DTU Management Engineering
Department of Management Engineering

Optimization of Services and Resources in Health Care

Anders Reenberg Andersen, PhD project

Relevance – challenges, problem or opportunity?

With a view to continually improve the treatment quality for the patients, control of hospital processes are enhanced through new and more ambitious service levels. Together with an ever increasing average life expectancy, population size and focus on cutting budgets, it has never been more important for the Danish public health care sector to be able to efficiently utilise its resources.

Research question?

- Describing the patient flow and staff systems, what are the adequate mathematical models?
- What is the potential for increasing performance through better planning with an upper bound on resources?
- To what extent is it possible to implement the obtained results in the dynamic and stochastic environment of a hospital?

Conceptual model/theory

Patient arrivals and treatment times are only a few examples of the highly stochastic processes that constitute a hospital environment. Due to high variance in both demand and service processes, patient throughput is often a non-linear function of the allocated resources. For this reason, linear scheduling approaches, such as mixed integer programming, is not a sufficient approach alone. This project is focused on deriving models for optimal resource allocation of non-linear stochastic systems.

Method

Many hospital processes are often stochastic and interdependent, and are thus in many situations interpretable as interacting processes of a queueing network. In simple cases, the system might be modelled as a Jackson network. In more complex cases, an adequate model might be derived by modelling system state changes as a Markov chain. The task at hand, is to optimise these non-linear models through an iterative interaction with mixed integer programming or other heuristic approaches.

Expected results

It is expected to prove *where* and *how* hospital resources are efficiently utilised with a view to increase performance. Besides fixed solutions, the obtained models and results should be applicable as either operational, tactical or strategic decision support tools for the hospital management.

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