# Thursday, 9:15-09:30

## ■ HA-04

*Thursday, 9:15-09:30 - Room: St Olavs, Kunnskapssenteret KA12*

### Opening Practitioner Day

Stream: Keynotes and panels
*Invited session*

# Thursday, 09:30-10:30

## ■ HB-04

*Thursday, 09:30-10:30 - Room: St Olavs, Kunnskapssenteret KA12*

### Plenary Lina Grännö

Stream: Keynotes and panels
*Invited session*
Chair: *Henrik Andersson*

**1 - Transforming healthcare delivery through data-driven organizational development and strategic planning**
*Lina Grännö*

As healthcare strives to meet patients' needs with high quality and accessibility, operations research (OR) offers opportunities to streamline and improve healthcare processes. In this keynote, we will explore how data-driven organizational development and strategic planning can transform healthcare delivery through practical examples from Karolinska University Hospital. We will discuss critical questions such as: How can we ensure optimal use of healthcare resources? While we may not have all the answers, we will share insights and experiences that can help shape future discussions.

# Thursday, 11:00-12:30

## ■ HC-04

*Thursday, 11:00-12:30 - Room: St Olavs, Kunnskapssenteret KA12*

### Innovation 1

Stream: Sessions
*Invited session*
Chair: *Kjartan Kastet Klyve*

**1 - Integrated care modelling utilising a shared patient information system**
*Joe Viana, Anders N. Gullhav, Heidi Dreyer, Marte Holmemo, Aud U Obstefelder, Hanne M. Rostad, Øystein Døhl*

The HARMONI project addresses the growing challenges in healthcare systems caused by aging populations, complex patient needs, and workforce shortages. Funded by the Research Council of Norway, HARMONI is a transdisciplinary initiative involving Trondheim Municipality, St. Olavs Hospital, and academic partners.

At the heart of HARMONI is a suite of modelling and simulation tools, including dashboards, simulators, optimization algorithms, and a shared patient information system. These tools support tactical-level planning, capacity dimensioning, and process redesign. The project emphasizes participatory model development, drawing on stakeholder engagement and action research to ensure relevance and usability.

HARMONI integrates insights from operations and supply chain management, health services research, and change management. It aims not only to support decision-making but also to serve as a pedagogical tool for fostering systems thinking among healthcare professionals.

This presentation invites discussion on several fronts: How can modelling and simulation models be effectively validated across disciplinary boundaries? What are the best practices for integrating simulation tools into real-world healthcare planning? How can participatory modelling approaches be scaled across institutions? And how might these tools influence long-term policy and practice in integrated care?

**2 - Explainable Optimisation in Healthcare**
*Felix Engelhardt, Christina Büsing, Catherine Cleophas*

Explainability is an important topic in AI research, since many common techniques are "Black Boxes" for users. In comparison, in optimisation and operations research, we like to think that our models are explainable by nature. However, is that really the case? To actual users such as industry partners, doctors or nurses, a mixed-integer programming solver is as arcane as a deep neural network. The same applies to many combinatorial algorithms and heuristics.

In this session, we raise several examples of explainability in optimisation in the specific context of healthcare optimisation. These include modelling to generate alternatives for rostering problems, counterfactual explanations for (integer) linear programming, and simulation - showcasing the broad range of notions of explainability that might be relevant in practice.

Based on this we would like to discuss the following questions: * What types of explainability do practitioners in healthcare desire (e.g. counterfactuals vs transparent vs rule-based)? * To what extent can explainability help with successfully implementing real-world problems? * What techniques are being used to do so? * Where are potential deficits in terms of the current explainability of healthcare OR, and where could research be strengthened by including explainability considerations?

**3 - Introducing capacity planning in home care**
*Annelies Van Der Ham*

Driven by an ageing population, ongoing nurse shortages, and the shift of care from hospitals to homes, home care organisations face growing demand and increasing planning complexity. Next to matching capacity and demand, home care planners must also create routes, meeting patients' care needs at specific time windows while minimizing travel times. Currently, appointment scheduling and routing are performed by nurses or local team planners, resulting in inefficiencies, lagging performance, and rising stress among staff. To reduce workload and enhance capacity, a more professional and data-driven approach is essential.

In this presentation, we will discuss our approach to implementing integrated capacity planning in home care, connecting strategic, tactical, and operational decision-making. Key components include setting concrete goals, measuring performance, professionalising the planner's role, and introducing advanced planning and routing software. We share lessons learned from real-world implementation, and conclude with our plans for the future, offering guidance for organisations seeking to future-proof their home care planning.

**4 - Algorithmic surgical planning at Oslo University Hospital**
*Kjartan Kastet Klyve, Jørgen André Schreiner*

We present the Surgical Cockpit, a comprehensive software developed and implemented in an innovation partnership with Oslo University Hospital, which leverages selected Operations Research methods. A key feature of the product is algorithmic planning of surgeries. Furthermore, the product includes numerous other capabilities, e.g. a patient portal where patients can communicate their availability, a calendar view reflecting different patients' risk of no-show, a re-planning module for planning of emergency cases, real time surveillance of surgical activity etc. In our session, we will tell the story of the product and how.

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## ■ HC-05

*Thursday, 11:00-12:30 - Room: St Olavs, Kunnskapssenteret KA11*

### Innovation 2

Stream: Sessions
*Invited session*
Chair: *Alexander Rutherford*

**1 - The last mile of research: How do we spread ORAHS' knowledge and make it stick?**
*Sebastian Rachuba, Erwin W. Hans*

Effective knowledge dissemination is crucial for bridging the gap between research and practice and, ultimately, for creating awareness and impact. While the academic reward and recognition system often prioritizes top-tier journal publications and citation metrics, this emphasis can overshadow the importance of reaching broader audiences – practitioners, policymakers, and communities – who can act on the findings. To sustainably influence healthcare systems and decision-makers, we must explore and value alternative, accessible dissemination formats that go beyond traditional academic outputs.

This discussion session explores innovative strategies for sharing research, providing example case studies to facilitate creative out-of-the-box thinking. We will use already existing dissemination channels to exemplify possibilities and facilitate a discussions focused on but not limited to the following questions: How can we make research more digestible without losing depth? What formats truly bridge the gap between evidence and action? Participants will collaborate to share insights and co-create ideas for improving knowledge translation in health services.

**2 - Balancing waiting lists and workloads in hospitals**
*Rob Vromans*

Long waiting lists and access times are persistent challenges for many healthcare organisations. Efforts to reduce external waiting lists by increasing outpatient consultations can inadvertently create unmanageable workloads and growing internal waiting lists. This presentation explores an innovative method for balancing and coordinating scarce capacity across departments such as outpatient clinics, operating rooms, and wards. With the aim to reduce waiting times for patients and optimize the patient flow.

Using real-world patient flow data, our method systematically allocates weekly capacity across medical specialties and develops daily schedules that balance workloads for downstream departments, such as diagnostics and wards. Drawing insights from implemented prototypes, we illustrate the broader potential for this approach in diverse hospital and clinical settings. By sharing lessons learned, this presentation offers hospitals and other healthcare organisations insight in how to effectively improve patient access to healthcare.

**3 - Developing an Embedded Program for Operations Research Applied to Community Health Services and Public Health in a Canadian Health System: A Discussion of Lessons Learned**
*Alexander Rutherford, Jessica Stockdale, Krisztina Vasarhelyi*

Simon Fraser University and Vancouver Coastal Health (VCH) have embarked on an embedded research program in which graduate students in operations research work on research projects at VCH embedded in the health authority environment. The students work directly with clinicians, operations directors, and data analysts at VCH. The focus of the initial phase of this program is on community health services, public and population health, and Indigenous health. During the pilot phase of the program, four projects were undertaken: 1. Determining optimal panel sizes for physicians caring for complex patients; 2. Developing methods for identifying people who are homeless or precariously housed from administrative data; 3. Optimizing the client pathway for people in need of mental health and substance use supported housing; 4. Using simulation modelling to better understand models of care and panel sizes for community care in Indigenous communities. In this discussion talk, I will describe our experiences and lessons learned in developing this program. I hope to engage a wider discussion on embedded research in healthcare operations research—what works well and what works less well.

**4 - Activity planning for surgeons with Deepinsight**
*Arvind Chawla*

Since 2022, Deepinsight has been working on Deepinsight Hero, a smart AI tool designed to help hospitals plan surgeries more efficiently. It makes it easier to manage resources, schedule operations, and make informed decisions using data. More than just new software, it also brings a new way of working, with Deepinsight supporting hospitals through the change process.

In this presentation, Arvind Pedersen Chawla, Head of Data Science at Deepinsight, will share how one of their AI models helps hospital staff with the challenging task of coordinating surgeons' time between surgeries, outpatient clinics, and other clinical responsibilities

# Thursday, 13:30-14:00

## ■ HD-04

*Thursday, 13:30-14:00 - Room: St Olavs, Kunnskapssenteret KA12*

### Poster session 2

Stream: Sessions
*Invited session*
Chair: *Joe Viana*

# Thursday, 14:00-15:00

## ■ HE-04

*Thursday, 14:00-15:00 - Room: St Olavs, Kunnskapssenteret KA12*

### Panel discussion on innovation in healthcare

Stream: Keynotes and panels
*Invited session*

**1 - Enabling healthcare innovation through Operations Research**
*Jarl Reitan, Birger Endreseth, Kjartan Kastet Klyve, Gréanne Leeftink, Øystein Døhl*

The panel will discuss the main challenges faced by the healthcare sector, and how innovation can enable better services in the coming years. Then, we will narrow down into OR-innovations and what specific challenges that these can target, and discuss how to increase the presence of OR practitioners in healthcare. The panelist represent different actors, including academia, business consulting, primary care and specialist care, and they will elaborate on the topics from their different points of view. Before the discussion, each panelist will give an introduction on how their institution or company promotes innovation and OR in the public healthcare today.

# Thursday, 15:30-17:00

## ■ HF-04

*Thursday, 15:30-17:00 - Room: St Olavs, Kunnskapssenteret KA12*

### Innovation 3

Stream: Sessions
*Invited session*
Chair: *Simen T. Vadseth*

**1 - Process Mining in Clinical Pathways: Bridging Challenges and Opportunities**
*Luca Murazzano, Paolo Landa, Jean-Baptiste Gartner, Andre Cote*

This study presents a systematic literature review examining the application of process mining (PM) in clinical pathways. The research aims to explore the potential of PM to analyze, discover, monitor, and optimize healthcare processes through event logs derived from hospital information systems. With the increasing complexity of patient care, clinical pathways serve as crucial instruments to harmonize practices and enhance patient outcomes. Despite PM's promising opportunities—such as improving workflow efficiency, ensuring protocol conformity, and enabling predictive analytics—several challenges persist. These include inadequate regulatory frameworks governing PM usage in clinical contexts and uneven exploration of PM applications, particularly predictive process mining. By synthesizing findings from over 50 peer-reviewed studies spanning diverse specialties and healthcare settings, this review uncovers key methodologies, trends, and frameworks deployed in PM. Preliminary results emphasize the need for robust longitudinal data integration and regulatory alignment while highlighting gaps in specific applications like predictive process mining. This study paves the way for more targeted investigations to advance the quality, efficiency, and compliance of clinical pathways through PM methodologies.

**2 - Process Mining Electronic Health Records of People with Multiple Sclerosis: A 5-year Longitudinal Study.**
*Märt Vesinurm*

Chronic care delivery systems often rely on standardized outpatient pathways to ensure efficiency and consistency at scale. However, when these pathways fail to adapt to individual patient needs, system rigidity can result in delayed interventions and suboptimal outcomes. We apply process mining to a 5-year longitudinal dataset of 1279 people with multiple sclerosis (pwMS) to analyze real-world care trajectories and assess deviations from the intended patient pathway. Our method reconstructs patient-level event logs to identify common patterns, transitions, and escalations.

We find four phenotypes for patient trajectories: (1) those treated with only outpatient contacts, (2) those with outpatient contacts preceding escalation into the emergency department (ED) or inpatient care, (3) those with extended periods of no contact followed by escalation into the emergency department or inpatient care, and (4) 'others' with high variation within the service use patterns. We find that on the system level, there is little variation in proportion of different service utilization categories of outpatient, inpatient, ED, no contact. Additionally, annually roughly 70-80% of pwMS are treated with outpatient contacts only, with no escalation. With a significant proportion of costs of care stemming from the more expensive inpatient and ED services, our findings highlight the need for 'flexibility triggers' to allow prediction and more flexible reaction to possible care escalations.

**3 - Staffing for Flexibility: Dimensioning and Scheduling Nursing Pools - A Case Study from St. Olav's Hospital**
*Aina Goday*

Health care staff are becoming a scarce resource in the coming years, stressing the need for efficient use of nursing staff. At St. Olav's Hospital (Norway), we are addressing this challenge by assessing the potential of establishing pools of float nurses. Unlike traditional unit nurses,

float nurses can cover multiple units and can be assigned to units that require additional staffing on short notice. By relying on a pool of nurses, the hospital can meet a variable demand with staff working regular hours rather than summoning unit nurses for overtime work or hiring external nurses.

We have developed an optimisation model for dimensioning and scheduling nursing pools in a multi-unit setting. Based on a stochastic demand for additional nursing staff in each unit on each workday and shift, the model determines the optimal pool size, the base shift schedule, and daily assignment of float nurses. The model's objective is to minimise the costs of covering demand with either employed float nurses or by summoning unit nurses to work overtime.

We apply our approach in two real life case studies at St. Olav's Hospital. In the first case, we assess the existing pool in the Medical clinic to determine whether its current size aligns with our model recommendations. In the second case, we compare four pooling strategies across five of the hospital's smallest clinics to investigate the benefits of establishing a common pool as an alternative to individual pools.

**4 - Automatized nurse rostering at St. Olav's Hospital**
*Simen T. Vadseth, Thomas Bovim*

Nurse rostering is a time consuming process, and nurse leaders typically spend weeks and months preparing a roster for their unit. In St. Olav's Hospital, there is about 300 nurse rosters assembled each year, representing a massive workload for the leaders. Furthermore, striving to achieve staff satisfaction while respecting the organization's needs for staffing around the clock is a challenging task when performing the planning. Through an innovation project at St. Olav's Hospital we have developed and piloted an optimization based tool for automatized nurse rostering. The tool shows promising potentials for generating nurse rosters fast - typically within a day for large units. We will present the fundamentals of the optimization model, revealing how we take into account both the employee and the organizational perspectives to create high quality rosters. We will also report on feedback from the pilot studies performed at the Emergency Department and in the Medical Clinic.

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# ■ HF-05

*Thursday, 15:30-17:00 - Room: St Olavs, Kunnskapssenteret KA11*

## Innovation 4

Stream: Sessions
*Invited session*
Chair: *Joe Viana*

**1 - Straight Home: An initiative to reduce the number of discharge ready patients**
*Tone Beate Svee, Ida Rasmussen Bjerke, Joe Viana*

The South Trøndelag Health Partnership faces persistent challenges with high numbers of patients deemed ready for discharge, especially at St. Olavs Hospital, which reports up to 11,500 such days annually—the highest in Norway. Many of these patients could go directly home with enhanced follow-up, avoiding short-term municipal care. The "Rett hjem - forsterket utskriving" (Straight Home - Enhanced Discharge) initiative introduces an interdisciplinary discharge team to bridge hospital and municipal services. Its goals are to speed up discharges, increase direct-to-home transitions, and optimize municipal care use. In 2024, 1,318 patients from St. Olavs Hospital in Trondheim were classified as discharge ready—a number expected to grow due to aging demographics and seasonal pressures. Trondheim's home care services, divided into 12 geographic zones, operate with small, fixed-schedule teams. Weekly interdisciplinary meetings support coordination, but safe hospital-to-home transitions require adequate staffing and competencies, especially for frail elderly patients. The project explores how municipalities can sustainably scale this model to manage fluctuating patient volumes while ensuring safe, high-quality care transitions. We invite the ORAHS community to contribute insights to improve the initiative's delivery.

**2 - Allocating operating room capacity to non-elective patients improves access and safety for elective patients at Aarhus University Hospital (DK)**
*Maartje Zonderland*

We address surgical scheduling within the Department of Neurosurgery at Aarhus University Hospital (AUH). The department provides neurosurgical care to a population of 1.3 million in Denmark and has national treatment obligations for specific neurosurgical diseases. Efficient utilisation of the department's four operating suites is crucial to ensure that patients have timely access to both non-elective and elective neurosurgical procedures. Historically, the elective OR schedule was made without consideration of the possible arrival of non-elective patients. The challenge was to introduce a structured way of planning for non-elective surgical procedures that would minimise the need for cancelling elective surgeries. Using a mathematical model developed in a previous study at Leiden University Medical Center, the effect of allocating OR time during regular working hours for non-elective neurosurgical procedures at AUH was analysed. This allocation was tested in a six-week pilot study before being implemented in 2021. In the 35 weeks following the implementation, the new allocation strategy resulted in a significant 77% decrease in the cancellation of elective neurosurgical procedures when compared with the same period in 2019, with a significant 16% increase in surgical productivity. We demonstrate how mathematical modelling solves complex problems in the distribution of OR capacity, improving both patient safety and the working environment of surgeons and OR staff.

**3 - Constructing a polarity lexicon for depression-specific for sentiment analysis of social media posts**
*Kurt Marais*

Online mental health communities are internet-mediated fora for individuals to share their experiences and challenges, gain understanding through the shared perspective of similar others and to seek advice or support with respect to their own mental health. Mental health information informed in this way also enables individuals without diagnoses to acknowledge the significance of their symptoms and seek professional help. A polarity lexicon for depression consisting of 5718 sentiment-bearing terms was constructed from using posts from the r/depression subreddit to better inform on depression experiences and expressions shared online. A depression-specific lexicon was constructed through a hybrid of traditional and embedding sentiment analysis techniques. The new depression-specific lexicon was evaluated against popular general-purpose lexica that are typically used in the absence of domain-specific corpora. The depression-specific lexicon performed well in the classification of longer social media posts related to depression, whereas the traditional domain-independent VADER lexicon performed marginally better in classifying shorter depression-related posts from Twitter/X. The depression-specific lexicon also improved on the classification of Reddit posts relating to anxiety, loneliness, PTSD and general mental health.

**4 - Personnel scheduling in hospital emergency departments**
*Anniek Pelleboer, Henrik Andersson, Thomas Bovim, Anders N. Gullhav, Gréanne Leeftink*

Personnel scheduling in hospital emergency departments (EDs) is challenged by highly variable patient arrivals and the need to balance staffing costs with quality of care. This thesis develops and evaluates a decision-support tool to optimize nurse shift scheduling in the ED of St. Olav's Hospital (Trondheim, Norway). The approach comprises two main components. First, a demand-modelling framework classifies patients by age and triage level into 25 care-intensity groups, assigning time-dependent workload across four care phases (triage, treatment, discharge, general care). Historical arrival data (one year, aggregated into 52 weekly profiles per hour) are cleaned via IQR-based outlier filtering and Winsorizing, then converted into hourly staffing percentiles. Second, a mixed-integer linear programming model determines optimal shift schedules under constraints on contract types, overtime,

weekend work, flexible tasks, and service-level targets, incorporating real-world cost parameters (base pay and premiums). Computational experiments demonstrate how the results of the proposed tool change the output measures.