increases by 30.6% (p<0.01). There is no corresponding increase in a single day delay for scheduled patients, suggesting that when demand is less predictable, physicians have a hard time making choices that prioritize the most critically ill patients.

This work contributes to the operations management literature in empirically quantifying the effects of prioritization and predictability among incoming patients. We find that predictability is more beneficial in inducing appropriate behavior in the face of high workloads, though prioritization can mediate the effects of unpredictability. We also show that there exists a tension between the priority and predictability of these different incoming patient types: while emergent patients are the most in need of a fast start to treatment, we provide empirical evidence that under periods of high load emergency patients are likely to be delayed. We show that current assumptions about clinical prioritization do not hold up in practice, suggesting the need for improved operational models and managerial insight into how to induce more appropriate behavior by physicians.

Works Cited


