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ABSTRACT

Health care systems are at the front line to fight the COVID-19 pandemic. Emergent questions for each hospital are how many general ward and intensive care unit beds are needed, and additionally, how to optimally allocate these resources during demand surge to effectively save lives. However, hospital pandemic preparedness has been hampered by a lack of sufficiently specific planning guidelines. In this paper, we developed a hybrid computer simulation approach, with a system dynamic model to predict COVID-19 cases and a discrete-event simulation to evaluate hospital bed utilization and subsequently determine bed allocations. Two control policies, the type-dependent admission control policy and the early stepdown policy, based on patient risk pro filing, were proposed to lower the overall death rate of the patient population in need of intensive care. The model was validated using historical patient census data from the University of Florida Health Jacksonville, Jacksonville, FL. The allocation of hospital beds to low-risk and high-risk arrival patients to achieve the goal of reducing the death rate, while helping a maximum number of patients to recover was discussed. This decision support tool is tailored to a given hospital setting of interest and is generalizable to other hospitals to tackle the pandemic planning challenge.

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