Ph.D. position at the Ecole des Mines de Saint-Etienne (France)

Demand modeling and operation management of complex cares

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Duration: Three years to start in September/October 2013.

Thesis: Complex cares such as oncology cares are subject to various care protocols and cover a long period of time. Rich information about health condition of patients is gathered along the health care process by blood tests before each chemotherapy session. Care protocols should be adapted according to the health condition of patients. Integrate explicitly data concerning patient health condition and care protocols in modeling and optimization of demand for complex cares is crucial for patient-centered health care. The goal of this research is to develop quantitative methods for demand forecasting and operation management of complex cares.

This research relies on our on-going work on optimization of oncology cares within the framework of the PhD thesis of Abdellah Saki [1, 2]. This on-going research focuses on planning and scheduling of chemotherapy treatments at an outpatient unit. It is observed that huge amount of medical data on patient’s health conditions are available and used empirically by oncologists for medical decisions such as change of care protocols. There are scarcely any research initiatives for exploiting these data for forecasting complex cares. However, recent research on medical decisions and disease screening policies [3-7] show that it is possible to forecast the evolution of patient's health condition and use it for better decision making.

This thesis will address two related issues. It will first address the forecasting of demand for complex cares at mid-term (over years) and at short-term (over weeks or months). It aims at developing quantitative models such as Markov chains for modeling the dynamic evolution of patient's health condition. It will be based on medical data on patient health condition and results of epidemiological research.

Starting from the model of patient health condition, the second goal of this thesis is the development of optimal strategies for planning of health care resources in order to meet the changing demand for complex cares. Both strategy and operational decisions will be addressed. Mid-term demand forecast over years will be used for planning human resource capacity. Short-term forecast on evolution of patient's health condition will be used in operational decisions such as appointment scheduling and working time scheduling of physicians. The main difficulty of this second part is the need to take into account uncertainties related to patient flow, the evolution of patient's health condition and the integration of medical data of patients. Monte Carlo optimization and Markov decision process will be exploited to investigate the underlying stochastic models.

Your background: Master of science in operations research or industrial engineering, optimization, combinatorial optimization, stochastic modeling.

How to apply: Email to (xie@emse.fr) the followings: CV, letter of motivation, notes and ranking of the three past years, letters of recommendation.

[6] M.S. Lavieri, M.L. Puterman, S. Tyldesley, W.J. Morris. When to Treat Prostate Cancer Patients Based on their PSA Dynamics, manuscript under revision