MASTER'S THESIS

Patient journey shortening using a multi-agent approach

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Patient Journey Shortening using a Multi-agent Approach

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Abstract

Shortening the treatment journey for patients suffering from diseases like cancer is challenging for healthcare providers. The underlying difficulty lies in the fact that each treatment journey involves different healthcare units possibly in different hospitals and the shortening is hard to be achieved without careful coordination among them.

In this thesis, we first investigate how patient scheduling can be improved to better utilize existing healthcare resources for patient journey shortening. As healthcare resources are geographically distributed and the patient demand is dynamic over a year, many existing centralized scheduling methods become inapplicable. With the assumption that healthcare resources can be mobilized between different healthcare units, a multi-agent based bidding approach is proposed for addressing the patient journey shortening problem. In particular, the approach allows patients to swap their timeslots with others via a bidding protocol. With reference to a dataset containing 9340 cancer patient journeys (which is provided by the Hospital Authority in Hong Kong), simulation models were designed for carrying out related what-if analysis. According to the simulation results, the proposed multi-agent scheduling framework can shorten patient journey as far as resource mobilization is allowed.

Another obvious alternative to shorten patient journey is to inject additional resources. The challenge is how to best allocate the resources for more effective patient journey shortening. In the second part of the thesis, we propose a 3-level bidding mechanism for dynamically allocating the resources. In particular, we designed several variants of the bid formulation so as to reflect the demand on additional resources, and proposed different strategies for distributing the resources over a year. In addi-

tion, we modified the dynamic allocation scheme to a progressive one for estimating the optimal solution if the resources can only be allocated at the beginning of the budget period instead of being dynamically allocated over the year. The effectiveness of the proposed framework has been demonstrated based on the simulation model derived from the dataset provided by the Hospital Authority in Hong Kong.

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