# Internship: Optimization of Operating Room Scheduling at the Heart-Lung Center (LUMC)

## Introduction

Operating rooms (ORs) are integral to the functioning of any hospital, significantly influencing the overall patient care process. Inefficiencies in OR scheduling can lead to extended waiting times, increased staff workload, disruptions in other departments, and ultimately, heightened operational costs. In addition, the increasing prevalence of staff shortages and absenteeism has led to the frequent closure of ORs, thereby compounding capacity issues.

At the Heart-Lung Center of Leiden University Medical Center (LUMC), surgical scheduling is currently managed manually by the planning office in coordination with multiple surgeons and a physician assistant. This complex and time-consuming process presents substantial opportunities for optimization. The development of a more efficient, data-driven scheduling system could reduce waiting times, improve resource allocation, and alleviate workload pressures. In the context of contemporary healthcare challenges, a flexible, evidence-based approach to surgical planning is essential to ensure the continuity and quality of care.

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## Project Focus

This internship focuses on the mathematical modeling and optimization of surgical planning processes, particularly in environments constrained by capacity volatility (e.g., last-minute OR closures, staff absence).

You will work on developing models that can support dynamic decision-making under constraints such as:

- Urgency and priority levels of patients
- Required resources per procedure
- Staff and room availability
- Predefined oncological and treatment-specific timing windows

The internship allows for a methodological focus, such as:

- Predictive modeling for procedure durations or cancellation likelihood
- Stochastic modeling and optimization using, e.g., (approximate) dynamic programming, stochastic programming or reinforcement learning
- Simulation to evaluate performance of rescheduling strategies

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## Proposed Methodology

The project will proceed in three phases:

1. **Modeling** – Formalization of the problem, including constraints and objectives, based on stakeholder input and clinical criteria.
2. **Solution Approach** – Design and implementation of solution approach.
3. **Validation** – Performance evaluation using historical data and/or scenario-based testing using simulation.

Throughout the internship, you will work closely with both the clinical team and technical supervisors to ensure practical relevance of your models.

These steps will be implemented progressively, with ongoing consultation and feedback from clinicians to ensure that the solutions are both practical and effective in a clinical setting.

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## Candidate Profile

The ideal candidate will possess strong analytical skills, proficiency in data analysis and programming (such as Python or R), and a keen interest in improving healthcare systems through technological innovation. While previous experience with healthcare systems or surgical processes is beneficial, it is not required. A structured approach, curiosity, and a willingness to collaborate with diverse teams are essential qualities.

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## Internship Details

- **Location**: The internship will be conducted partly at the Leiden University Medical Center (LUMC), with the possibility of working remotely or spending some time in Enschede, depending on the student's preference. However, some time at LUMC will be required to ensure integration with the clinical team.
- **Duration**: Minimum 3 months (with flexibility in start and end dates)
- **Supervision**: The project will be supervised by an interdisciplinary team consisting of clinical researchers, data scientists, and surgeons, ensuring a well-rounded and supportive learning environment.
- **Opportunities**: Interns will gain hands-on experience in data-driven healthcare optimization and may contribute to ongoing research projects that could have a direct impact on clinical care.

Should you have any questions or wish to apply, please feel free to email me directly at l.n.a.coopmans@lumc.nl .

Supervision from Applied Mathematics will likely be done by Anne Zander (a.b.zander@utwente.nl).