# Optimizing the ICU during epidemics: developing frameworks supporting healthcare systems during public health emergencies

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**Abstract**

Public health emergencies like the COVID-19 pandemic motivate the development of tools supporting the healthcare system. Mathematical modeling plays a role in creating these frameworks aiding the healthcare system at multiple levels. In this work, we explore how different models can optimize workflow and resources through the intensive care unit in the face of an epidemic.

Decision support tools can provide clinicians with augmented views of their patients, allowing them to deliver precise medical care even during an emergency. At the clinician level, we leverage machine learning to create decision support tools in aiding patient classification. Using patient-level data, we explore the predictability and interpretability of various machine learning models in their ability to classify COVID-19 severity types. These models provide useful predictions and insight on severely ill patients with COVID-19.

Public health emergencies place high levels of burden on the healthcare system, especially the intensive care unit. Aiming to support the systemic level, we develop an advanced framework simulating the intensive care unit under epidemic conditions. Investigating the tradeoff between ICU capacity and clinician staffing levels when constrained by an operating budget, we demonstrate a robust modeling foundation for optimizing critical care resources. This flexible framework provides the space for rich analysis of a diverse set of healthcare systems under various scenarios.

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