

Day surgery scheduling and optimization in large public hospitals in China: a three-station job shop scheduling problem

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Research article

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Abstract

Background

Efficiency and flexibility constitute the prime performance index that is used to evaluate the Day Surgery Center (DSC). Based on the day surgery service process for large public hospitals in China, we found that the service efficiency of the overall process depends on the utilization of day operating rooms (ORs and could be optimized through key resource management and scheduling. Day surgery scheduling can be described as being a flexible flow shop owing to the three-station nature of surgery. Allocating all types of hospital resources to the three stations and determining the length of time for each stage during surgeries is crucial to improve the efficiency of a hospital's DSC.

Methods

This paper integrates a three-station job shop scheduling problem (JSSP) into the day surgery scheduling and optimization problem. The JSSP was formulated as a mixed-integer linear programming model, and the elicitation of the model for scheduling surgeries with different priorities in the DSC is discussed. The model illustrated a detailed example of the DSC within West China Hospital. Numerical experiments based on the genetic algorithm design were conducted.

Results

We found that the optimal scheduling strategy could not only minimize the makespan of the whole day surgery process, which would improve the efficiency of the DSC in large public hospitals in China, but also allow for timely scheduling adjustments during the advent of emergency surgeries, which is essential for the efficient management of day surgery rooms in large public hospitals in China.

Conclusions

By further refining the day surgery procedure, the JSSP model dispatches the resources involved in the various processes of the surgery. The switching time is reduced owing to the subdivision of the surgery process, resulting in an increase in OR utilization, promoting the standardization of the surgery process. We found that the JSSP model is more suitable for the efficient management of day surgery rooms of large public hospitals in China. Although this study considered a variety of resource constraints based on the day surgery service process implemented in China, there are still some shortcomings which needs further research.

Full Text

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Figures

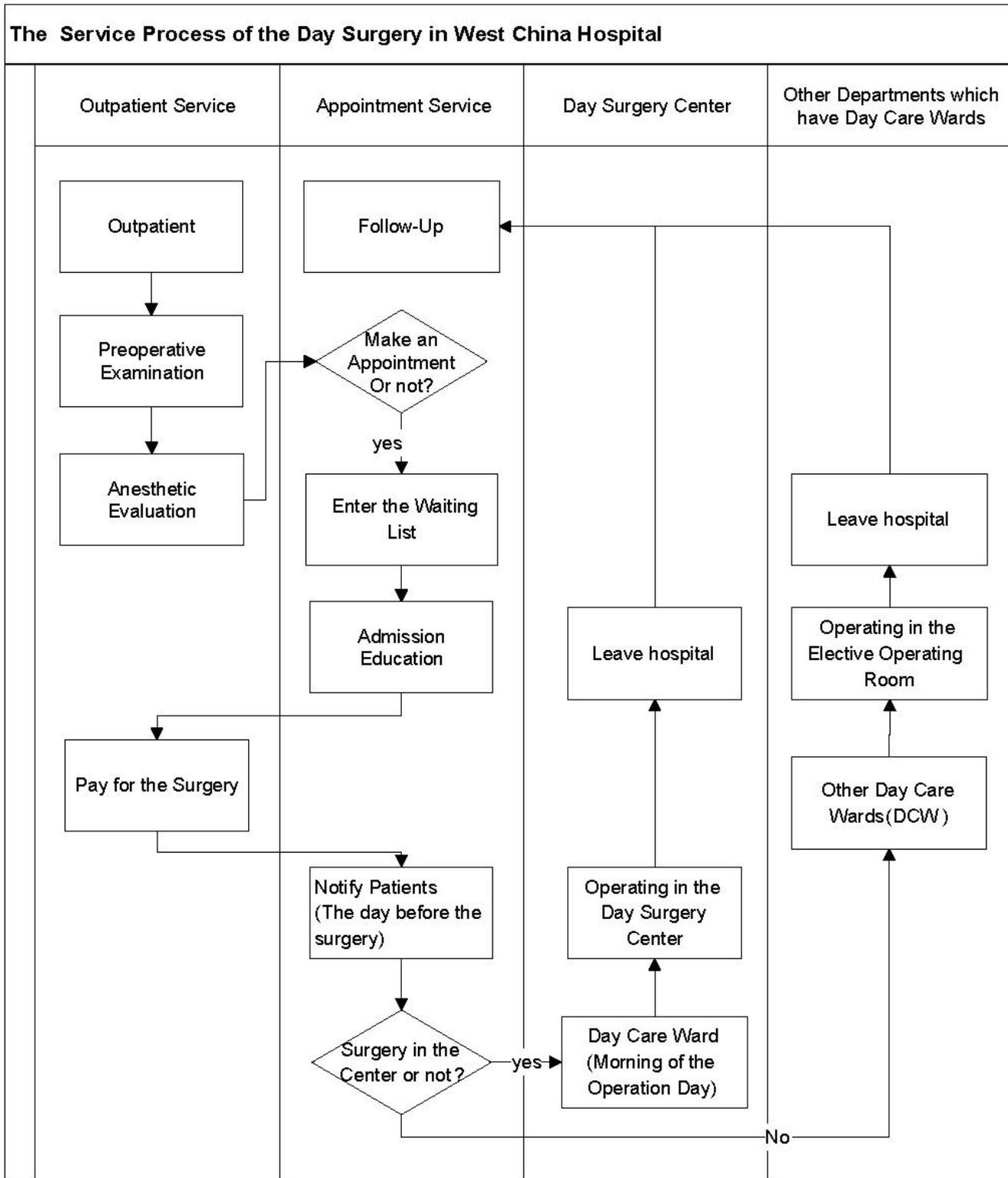


Figure 1

The Day Surgery Service Process of West China Hospital

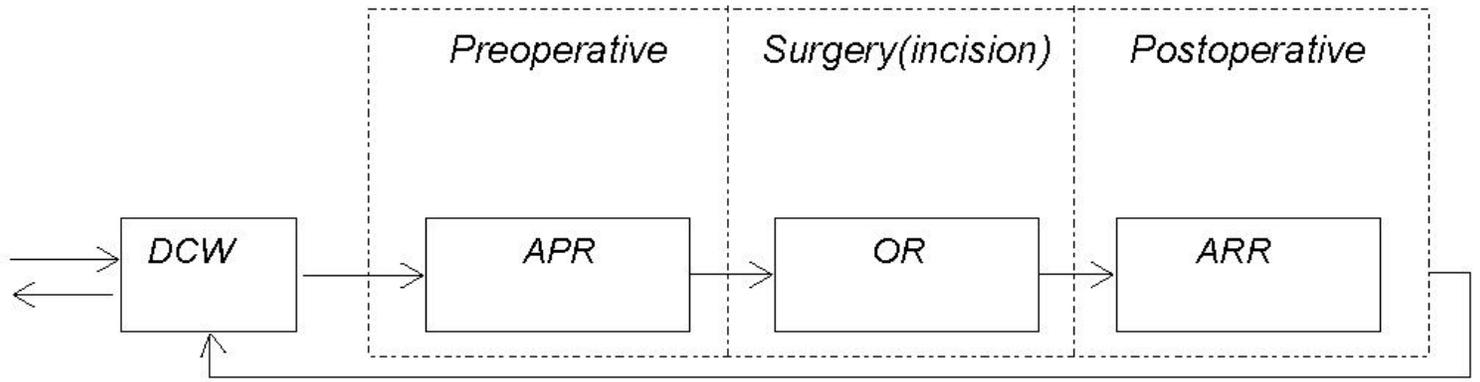


Figure 2

Three-Station of the Day Surgery Center

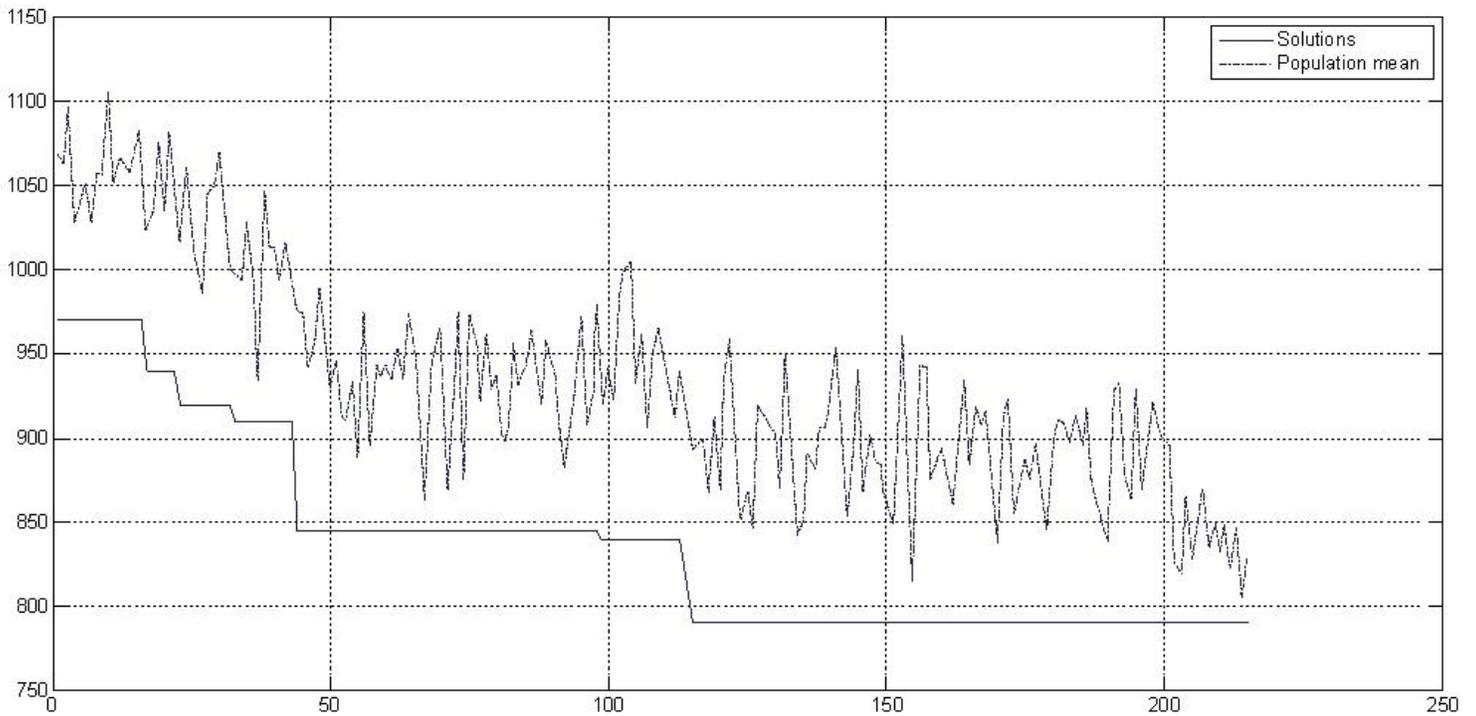


Figure 3

Population Evolution of the Scheduling Strategy of Day Surgery

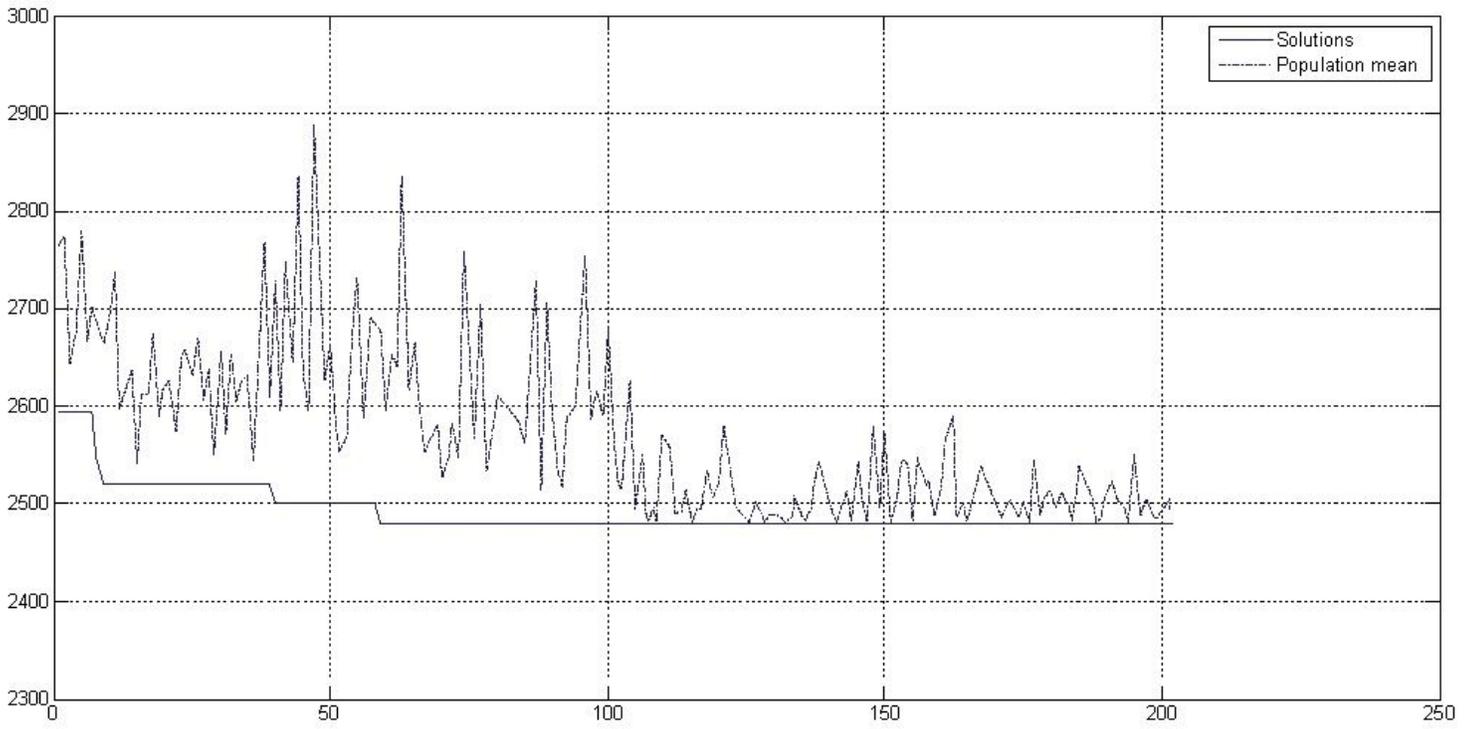


Figure 4

Population Evolution Considering Emergency Surgeries