

# Recovery Beds and Blocking in Stochastic Operating Theatres<sup>\*</sup>

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## Abstract

In health care systems, the operating theatre plays an important part in the creation of care, notably in terms of generated income and cost. Its management, and in particular its scheduling, is thus a critical activity, and has been the subject of many studies. However, the stochasticity of the operating theatre environment is rarely considered while it has considerable impact on the actual working of a surgical unit. In this paper, we propose a complete analytical modelling of the operating theatre, aiming at giving insights on how to consider its stochastic reality, and based on the Markov theory. We consider various sources of randomness: stochastic operating times, unpredictable emergencies arrivals, and blocking due to recovery beds. From our model, various performance measures can be computed: the emergency disruption rate, the waiting time for an emergency, the probability of blocking, etc.

*Key words:* Health care management, surgical schedule, emergencies, recovery beds, Markov processes.

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## 1 Introduction

In recent years, throughout Europe, the hospital environment has been subject to profound changes. Authorities introduced numerous reforms in order to rationalize health care expenses and to improve the citizens' quality of service. In addition to these structural challenges, health care management is made more and more complex and critical by various factors, such as the continuously growing demand for medical care, the ageing population, and the evolution of the pathologies. This constrains hospitals to manage more efficiently their human and material resources, in order to reduce the costs while preserving the quality of care.

In this context, efficiently managing the operating theatre is a crucial question for hospitals. Indeed, the operating theatre plays a critical part in the hospital. It is an important activity for care creation, and it generates large income. However, it is also well known that the surgical units are one of the most important sources of expenses, with up to 10% of the hospital budget [3]. A more effective management of the operating rooms comes with a more rational use of the surgical resources, and consequently with a refined planning of the surgical units. Planning the operating theatre aims at optimally scheduling the surgical operations that will take place during a period of time, often one or two weeks, on the basis of

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