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A Novel Approach to determine a Tactical and Operational Decision for Dynamic Appointment Scheduling at Nuclear Medical Center

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Abstract

In this research, appointment scheduling is addressed in a nuclear medical center. A finite-horizon Markov Decision Process as dynamic programming is applied to formulate the problem by considering the patients' choice behavior, and different no-show rate for patients. The proposed model determines a tactical and operational decision for patient appointments. Based on the tactical decision; How many patients request for hospitalization as they call in and to what slot should they be assigned? According to the operational decision, should a walk-in patient hospitalization request be accepted? Also, this decision determines which patients must receive the services for each slot. One of the distinguishing contributions of this research is that two algorithms and one mathematical programming are developed hierarchically to solve exactly and deal with an intractable dimension of the Markov Decision Process model. Simulation tools are applied to compare the performance of optimal policies with First-Come-First-Serve policy based on a real case. The results show that the proposed model presents a more effective and efficient scheduling compared with current policies for scheduling. More revenue, lower patients waiting during the working day, and lower postponed patients are the results of the proposed model rather than the current policies for scheduling. Then, the impact of revenues, waiting costs, penalty costs, and center's capacity on the results has been investigated. By increasing revenue and capacity and decreasing waiting costs and penalty costs, the total net revenue is increased.

Keywords Markov decision process, Nuclear medicine, Multi priority patients, No-shows, Simulation

1. Introduction

Fast and timely diagnoses and treating diseases to prevent further consequences of the diseases play the most significant functions in diagnostic centers. Hence, Diagnostic