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A Multi-objective Simulation based Optimization Model for Outpatient Care Delivery

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Abstract

Outpatient care delivery is one of the key revenue sources of a hospital which plays a salient role in timely care delivery. The key purpose of the study is to propose a multi-objective simulation-based decision support model that considers the cost of care delivery and patient dissatisfaction as its two key conflicting objectives. Patient dissatisfaction considers service fairness. Patient idiosyncrasies such as no-show, unpunctuality and balking have been considered in the model involving multiple classes of patients. Model has been designed using data collected from field investigations. In the first stage, queuing theory based discrete event simulation model has been developed. Genetic algorithm has been used to solve the scalarized problem and obtain actionable insights. In the second stage, non-dominated sorting genetic algorithm II (NSGA-II) has been involved to achieve the Pareto-optimal fronts considering equal priority of the two objectives. The computational results considering various parameter settings can help in efficient resource planning while ensuring better care delivery. Our model provides structural insights on the business strategy of healthcare service providers on optimizing the dual goals of care delivery cost and service fairness. The study is one of the early works that helps to improve the care delivery process by taking into consideration the environmental factors as well as service fairness. The study demonstrates the usage of simulation-based multi-objective optimization to provide a more sustainable patient centric care delivery.

Keywords
genetic algorithm, Optimization Model, Outpatient Care