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EDITORIAL

# Analytics and Optimization in Healthcare Management

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This special issue of the Flexible Services and Manufacturing Journal aims to show advanced solutions to problems arising in the management of different health care facilities, which exploit quantitative analytics and optimization approaches.

The papers of the issue are mostly an outcome of the 4th International Conference on Health Care System Engineering (HCSE 2019), which was held in Montréal, Canada, from May 30th to June 1st, 2019. It was the first edition of the HCSE conferences in North America, after the conference was hosted in Italy and France. It provided an opportunity to discuss operations management problems in health care delivery systems. Researchers and health care professionals shared new ideas, methods and technologies to improve the operations of health care organizations. Following the tradition of HCSE conferences, the event took place inside a hospital, to facilitate discussion between researchers and hospital staff, and immediately discuss the practical impact of the research works presented. In particular, HCSE 2019

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was held at the CHU Sainte-Justine University Maternal and Child Hospital, Montréal, Canada, and each session was co-chaired by a discussant from this hospital.

There were about 30 submissions for this special issue, a subset of this was discussed in a reduced and earlier version at the HCSE 2019. After a thorough peer review according to the standards of the Flexible Services and Manufacturing Journal, the nine papers reported below were accepted for publication.

## 1 Papers in the special issue

Oliveira et al. (2022) developed an optimization-simulation framework that generates dynamic master surgery schedules for a long planning horizon, in which the schedules are optimized by an integer programming model and the demand levels are given by the simulation model. The obtained results were proven robust and compared to static and flexible long-term approaches.

Zhao et al. (2022) proposed an appointment scheduling of reusable health care resources to sequentially arriving users, in which each user communicates in advance the intended usage duration of each resource before a decision needs to be made. They proposed an algorithm based on linear approximations of the optimal value functions for the setting where users arrive randomly, and showed that it outperforms other common methods when applied to simulated and real data.

Li et al. (2022) focused on scheduling physicians in an outpatient system with non-homogeneous patient arrivals and priority queues. They formulated a staffing optimization model and a physician rescheduling model for the case when a physician is unexpectedly absent. Results on data from a hospital in Shanghai showed effectiveness and efficiency when applied in practice.

Cappanera et al. (2022) proposed a two-phase approach for workload balancing in physician rostering problems in emergency departments. They tested the proposed optimization models on real data coming from a leading European hospital and on benchmark instances derived from the literature. The obtained results demonstrated that the proposed models make it possible to consider the complexity of these rostering problems and to obtain balanced and equitable work schedules.

Zhou and Guo (2022) developed a dynamic programming system for appointment scheduling of medical resources in the presence of different service times of regular patients and non-preemptive priority of emergency patients. Simulation results show that the system provides an improvement in terms of total reward of the service system.

De Santis et al. (2022) solved a non-linear integer optimization problem that determines the best piecewise constant approximation of the time-varying rates in a non-homogeneous Poisson process for the arrivals to an emergency department. It is indeed the first requirement of all tools dealing with the management of patient flows within the emergency department, which is required to ensure the reliability of the results when the tool is applied in practice.

Breuer et al. (2022) studied timely access to specialist health services in rural areas. They developed deterministic, robust and chance-constrained optimization models to improve access and care continuity by minimizing patient travel times,

appointment delays, out-of-network referrals, and costs. They applied these models to a large health system for cardiovascular services in Maine, United States, identifying the most critical resources and the factors to increase patients' access.

Hwang et al. (2022) developed a location-allocation model for healthcare facilities in medically underserved areas. They demonstrated the utility of the proposed model by using data from the Korean support program for perinatal care in medically underserved areas.

Chan et al. (2022) developed two machine learning-based approaches to build sparse flexible designs that leverage a neural network to predict the performance of several candidate designs. They showed that their heuristics produce high-quality solutions for both balanced and unbalanced networks, and applied them to study the flexibility of linear accelerators that deliver radiation to treat various types of cancer.

## 2 Concluding remarks

We thank all participants of HCSE 2019 and those who submitted a paper to this special issue. We congratulate the authors of the selected papers for their excellent research and, finally, we thank all reviewers for their helpful comments and timely refereeing.

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