

## Detailed program HOpeR 2022 – Bogotá, Colombia

	<b>Monday November 28</b>	<b>Tuesday November 29</b>	<b>Wednesday November 30</b>	<b>Thursday December 1</b>	<b>Friday December 2</b>
<b>8:00</b>	OR in Healthcare Inaugural talk (Sally Brailsford)*	My thesis in 3 min.	Home Health Care Optimization I (Nadia Lahrichi)*	Optimization and Simulation-Based Optimization in Health II (Fermin Mallor)	Location, relocation and dispatching in Emergency Medical Services (EMS) II* (Valérie Bélanger)
<b>9:30</b>	Coffee break	Coffee break	Coffee break	Coffee break	Coffee break
<b>10:00</b>	Atelier on Machine Learning (Janosch Ortmann)*	Introduction to Hybrid Simulation I (Sally Brailsford)	Home Health Care Optimization II (Nadia Lahrichi)	Location, relocation and dispatching in Emergency Medical Services (EMS) I (Valérie Bélanger)	A decisional framework for patients' prioritization I * (Ángel Ruiz)
<b>12:00</b>	Lunch	Lunch	Lunch	Lunch	Lunch
<b>14:00</b>	Integrated capacity planning in hospitals II (Erwin Hans)*	Introduction to Hybrid Simulation II (Sally Brailsford)	Optimization and Simulation-Based Optimization in Health I (Fermín Mallor)*	Practitioner problem solving activity*	A decisional framework for patients' prioritization II (Ángel Ruiz)
<b>15:30</b>	Coffee break	Coffee break	Social activity		Coffee break
<b>16:00</b>	Integrated capacity planning in hospitals II (Erwin Hans)*	My thesis in 3 min.		Cocktail	Serious Game for Healthcare
<b>18:00</b>	Welcome cocktail				

\*Activities marked by an asterisk are particularly suitable for practitioners without a strong background in Operations Research (OR).

**Title: OR in Healthcare - Inaugural Talk \***

By: Sally Brailsford

Date: Monday 8am

This talk by Sally Brailsford is aimed at the general public, including the practitioner participants. Sally will give a general introduction to operations research and how it is used in healthcare.

**Title: Atelier on Machine Learning\***

By: Janosch Ortmann

Date: Monday 10am

Janosch will introduce machine learning for non-specialists. He will discuss the different forms of machine learning (supervised, unsupervised and reinforcement learning) and explain how this methodology can be useful in healthcare.

**Title: Integrated Capacity Planning in Hospitals: Successful cases from the Netherlands' healthcare system**

By: Erwin Hans

Date: Monday 2pm and 4pm

Prof. Erwin Hans will give two talks, which both are suitable for healthcare academics and practitioners. In the first talk, we will address capacity planning of hospital staff and other resources. Hospital processes are often perceived as 'running and standing still'. We will introduce the concept of integral capacity planning, which is applicable both in hospitals and other healthcare provider's processes. We will outline four dimensions of this integrality and give several examples of integral capacity planning concepts that were implemented in the Netherlands' healthcare system, and their underlying OR models.

In the second talk we will discuss our experiences with how to collaborate between academia and healthcare practice. We will share many lessons learnt and will give tips on how to maximize impact through this collaboration.

**Title: My thesis in 3 min.**

Date: Tuesday 8am and 4pm

Students are invited to submit a short abstract of their research on ahead of the event. On Tuesday, the group will be divided in two or three sub-groups, each with two or three experts, based on the abstract's submission. Each selected student presenter will have three minutes to present their work to their group, followed by ten minutes of questions, feedback and discussions.

**Title: Introduction to Hybrid Simulation**

By: Sally Brailsford

Date: Tuesday 10am and 2pm

Computer simulation is arguably the most widely used Operational Research approach in healthcare. This is because of its flexibility and realism, its ability to take account of variability and uncertainty, its ability to take a ‘systems’ view of complex problems with many different (and sometimes conflicting) stakeholders, and the fact that graphics and animation can make models understandable to people with no background in OR. There are several different simulation methods, each with their own strengths and weaknesses. Hybrid simulation is defined as a combination of at least two of the following methods: discrete event simulation, agent-based simulation, and system dynamics. It has rapidly gained popularity in recent years, partly due to the availability of commercial software for developing hybrid models, but mainly because hybrid simulation can get the ‘best of both worlds’ and tackle different aspects of the same problem using the most appropriate method for each.

These two sessions provide a basic introduction to hybrid simulation modelling. They are mainly aimed at students but are also suitable for practitioners with an interest in computer games! Minimal mathematical knowledge is required. The morning session will begin with a very brief overview of each of the three individual methods and their strengths and weaknesses, and will then cover the principles of hybrid simulation, illustrated by lots of practical applications and case studies. The afternoon session will include a hands-on tutorial/demo in the hybrid simulation modelling software AnyLogic, for those in the audience with laptops. People can download the free Personal Learning Edition in advance from <https://www.anylogic.com/downloads/>

**Title: Home Health Care Optimization**

By: Nadia Lahrichi

Date: Wednesday 8am and 10am

Managing home health care is a challenging task. While in practice, many aspects are handled based on experience, based optimization tools are widely recognized to provide efficient solutions. In the two sessions dedicated to this theme, we will discuss how these methods can be used to handle mid-term decisions (districting and allocation of capacity to districts), short-term (assignment of operators to visits or assignment of operators to patients) and very short term (i.e., routing). Managerial insights will also be provided. In the first session, we will focus on the overview of the problems and how they are currently addressed, and in the second session, we will detail the mathematical models and solving methods.

**Title: Optimization and simulation-based optimization in health**

By: Fermin Mallor

Date: Wednesday 2pm and Thursday 8am

Decision-making in healthcare is a complex process that usually involves planning and coordinating multiple scarce resources and considering several stakeholders, often having conflicting goals. Decision-making is concerned with the efficient use of the resources to provide a timely healthcare service of quality for the whole population, considering both economic and societal perspectives. In addition, the nature of healthcare delivery is stochastic, having uncertainty in the amount and urgency of the demand and in the time and the resources necessary for the service. Therefore, combined simulation and optimization techniques constitute the appropriate approach to simultaneously deal with uncertainty and find good (optimal) solutions to healthcare complex decision problems.

In this seminar, we present models and some of these techniques that combine simulation with optimization to solve healthcare decision-making problems. The first part of the course is devoted to the theoretical and methodological aspects of these techniques, while the second part presents real problems analysed using simulation and/or optimization tools. Specifically, in the first part, we present different approaches such as Stochastic Approximation, Sample-Average Approximation, Ranking and Selection, and the combined use of Metaheuristics methods with simulation. In the second part, we illustrate the use of simulation-based optimization to fit decision-making policies that better describe the management of an Intensive Care Unit (ICU) and, subsequently, the formulation of stochastic optimization problems to determine the optimal ICU-management policies. The second application deals with optimizing the patient flow in an Emergency Department (ED). We also present the optimization in a deterministic setting of physician shift scheduling in an ED.

**Title: Social activity\***

Date: Wednesday 3:30pm

A nice walking tour around the historic centre of Bogotá will be scheduled. All participants in invited to join one of the groups.

**Title: Location, relocation and dispatching of resources in Emergency Medical Services (EMS)**

By: Valérie Bélanger

Date: Thursday 10am and Friday 8am

Emergency Medical Services (EMS) are essential in modern health systems. In particular, the location of their resources will significantly impact their ability to efficiently respond to emergency calls and, eventually, on patients' health and recovery. The uncertainty and dynamism inherent to EMS make it even more challenging, often leading to real-time decision-making. In this lecture, we will see how OR models and methods can be used to support the location, relocation and dispatching of resources in the specific context of EMS, and present real-life examples stemming from collaboration with EMS organizations.

EMS organizations now use various types of resources, both human (e.g. volunteers, advanced medical teams, etc.) and technological (e.g. AED, drones, etc.), to improve service to the population. In this lecture, we will present the case of an organization covering a region in the Province of Québec, Canada, concerned with the deployment of their resources. Participants will be invited to discuss and analyse the problem and provide recommendations on how to address it.

**Title: Practitioner problem solving activity\***

Date: Thursday 2pm

Practitioners are invited to submit a short problem description ahead of the event. These descriptions will be shared at the beginning of the school, giving students time to familiarise themselves with the problems and to start considering and discussing possible solution approaches.

At the event itself, the academic participants (students and professors) will be split into working groups. In each working group, a practitioner will present their problem, giving a brief outline of the context and answering any questions from the students and professors. The remainder of the session will consist of a discussion on solution approaches, involving all participants. At the end, a short summary of the results will be produced.

**Title: A decisional framework for patients' prioritization**

By: Ángel Ruiz

Date: Friday 10am and 2pm

During the last years, the imbalance between offer and demand for healthcare services have negatively impacted waiting lists so that waiting times have become a serious issue in OECD countries. In many medical procedures, these long waiting times directly affect the patients' health and quality of care. Patients' prioritization on waiting lists and their access to treatment based on various factors can play an important role in diminishing undesirable outcomes, such as patients' injury or mortality.

Patients' prioritization is challenging. Higher priority patients should be treated ahead of those with a lower priority, regardless of when they were added to the list. The question is how to elect the factors on which the patient priority should be based and how to evaluate an individual's priority with respect to other in a rigorous, homogeneous, and equitably manner.

This talk proposes a general 3-step decision framework to prioritize patients. The first step, Design, seeks to identify a set of criteria considered as relevant to evaluate the importance of a given service for the patient. Then, it is necessary to quantify the relative importance of each criterion to the others. In the second step, Evaluation, each patient on the waiting list is evaluated with respect to all the criteria by one or several experts using common scales, and a global score is computed. The waiting list is sorted according to the score produced for each patient, a higher score indicating that the service has a higher value/urgency for that patient. The third and last step, Operation, translates the sorted list into schedules for the service delivery. Indeed, practical and administrative constraints make it almost impossible to treat patients in the exact order established by the patients' scores, so an optimization tool is needed to elaborate service delivery schedules see.

Several approaches or tools can be proposed for each step in the framework. The talk will be divided into two parts. The first part will introduce the proposed framework and the challenges associated to patients' prioritization in several contexts. The second part present specific technics and approaches that can support the framework's steps. It will briefly describe qualitative consensus technics such as TRIAGE and DELPHI, multicriteria decision making approaches (analytical hierarchy process – AHP – and its fuzzy version Fuzzy – AHP), and finally a case study where an optimization model is used to schedule surgical patients according to their priority.

**Title: Serious game for Healthcare\***

Date: Friday 4pm

At the first day of the conference, participants will be invited to create groups of 4 or 5 members. Each group will plan, create, and execute a serious game to illustrate (in a classroom or in a practical environment) a concept of their choice in healthcare planning or optimization. The participants are encouraged to apply their knowledge, experience as well as the learnings acquired during HOpeR. This is the closing activity of the conference.