

## Structural Estimation of Intertemporal Externalities on ICU Admission Decisions

**Abstract:** Service systems' behavior can be affected by multiple factors. In the case of intensive care units (ICUs), which admit patients from four primary loci (the emergency department (ED), scheduled patients, planned transfers from other ICUs, and unplanned transfers), it is known that admission rates of some patients decrease as occupancy increases. It is also known that, for at least some conditions, ICU admission is not just a function of patients' illness, and that a significant proportion of the variation in ICU admission rates is due to hospital, not patient, factors. In this paper, we employ two years of data from patients admitted to 21 Kaiser Permanente Northern California ICUs from the ED. We quantify the variation in ICU admission from the ED under varying degrees of ICU and ED occupancy. We find that substantial heterogeneity in admission rates is present, and that it cannot be explained either by patient factors or occupancy levels alone. We use a structural model to understand the extent that intertemporal externalities could account for some of this variation. Using counterfactual simulations, we find that, if hospitals had more information regarding their behaviors, and if it were possible to alter hospital admission processes to incorporate such information, hospitals could achieve greater efficiency safely.