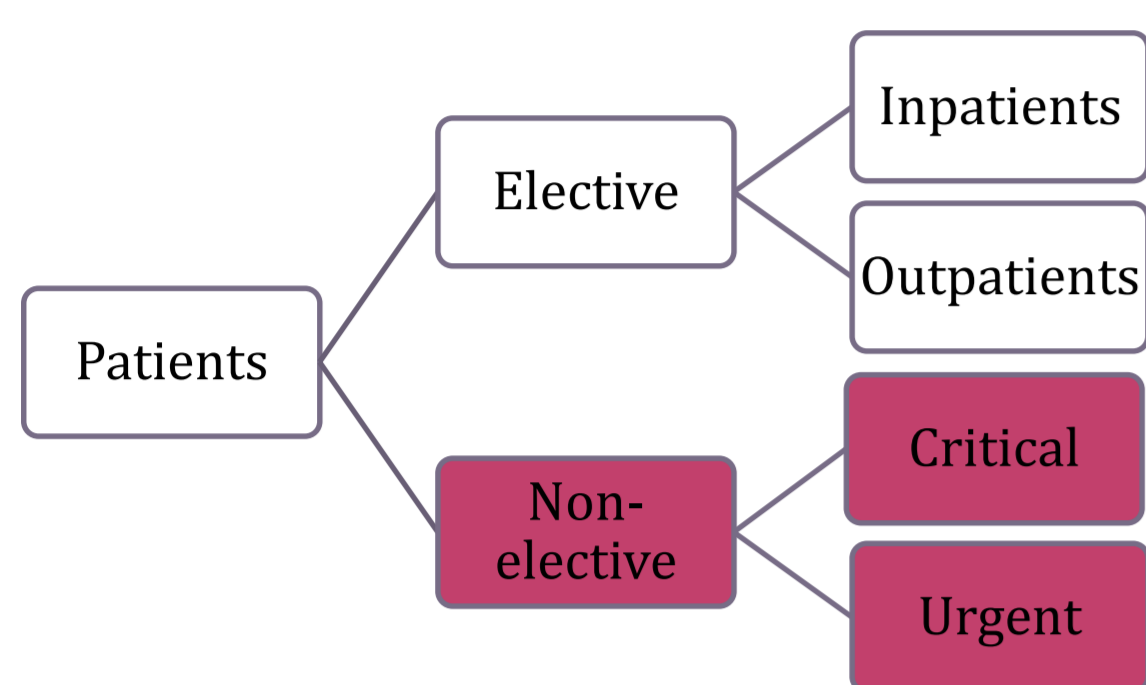


Background



- Surgery rooms are the main cost and profit drivers within a hospital, representing about 40% of the costs and income.
- Two main types of surgery, each with further classes.
- Hospitals may have dedicated or non-dedicated surgery room policies.
- Emergency Surgery Rooms are the most complex to analyze and optimize in an Operating Theater, for two reasons:



Uncertainty of patient arrivals

Variability of patient condition/surgery type

Motivation – What's at stake



- The amount of patients requiring emergency surgery services is increasing worldwide.
 - This trend creates pressure on healthcare systems, hospital managers and physicians in general.
- Restricted budgets + mounting healthcare costs → Need for higher efficiency in the investment of current resources (human, physical, and financial).
- This can lead to a reduced/restricted access to surgery for people who are in urgent need of it.

Context

+ 1600 beds

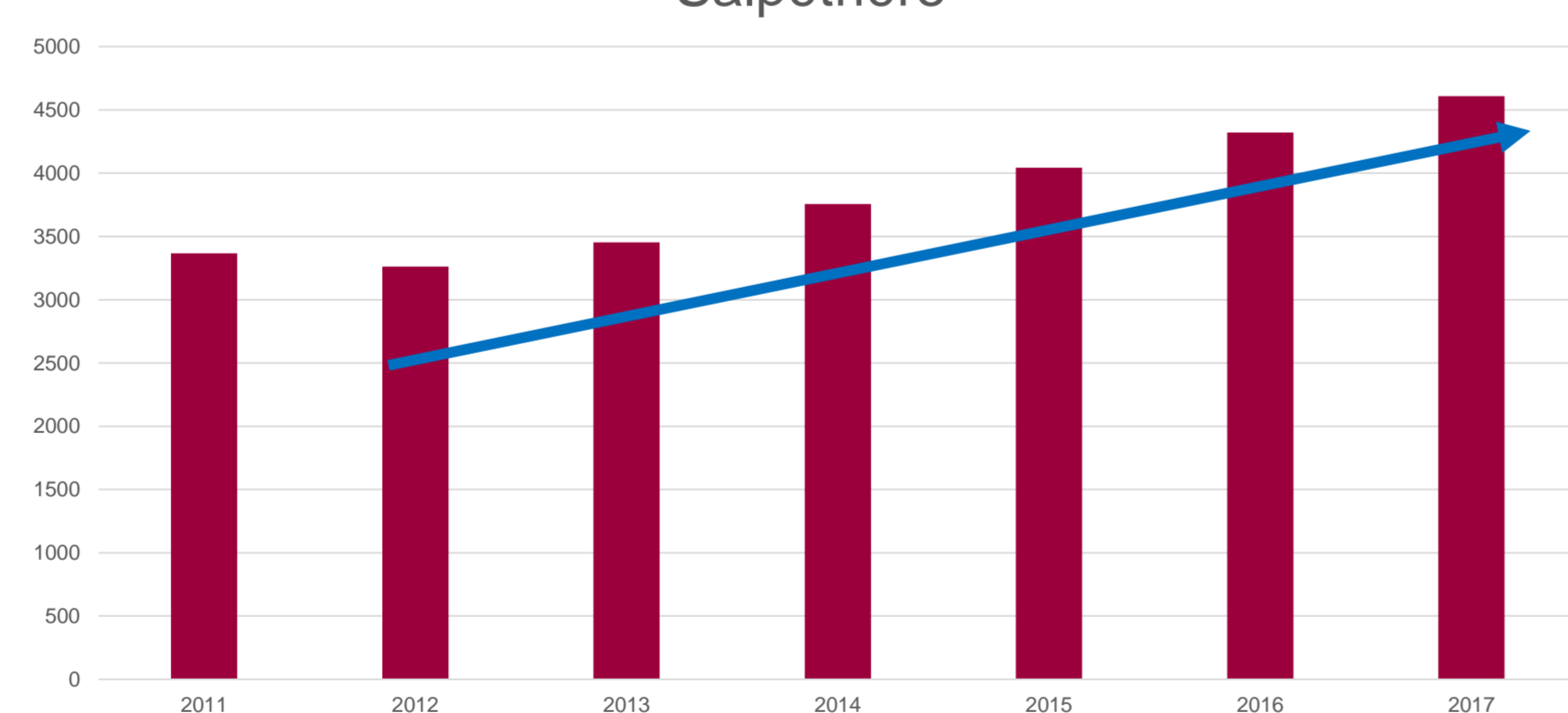
+70,000 Emergency Patients

+4500 emergency surgeries

5 main specialties

2 Polyvalent Emergency Surgery Rooms

Total of Emergency Surgeries per year at Pitié Salpêtrière



Objectives

Two major research focuses:

- ▶ Develop a predictive optimization model for patient arrivals, criticality, and typology
- ▶ Conduct sensitivity and resource synchronization analysis using Discrete Events Simulation.

Current studies

- ◆ Increasing the utilization rate of surgery theaters with scheduled surgeries.
- ◆ Estimating the number of operating rooms needed to manage non-elective cases.

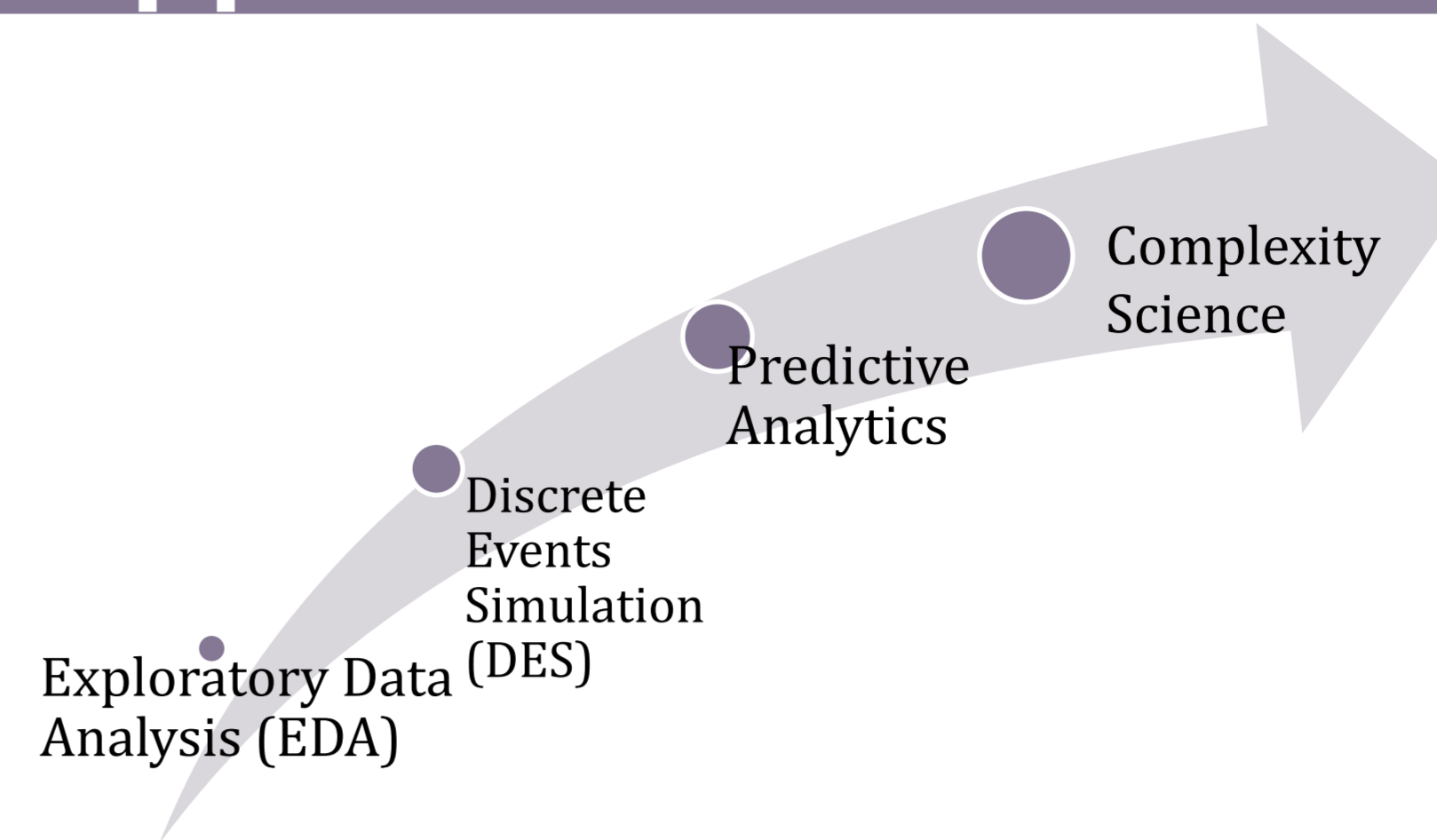
Expected results

- ◆ How can predictive analytics improve the outcome and efficiency of EOR's?
- ◆ How does resource synchronization and conflicting interests affect performance?

Bibliography

- M. Armony et al (2015), "On patient flow in hospitals: A Data-Based queueing-science perspective" in *Stochastic Systems*, Vol 5, No 1, pp. 146-194.
- Antognini et al (2015), "How many operating rooms are needed to manage non-elective surgical cases?" in *BMC Health Services Research* Vol 15, pp 487-496
- B. Denton, J. Viapiano, A.Vogl (2007), "Optimization of surgery sequencing and scheduling decisions under uncertainty" in *Health Care Management Sciences* No. 10, pp 13-24.

Approaches and Methods



Challenges

DATA AVAILABILITY

Healthcare data is usually confidential, so making it available takes a considerable amount of time., and not all the desired data can be made available to us.

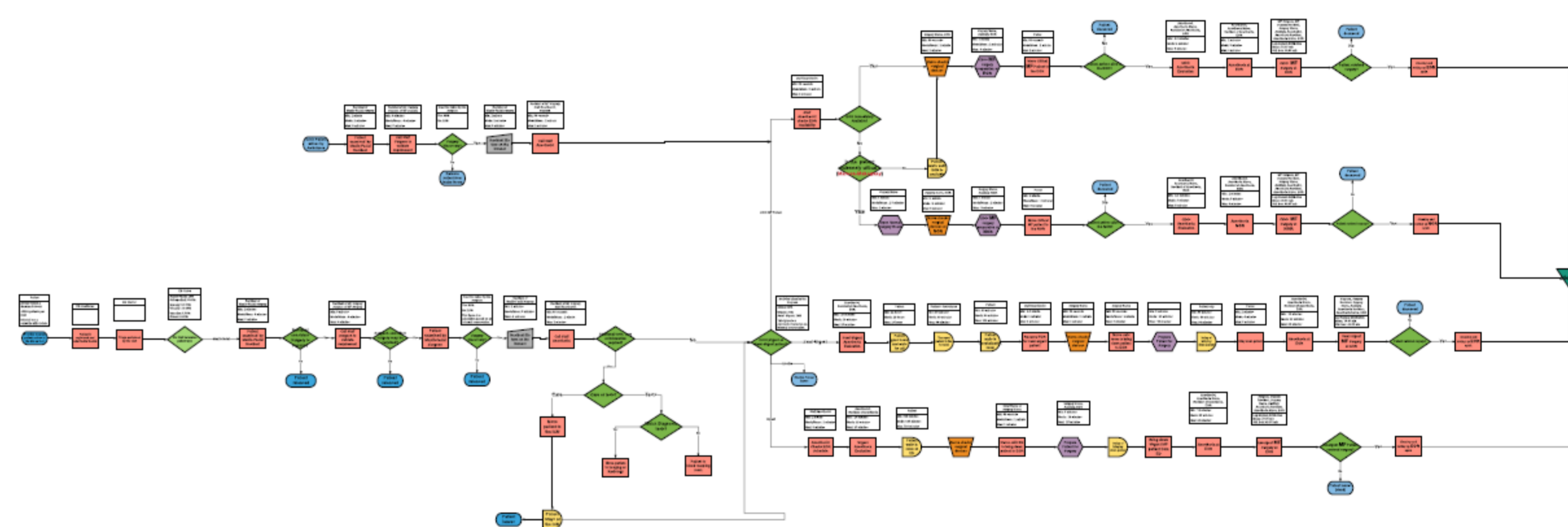
SYSTEM COMPLEXITY

This is an extremely complex system with several stakeholders, hundreds of outcomes, and hundreds of thousands of entities.

CONFLICTING INTERESTS

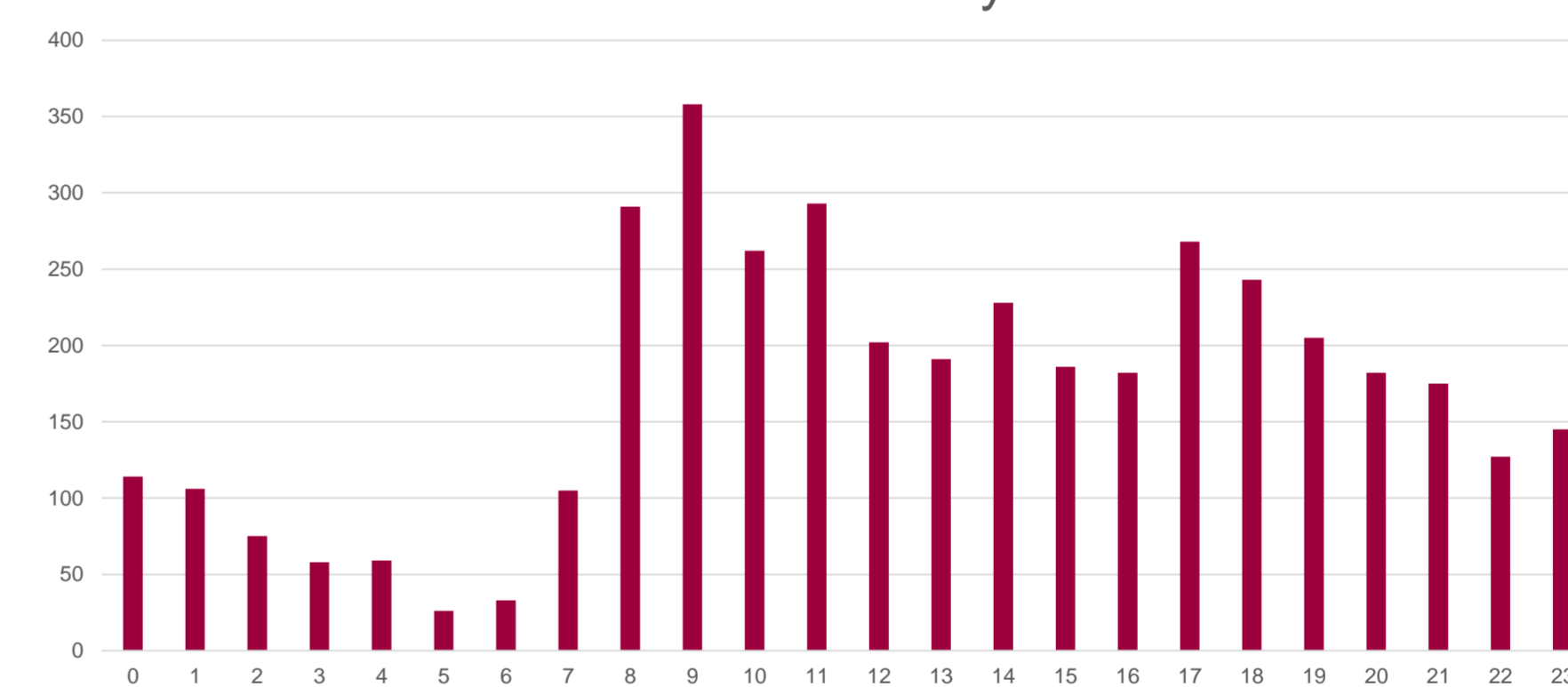
There are many different interests in a surgery theater: the surgeon, the anesthesiologist, the nurses, the hospital, and the patient may have different priorities and satisfying all of them can prove quite complicated.

System description and analysis



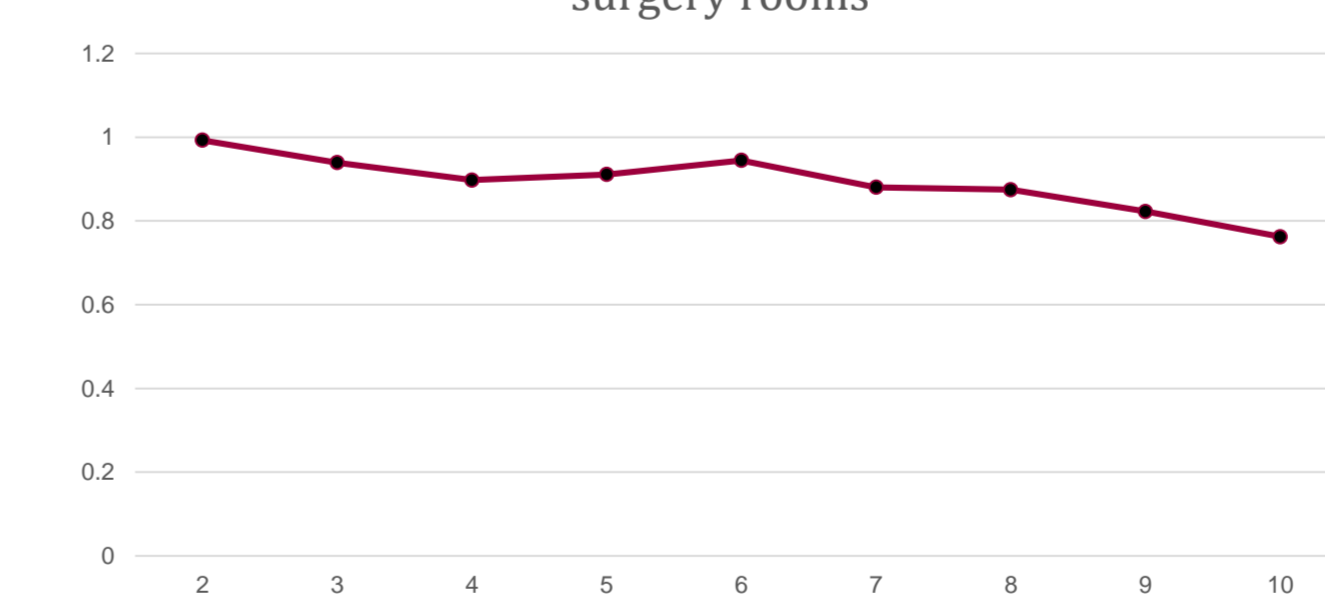
The flowchart of one of the five specialties shows the different paths that a patient can take within the system, the possible exit points (in blue), and the inherent complexity of the system.

Hour of the day in which a surgery patient is scheduled in the system



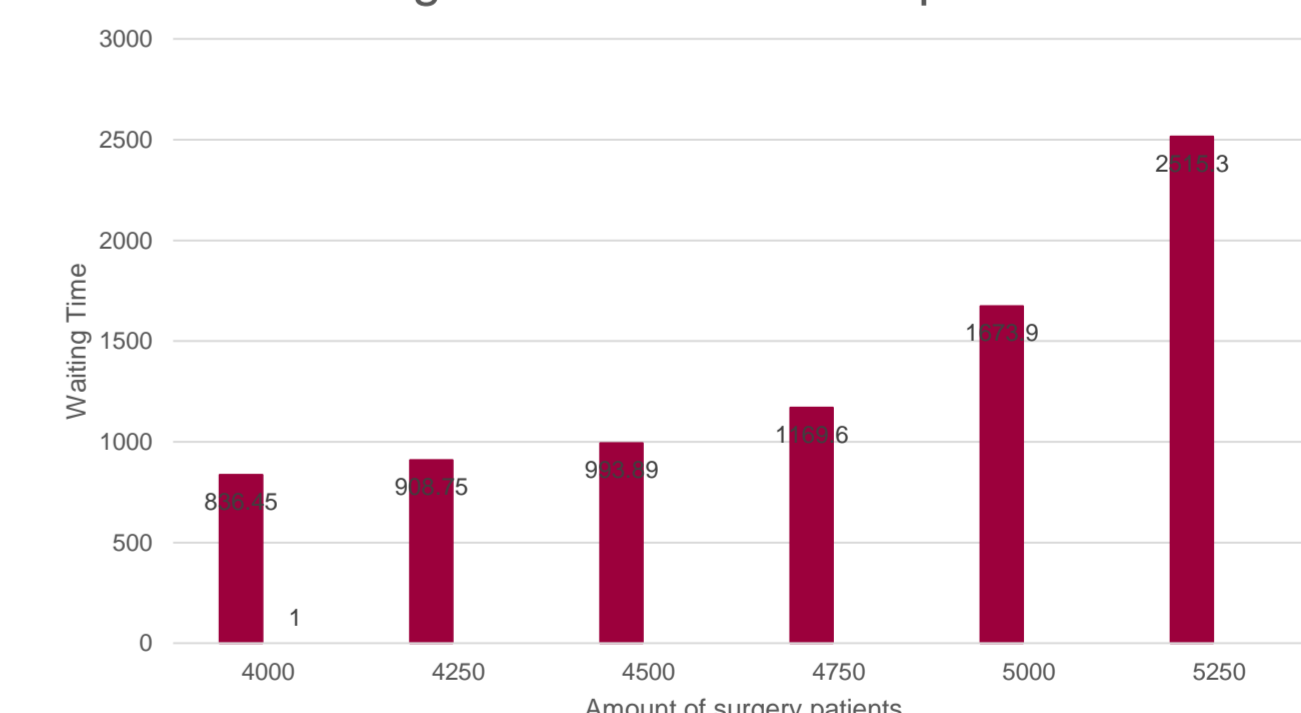
Preliminary Results

Surgery room utilization rate vs amount of surgery rooms



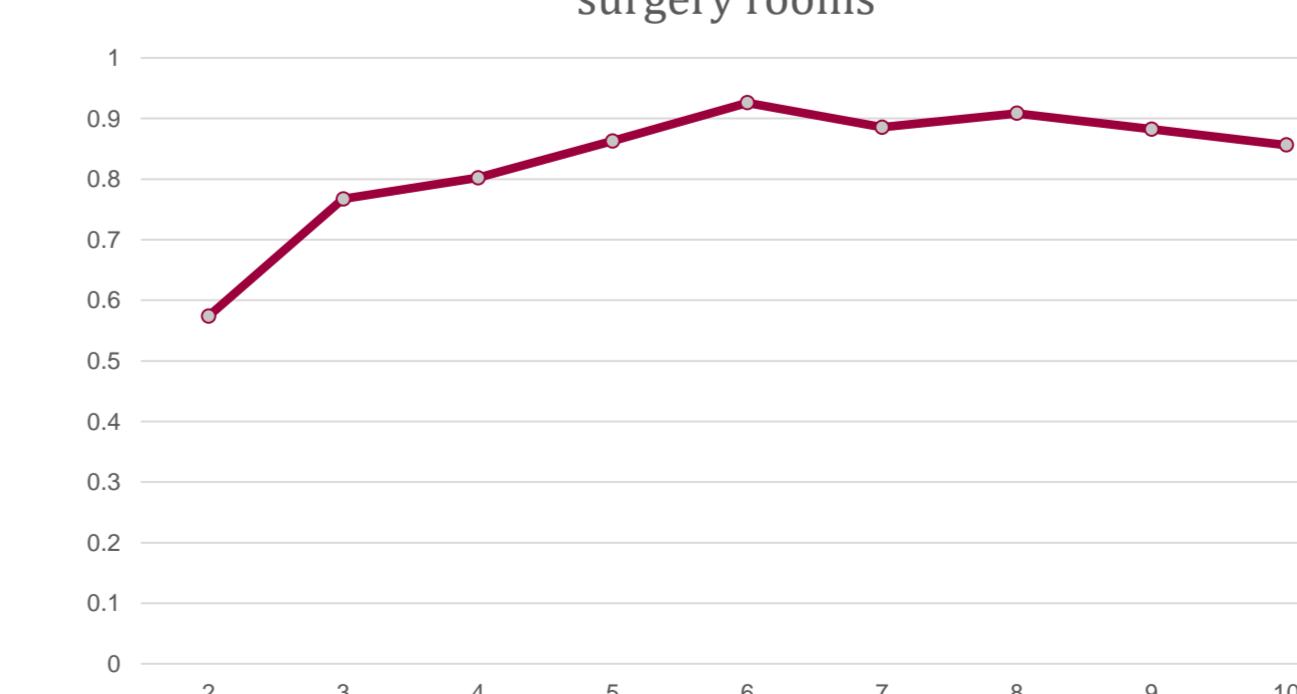
The utilization rates of surgery rooms does not decrease dramatically when the amount of rooms increases.

Waiting times vs amount of patients



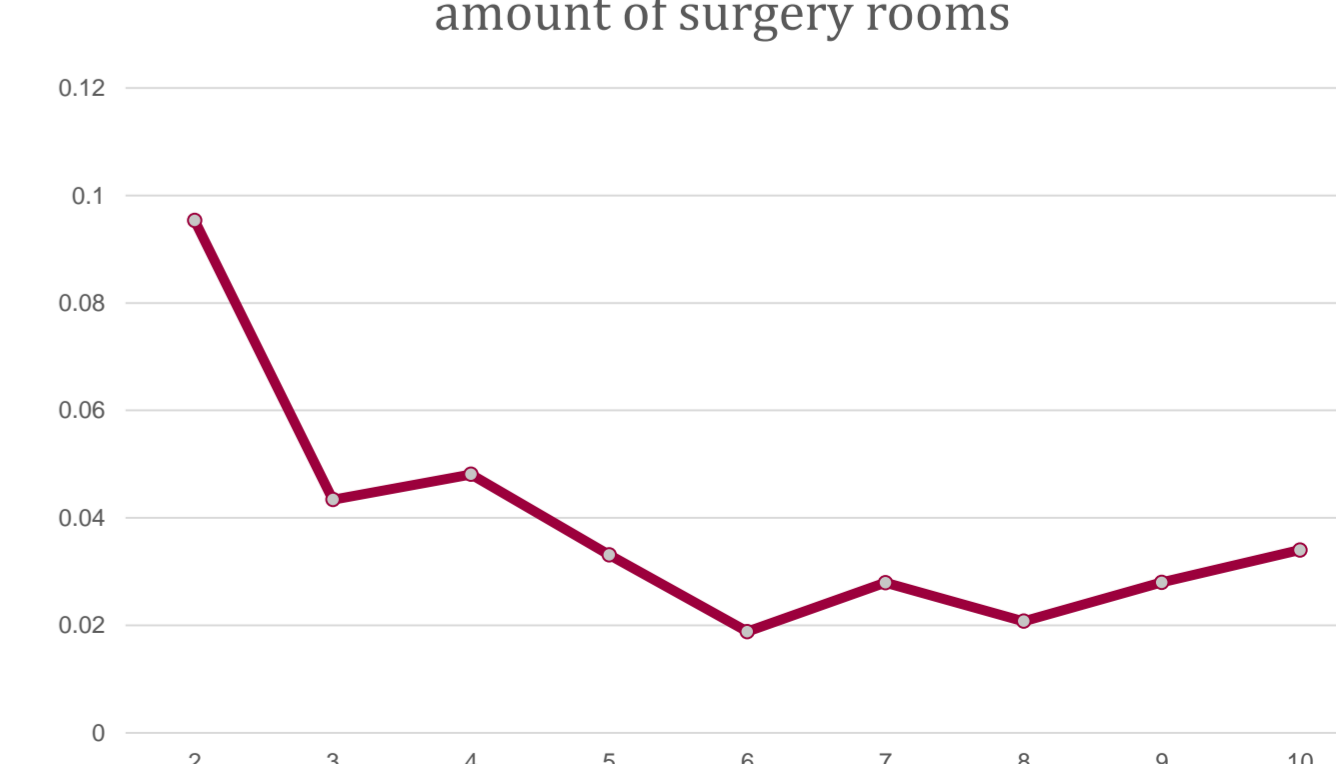
When the amount of patients is above 4500, the waiting times start to increase exponentially

Anesthesiologists utilization rate vs amount of surgery rooms



Increasing the amount of surgery rooms alone makes anesthesiologists work longer shifts...

General surgeon scheduled utilization vs amount of surgery rooms



But decreases the reserved hours of surgeons.