Winter School of Operational Research in Public Health EmergencieS

Scientific Program

January 10 -- February 25, 2022 -- (version 2022-01-05)

Contents

Introduction to ORPHES

The South-East Asia Regional Office of the World Health Organization (WHO-SEARO), the Global Outbreak Alert and Response Network (GOARN), the Association of European Operational Research Societies (EURO and ORAHS), and the Association of Asia-Pacific Operational Research Societies (APORS) are glad to announce the Winter School of Operational Research in Public Health EmergencieS (ORPHES). ORPHES will take place online from January 10 to February 25, 2022, with the support of the International Federation of Operational Research Societies (IFORS).

Theme

Public Health Emergencies (PHE), due to their scale, timing, or unpredictability, can overwhelm routine local health capabilities. Operational Research (OR) has shown its capability to aid decision makers in the fields of health and disease management, patient flow and all aspects of optimal use of scarce resources. The goal of ORPHES is to illustrate how public health emergency preparedness and response can benefit from the application of OR methodologies to prevent, protect against, quickly respond to, and recover from health emergencies.

Audience

ORPHES seeks to develop a community of people interested in the application of OR to PHEs, connecting public health practitioners with OR professionals. The ideal audience is a mix of public health officials, and OR experts (graduate and PhD students, and practitioners with an OR or Operations Management background). Participants from member states of the WHO South-East Asia Region and WHO Western Pacific Region will be given priority.

Registration

Participants can register to either only attend the lectures (hereafter attenders), i.e. general registration, or they can attend and also submit abstracts of current or future work (hereafter proposers). Abstracts must depict a PHE problem suitable to be solved through the application of OR approaches. Abstracts will be reviewed and some will be selected to be presented by the participant (during the debriefing part of the school agenda).

As the School intends to build a community of OR practice, faculty members will be available to work together with the participants whose abstracts were chosen towards the completion of the work. The more promising works (which may continue past the School), if suitable for publication may be supported by the School, i.e. covering article publishing charges.

All participants to the school will receive a certificate of attendance, after adequate completion of a post-event questionnaire.

How to apply

Applicants should send their candidature online by filling out the form linked below. The form is intended to collect information about the participants (educational background, affiliations, previous experiences, ...), the motivation for attending the school, and eventually the abstract of current or future work (only for proposers).

Organisation

Participation in the school for selected applicants is free of charge. School numbers are limited to 40. ORPHES will select the participants in order to guarantee a balance in terms of gender and country of origin. The lectures will take place in the time interval 12:00 - 16:00 CET and it will be recorded.

Syllabus

Learning Goals	The Winter School is aimed at providing the students with notions of (i) the main OR methodologies, especially those widely used in the delivery of health care and public health services during public health emergencies, and (ii) the most successful OR applications in the area of health and social care. Furthermore, the students will learn from practice through a series of case studies.
Intended Learning Outcomes	At the end of the school, students will be able to (i) recognise a specific OR problem in a real operative context, (ii) identify relevant parameters and variables of the problems, (iii) describe / develop a model for the problem using the OR methodologies, and (iv) understand the numerical results obtained by solving the model and their applicability to the real context.
Desirable skills and interests	Numeracy, computer programming, and interest in applying Operational Research in Public Health Emergencies.
School organisation	The Winter School will be composed of a set of online lectures. All experts / teachers involved in the winter school will provide their own materials. The lectures will take place in the time interval 12:00 - 16:00 CET and it will be recorded.

Important dates

- Deadline for applicants: Dec 1, 2021, 17:00 CET
- Selection of the participants: Dec 8, 2021, 17:00 CET
- Winter School: from Jan 10 to Feb 25, 2022

Links for the online application form and further information

- Request for information: orphes AT euro-online DOT org
- WWW: https://www.euro-online.org/web/pages/1700/
- Call for Applications: https://di.unito.it/orphescallforapplicants
- Application form: http://di.unito.it/orphesapplicationform
- List of speakers: see the PDF document
- Scientific Program: available soon

Organising Committee and Sponsors

Organising committee.

- Prof. Roberto Aringhieri, University of Turin, Italy (EURO contact person)
- Dr. Victor Del Rio Vilas, WHO SEARO (GOARN contact person)
- Dr Honora Smith, University of Southampton, UK
- Prof. Stefan Nickel, IFORS Vice-President for EURO, KIT, Karlsruhe, Germany

Sponsors.

World Health Organization
Regional Office for South-East Asia

APORS
Association of Asia-pacific Operational Research Societies
A Regional Grouping within IFORS

EURO
THE ASSOCIATION OF EUROPEAN OPERATIONAL RESEARCH SOCIETIES

GOARN
Global Outbreak Alert and Response Network

EWG
ORAHS
OR APPLIED TO HEALTH SERVICES

IFORS
International Federation of Operational Research Societies

Program at a glance

<table>
<tr><th>Week</th><th>Lectures</th><th>Other teaching activities</th></tr>
<tr><td>From

Jan 10
to
Jan 21

2022
(2 weeks)</td><td>Introductory talks (~2 hours each):

An introductory talk will offer an overview about the main topic of the talk. The speakers can also illustrate real or realistic case studies to highlight some aspects of the topic and/or how to apply a methodology.</td><td>Team building

In this phase, proposers with similar or related problems can be grouped together in order to benefit from the joint analysis.</td></tr>
<tr><td>From

Jan 24
to
Feb 4

2022
(2 weeks)</td><td>Case studies (~1 hour each):

A case study talk will report the impact of the application of operational research methodologies to a real situation. This type of talk will present how the methodology has been implemented, which data have been used, how the solution has been implemented in the real situation, and a measure of the impact of such a new solution.</td><td rowspan="2">1-to1 Mentoring

Attenders and proposers can discuss the topics of the lectures with the speakers.

Proposers will be supported by a team (composed of senior and junior faculties) in the development of the project described in the abstract.</td></tr>
<tr><td>From

Feb 7
to
Feb 18

2022
(2 weeks)</td><td rowspan="2"></td></tr>
<tr><td>Feb 21 - 25

2022
(1 week)</td><td>Debriefing

Each project will be presented to the other students for discussions and improvements.</td></tr>
</table>

Speakers and Abstracts

In the following pages, the calendar of the lectures with a link to a page including a short bio of the speaker and the affiliation, and the abstract of the lectures.

Introductory talks: calendar of lectures

Day	Time (CET)	Lectures - Introductory Talks
Jan 10, 2022	**12:00 - 13:00**	Opening Session
Jan 11, 2022	**12:00 - 14:00**	Roberto Aringhieri -- [abstract, bio] Models for dealing with medical emergency: from the ambulance to the emergency department
Jan 12, 2022	**12:00 - 14:00**	Joaquim Gromicho -- [abstract, bio] A bird's eye flight over the Python analytics landscape
Jan 14, 2022	**14:00 - 16:00**	Jennifer Nuzzo -- [abstract, bio] Overview of the Outbreak Observatory and How it Conducts Operational Research
Jan 17, 2022	**12:00 - 14:00**	Stefan Nickel -- [abstract, bio] Health Care Logistics
Jan 18, 2022	**12:00 - 14:00**	Marion Rauner -- [abstract, bio] A Simulation-Optimization-Based Management Game for Mass Casualty Incidents: Improved Strategies for Different Disaster Scenarios
Jan 20, 2022	**12:00 - 14:00**	Honora Smith -- [abstract, bio] Facility location and capacity boosting for public health emergencies: laboratory testing
Jan 21, 2022	**12:00 - 14:00**	Proposers' discussion session

Roberto Aringhieri

Roberto Aringhieri
Associate Professor of Operations Research
Computer Science Department
University of Torino

WWW:

http://di.unito.it/aringhieri

Title of the lecture:

Models for dealing with medical emergency: from the ambulance to the emergency department

Abstract:
Emergency Medical Service (EMS) and Emergency Departments (EDs) are the crucial components of one of the most important health care services as it plays a vital role in saving people's lives and reducing the rate of mortality and morbidity. In emergency management, many decision problems are connected to each other: for instance, it is well known relationship between ED overcrowding and EMS ambulance diversion.
The structure of this talk is therefore based on the concept of emergency care pathway (ECP), that is the pathway of the patient along the emergency health system. Focusing on the ECP means to shift the attention from the each single component of the system to the whole Emergency Care Delivery System (ECDS) in order to enhance the quality of care, which will improve patient outcomes, promote patient safety, increase patient satisfaction, and optimize the use of resources.
After a general introduction, we will consider three different phases of the management of an ECDS: (i) the design and the evaluation of an EMS system, (ii) the management of the ambulances in real time, and (iii) the management of the resource of an ED to alleviate overcrowding.

Bio:
Roberto Aringhieri, Dr. Ph.D. is an Associate Professor of Operational Research at the Department of Computer Science, University of Turin.
His main skills are in the field of quantitative analysis using Operational Research methodologies and Simulation, and the design of efficient optimization algorithms. Following its educational background and its natural bent, his scientific career is characterized by the ability to change research topics successfully and productively, as shown in his list of papers. As well as other topics as Bioinformatics, Combinatorial Optimization and Simulation and Performance Evaluation, Roberto Aringhieri is working on Health Care Management Science, especially on emergency medical services, workforce management, operating room planning and clinical pathways optimization. He has been in charge of several pure and applied research projects.

He published 73 papers in blind review, including 29 papers in refereed international journals, 36 in refereed conference proceedings, and 8 book chapters. Further, he published 5 editorials and 7 popular papers. At the end of 2021, he has been a speaker at over 50 scientific conferences, including 8 invited talks. With Davide Duma, he was awarded the Best Conference Paper at International Conference “Simulation and Modeling Methodologies, Technologies and Applications”, Wien, 2014, with a paper titled “A hybrid model for the analysis of a surgical pathway”.
From 2015, he is member of the committee for the Ph.D. Program in Computer Science at the University of Turin. He organised of several international conferences (CTW 2008, ORAHS 2010, ESI XXXI 2014), and member of the scientific committee of the international conference organised by the “EURO Working Group” (EWG) on “Operational Research Applied to Health Services” (ORAHS). From 2010, he is member of the EWG board, and from 2019 he is co-coordinator of the EWG. He is member of the program committee of the “International Conference on machine Learning, Optimization & Data science” (LOD). He organised several streams and/or sessions on health care topics at the following international conferences: European Conference on Operational Research (EURO), Conference of the International Federation of Operational Research Societies (IFORS), Winter Simulation Conference (track “Healthcare Applications”). From 2016, he is Associate Editor of the international journal “Operations Research for Health Care”.

Joaquim Gromicho

Prof. dr. J.A.S. (Joaquim) Gromicho
Faculty of Economics and Business
Section Business Analytics

WWW:

https://www.uva.nl/en/profile/g/r/j.a.s.gromicho/j.a.s.gromicho.html

Title of the lecture:

A bird's eye flight over the Python analytics landscape

Abstract:
Python is strong at all levels of analytics: descriptive, diagnostic, predictive and prescriptive. This introduction demonstrates some of the most important packages using colab notebooks that will be available to you to experiment at your own convenience. This will help you to think about possible applications.

Bio:
Joaquim Gromicho, MSc Statistics and Operations Research from the University of Lisbon and PhD Optimization from the Erasmus University Rotterdam, combines a career as Science and Education Officer at www.ortec.com with the chair Business Analytics at the www.uva.nl. Joaquim participates in projects that help several of the UN's Sustainable Development Goals from within Analytics for a Better World, an institute of the University of Amsterdam created in collaboration with the MIT and ORTEC.

Jennifer Nuzzo

Jennifer Nuzzo, DrPH, SM
Senior Scholar, Associate Professor

WWW:

https://www.centerforhealthsecurity.org/our-people/nuzzo/

https://www.outbreakobservatory.org/

Title of the lecture:

Overview of the Outbreak Observatory and How it Conducts Operational Research

Abstract:
Practical knowledge gained from firsthand observations of outbreak and epidemic responses can inform preparedness and response efforts for future public health crises. Though practical and operational knowledge gained during outbreak and epidemic responses are crucial for preparedness, the limited available public health and healthcare resources must be dedicated to performing response activities rather than conducting research on response activities. Observers external to the response are needed to capture and analyze the valuable, ephemeral data that are crucial for identifying challenges and improving operational response to future crises. Since it was founded in 2017, the Outbreak Observatory has been conducting operational research in partnership with front-line practitioners responding to infectious disease outbreaks. The goal of the observatory is to expand the evidence base for preparedness for infectious disease outbreaks, epidemics and pandemics in five different areas:

- Establishing, maintaining, and utilizing robust disease surveillance systems to enable rapid event detection and characterization as well as conducting necessary epidemiological activities and maintaining situational awareness during response operations.
- Implementing effective and feasible non-pharmaceutical interventions (eg, social distancing, masks, quarantine and isolation, improved hygiene) and other non-medical strategies to limit or interrupt disease transmission during outbreaks, both in the community and in healthcare settings.
- Establishing and implementing rapid and effective distribution and dispensing protocols for applicable medical countermeasures (eg, vaccines, antibiotics, antivirals, immunoglobulin) in the midst of outbreak response.
- Building the necessary relationships and shared experience to integrate public health activities, particularly those implemented in the community, with healthcare facility

operations to support a comprehensive health response to outbreaks.

- Identifying the resources (eg, financial, personnel) and other support (eg, guidance, policy) required to facilitate the development and operation of sustainable public health and healthcare capabilities and capacity for outbreak response operations.
- Identifying effective strategies for communicating with and educating the public, with a particular focus in engaging with high-risk and vulnerable populations, before, during, and after the response to improve the adoption of evidence-based protective actions.

Bio:

Dr. Nuzzo is a Senior Scholar at the Johns Hopkins Center for Health Security, an Associate Professor in the Department of Environmental Health and Engineering and the Department of Epidemiology at the Johns Hopkins Bloomberg School of Public Health, and a Senior Fellow for Global Health at the Council on Foreign Relations. An epidemiologist by training, her work focuses on global health security, with a focus on pandemic preparedness, outbreak detection and response, health systems as they relate to global health security, biosurveillance, and infectious disease diagnostics. She directs the Outbreak Observatory, which conducts, in partnership with frontline public health practitioners, operational research to improve outbreak preparedness and response.

Dr. Nuzzo is also the lead epidemiologist for the Johns Hopkins COVID-19 Testing Insights Initiative housed within the Johns Hopkins Coronavirus Resource Center. Together with colleagues from the Nuclear Threat Initiative and the Economist Intelligence Unit, she coleads the development of the first-ever Global Health Security Index, which benchmarks 195 countries' public health and healthcare capacities and capabilities, their commitment to international norms and global health security financing, and their socioeconomic, political, and environmental risk environments. Previously, she conducted research related to the Affordable Care Act, tuberculosis control, foodborne outbreaks, and water security. Dr. Nuzzo is an Associate Editor of the peer-reviewed journal Health Security.

In addition to her work at the Center, Dr. Nuzzo advises national governments and for-profit and nonprofit organizations on pandemic preparedness and response, including COVID-19. She has also served as a member of the US Environmental Protection Agency's National Drinking Water Advisory Council (NDWAC) and the NDWAC's Water Security Working Group. She has also served as a project advisor for the American Water Works Association Research Foundation (now called the Water Research Foundation), a primary funding organization for drinking water research in the United States.

Prior to joining the Center for Health Security, Dr. Nuzzo worked as a public health epidemiologist for the City of New York, where she was involved with disease and syndromic surveillance efforts related to the city's Waterborne Disease Risk Assessment Program. Central to her duties was the management of an over-the-counter medication sales monitoring program, which was part of the city's syndromic surveillance efforts. She also previously worked for the City of Cambridge, Massachusetts on a local climate change initiative.

Dr. Nuzzo received a DrPH in epidemiology from the Johns Hopkins Bloomberg School of Public Health, an SM in environmental health from Harvard University, and a BS in environmental sciences from Rutgers University.

Stefan Nickel

Prof. Dr. Stefan Nickel

Editor-in-Chief Operations Research for Health Care

Karlsruhe Institute of Technology (KIT)
Institute of Operations Research
Discrete Optimization and Logistics

Director FZI
Director KSRI

WWW:

http://dol.ior.kit.edu/

http://www.journals.elsevier.com/operations-research-for-health-care/

Title of the lecture:

Health Care Logistics

Abstract:
Healthcare logistics addresses the efficient planning, realization and control of patient-, material- and information-flow within the healthcare sector. Therefore, the use of Operations Research (OR) methods plays a crucial role. It is important to not only put emphasis upon the economic efficiency but also to take the quality of care and patient satisfaction into account. On the other hand, healthcare logistics should not get involved in (core) medical decisions.
Healthcare logistics addresses healthcare facilities and service providers at all levels, for example general practitioners (GP) providing primary care or emergency departments (ED) treating patients with pressing health issues. Care pathways containing several different providers as well as the interaction of providers and services, e.g. when patients are transferred to a hospital by their GP, are also targeted. Usually, processes in healthcare grew historically ("We have always done it this way."). Consequently, processes have not been analyzed critically until reforms of the health system have put increasing pressure on the providers. Nowadays, especially hospitals are looking for possibilities to improve their processes. The success of logistics concepts in healthcare lies in resource conservation for non-value-adding activities (not directly relevant for the healing process, e.g., administrative work) and high resource utilization for value-adding activities (e.g., surgery) while the personnel shall not be over-utilized (i.e., no overtime). Moreover, the interaction of appropriate logistics concepts with modern OR models allow a patient centered treatment, by respecting the needs of a patient and allowing a smoother process. The digitalization of the healthcare sector offers

additional opportunities.
In this talk, we give an overview on how OR methods can be used in order to support process optimization in healthcare organizations. For a subset of healthcare logistics applications arising in different healthcare sectors OR models and numerical results mainly from real world projects will be presented. Examples include: location planning for ambulances and GPs, appointment planning, emergency department simulation, layout planning for hospitals and many more. We will also give some information on how healthcare logistics research is organized in Karlsruhe.

Bio:
Stefan Nickel is a full professor at the Karlsruhe Institute of Technology - KIT (Germany) and one of the directors of the Institute of Operations Research.
He obtained his PhD in mathematics at the Technical University of Kaiserslautern (Germany) in 1995. From 1995 to 2003 he was assistant and associate professor in mathematics at the Technical University of Kaiserslautern. After a full professor position at the Saarland University (Chair of Operations Research and Logistics) from 2003 to 2009, he joined the Karlsruhe Institute of Technology as the Chair in Discrete Optimization and Logistics in April 2009. From 2014-2016 he was the dean of the Department of Economics and Management at the KIT. Stefan Nickel was also member of the scientific advisory board as well as of the management board of the Fraunhofer Institute for Applied Mathematics (ITWM) in Kaiserslautern from 2004-2016. Since 2011 he additionally holds the positions of one of the directors of the Karlsruhe Service Research Institute (KSRI) and of the Research Center for Computer Science (FZI). From 2006-2015 he was editor-in-chief of Computers & Operations Research. Moreover, he is editor-in-chief of Operations Research for Health Care. He has coordinated the Health Care working group within the German OR society (GOR) and has been the president of GOR from 2013-2014. Since 2019 Stefan Nickel serves as VP IFORS in the EURO executive committee and is member of the AC of IFORS.
Stefan Nickel has authored or co-authored 6 books as well as more than 120 scientific articles in his research areas Locational Analysis, Supply Chain Management, Health Care Logistics, and Online Optimization. He has been awarded the EURO prize for the best EJOR review paper (2012) and the Elsevier prize for the EJOR top cited article 2007-2011. In addition, he conducted several industry projects with well-known companies such as BASF, Lufthansa, Miele, or SAP.

Marion Rauner

Associate Professor Marion S. Rauner

University of Vienna, Faculty of Business, Economics, and Statistics, Department of Business Decisions and Analytics

WWW:

https://pnpm.univie.ac.at/about-us/aouniv-prof-dr-marion-rauner/

https://oegor-hcdm.univie.ac.at/

Title of the lecture:

A Simulation-Optimization-Based Management Game for Mass Casualty Incidents: Improved Strategies for Different Disaster Scenarios

Abstract:
Policy makers are confronted with an increasing number of complex and unique mass casualty incidents ranging, for example, from technological disasters, terror attacks, flooding, wild fires, to hurricanes worldwide. All of those disaster scenarios are rather complex and unique depending on scale and scope.
This is why, we developed a discrete event simulation-optimization policy model which can be used as a management game to train policy makers for better decision making of mass casualty incidents. It has been implemented for and applied by the Austrian Samaritan Organization to support planning of ambulance resources at the incident side for triaging, treating, and transporting patients to hospitals. We adapted this policy model to account for the latest organizational changes (merging of treatment rooms and changing of transportation rules from treatment rooms to hospitals). In the past, either the total number of fatalities or the total average waiting time of patients could be optimized in this tool by policy makers. To better balance these contradicting goals, we provide the total average health status of heavily injured patients as an additional decision variable for optimization. Because the healthier patients reach the hospital, the higher their chance of survival and the better their morbidity in the long run. We also refined the entry of the distribution of the patients' health status to better account for more policy scenarios.
Mass casualty incidents vary from realistic small, simple, urban to rather big complex, remote

mass casualty ones. We investigate in detail a variety of realistic predetermined disaster scenarios for improved policy making. Next, we illustrate that optimal scheduling guidelines for triaging, treatment, and transportation of patients vary both among the three outcome measures for one disaster policy scenario (total number of fatalities, total average waiting time, total average health status of heavily injured patients) and among the different disaster scenarios. These findings enable disaster policy makers to best prepare for rare and unique disasters and to train their staff accordingly. Furthermore, ORPHES participants can investigate selected policy scenarios (terror attack, plane crash, stadium roof collapse) on their own after the introductory talk and benchmark their outcomes with other ORPHES participants and research-based benchmark results.

Acknowledgement: I thank my co-author and former PhD student/staff member of the EU project S-HELP Helmut Niessner for developing the disaster management game under my supervision and my teaching/research assistant Simeon Beile for developing the realistic policy scenarios under Helmut Niessner's and my guidance. Furthermore, we thank numerous students and practitioners in serval countries who helped improving the game (especially Natasa Peric and Teresa Herdlicka).

References:

Rauner, M. S., Schaffhauser-Linzatti, M. M., & Niessner, H. (2012). Resource planning for ambulance services in mass casualty incidents: a DES-based policy model. Health Care Management Science, 15(3), 254-269.

Rauner, M. S., Niessner, H., Leopold-Wildburger, U., Peric, N., & Herdlicka, T. (2016). A policy management game for mass casualty incidents: an experimental study. Flexible Services and Manufacturing Journal, 28(1-2), 336-365.

Niessner, H., Rauner, M. S., & Gutjahr, W. J. (2018). A dynamic simulation–optimization approach for managing mass casualty incidents. Operations Research for Health Care, 17, 82-100.

Rauner, M.S., Beile, S., Niessner, H. (working paper, under resubmission, 2021) A simulation-optimizer for the New Austrian Advanced Medical Post (AMP): Investigating different realistic policy disaster scenarios.

Website of the Disaster Game: https://sanhist.at/

Bio:

Marion S. Rauner is Associate Professor at the Department of Business Decisions and Analytics at the Faculty of Business, Economics, and Statistics, University of Vienna, Austria. She received an MBA in Business Informatics (1992), a Ph.D. in Social and Economic Sciences (1997), and her habilitation in Business Administration (2003), all of them from the University of Vienna, Austria, and an MBA in Business Administration from Vienna University of Economics and Business Administration, Austria (1993). During the academic year 1999/2000, she was visiting Assistant Professor at University of Stanford, Department of Management Science and Industrial Engineering collaborating with Prof. Dr. Margaret Brandeau sponsored by an Erwin-Schrödinger-Fellowship of the FWF.

Professor Rauner's research interests include operations research in public and non-profit management, disaster management, health care management, strategic management, disease policy modeling, as well as technology assessment. She is Co-Editor of Central European Journal of Operations Research, Associate Editor of Socio-Economic Planning Sciences, and Editorial board member of Health Care Management Science, Health Systems, and Operations Research for Health Care. She has edited 12 special issues. Her refereed research has been

published in a wide variety of journals, including Operations Research, European Journal of Operational Research, Journal of the Operational Research Society, Computers & Operations Research, OR Spectrum, Central European Journal of Operations Research, Socio-Economic Planning Sciences, Flexible Services and Manufacturing Journal, International Journal of Production Research, Journal of Decision Systems, Health Policy, Health Care Management Science, Operations Research for Health Care, International Journal of Healthcare Technology and Management, and International Journal of Technology Management.

She was awarded several research prizes and received four teaching awards. She has been teaching at undergraduate and graduate, as well as PhD level both in English and German for more than 25 and 15 years, respectively. Her main teaching experience comprizes public and non-profit management, health care management, health economics, production and logistics, innovation and technology management, as well as strategic management. In several research projects, she supported health care policy makers in Austria and she also participated in the fp7-EU-Project S-Help (Securing Health.Emergency.Learning.Planning) from 2014-2017. She served as a President of the Austrian Operations Research Society (ÖGOR) from 2006-2012 for which she also co-coordinates the working group “Operations Research in Health Care and Disaster Management.” She organized the "Operational Research Applied to Health Services" (ORAHS) working group meeting in Vienna in 2001 and in 2020 (e-version due to the COVID-19 pandemic situation). In addition, she organized the 1st International Health Care Technology Management PhD Workshop in Vienna in 2004 and is organizing the OEGOR working group meetings "OR in Health Care" meetings since 2004 and "OR in Health Care & Disaster Management" since 2017. She is currently serving as a Member of the Equal Opportunity Commission at the University of Vienna.

Honora Smith

Dr Honora Smith
University of Southampton

WWW:

https://www.southampton.ac.uk/maths/about/staff/hks1u06.page

Title of the lecture:

Facility location and capacity boosting for public health emergencies: laboratory testing

Abstract:
Whether in emergency situations or longer-term forward planning, Operational Research (OR) offers several techniques for finding best locations for public health facilities, whether entirely new or boosted, and for modelling internal operations to boost existing service capacity. In this session, we consider laboratory testing and several suitable OR techniques for location and capacity changes. These techniques, moreover, can be applied to other services needed in public health emergencies such as blood centres.
An essential factor in disease control is efficient, timely, high-quality laboratory testing. Finding appropriate locations and capacities for laboratories is therefore of major importance. The largest laboratories are usually located in big cities, perhaps in tertiary or teaching hospitals, and much smaller facilities are found in smaller towns. Samples for testing are collected in health facilities as close as possible to where people reside, so, again, this may be in large hospitals with on-site laboratories or alternatively in small local clinics with limited facilities. Logistics may be involved in transporting batched samples to laboratories for testing, and journeys must be completed during the allowed period before samples deteriorate, perhaps involving refrigeration. However, some people may live in rural locations too remote to arrange timely transport, and thus point-of-care testing at a local health facility may be needed, avoiding the use of laboratories and providing a fast turnaround time, but perhaps with lower test accuracy. A mobile testing service might also be offered, with public health personnel travelling around remote settlements to offer tests with rapid results.

Facility location analysis is a branch of OR that offers a multitude of approaches suited to location of laboratories with capacities appropriate to local demand. Several classical models have been developed and applied in different situations. The so-called “P-median” model type aims to find the best locations for a given number of facilities so that the total overall travel distance for the regional population is minimised. Alternatively, the “Maximal Cover” type of model considers the maximum travel time or distance that can be travelled to a facility, and maximises the population covered by the number of facilities planned. Capacity planning can be included in the solutions obtained.

An allied branch of OR, vehicle routeing, is also appropriate in planning locations for laboratories, bearing in mind the need to collect samples from distant clinics. Vehicle routeing models generally have the objective of minimising total travel distance.

Finally, simulation modelling offers possibilities for highlighting capacity bottlenecks in internal laboratory operations. This form of OR can be used to run ‘what-if’ scenarios, to determine the possible effects of demand growth and how much extra capacity is needed to cope with it.

Bio:

Dr Honora Smith’s PhD at the University of Southampton, UK, was entitled “Locating Sustainable Community Health Facilities” – this work was largely inspired by community health projects run by Emmanuel Hospital Association in rural North India. Honora has lectured on and co-directed MSc programmes in Operational Research and Data Analytics in Mathematical Sciences in Southampton. Honora has supervised PhDs of students from Thailand and Colombia related to the blood supply chain in those countries. She has collaborated with the National Health Laboratory Service of South Africa in analysis of locations for HIV/AIDS test laboratories throughout the country, with a particular emphasis on point-of-care delivery.

Case study talks: calendar of lectures

Day	Time (CET)	Lectures - Case Study Talks
Jan 24, 2022	**12:00 - 13:00**	Ettore Lanzarone -- [abstract, bio] Blood donation towards service delocalization: new models and new challenges
Jan 25, 2022	**12:00 - 13:00**	Gilberto Montibeller -- [abstract, bio] Decision Analysis for Health Security Decisions
Jan 26, 2022	**15:00 - 16:00**	Nadia Lahrichi -- [abstract, bio] Testing the capabilities of labs (COVID 19) and similar applications
Jan 28, 2022	**12:00 - 13:00**	Parvathy Krishnan -- [abstract, bio] Optimising Stroke Care Access in Vietnam
Jan 31, 2022	**12:00 - 13:00**	Derya Demirtas -- [abstract, bio] Allocation of casualties to ambulances and hospitals in a mass casualty incidence: Evaluation of Medical Disaster Planning Exercises
Feb 2, 2022	**12:00 - 14:00**	Melanie Reuter-Oppermann and Derya Demirtas -- [abstract] Pre-EMS Services & Volunteer Alert Systems
Feb 4, 2022	**12:00 - 13:00**	Melanie Reuter-Oppermann -- [abstract, bio] Primary care logistics - Importance, challenges and case studies

Ettore Lanzarone

Ettore Lanzarone
Department of Management, Information and Production Engineering,
University of Bergamo

WWW:

http://www.ettorelanzarone.it/

Title of the lecture:

Blood donation towards service delocalization: new models and new challenges

Abstract:
The Blood Donation Supply Chain (BDSC) provides blood units to the different health services in Western countries, whose first step is the collection of blood from healthy donors. It requires a careful planning because unbalanced supply of blood units to the rest of the chain could give periods of blood shortage and wastage. Morever, as common to other health care service, a deep restructuring of blood collection could meet delocalization needs, innovative ways of recruiting new donors, and any future pandemic or emergency. To this end, new organizational models for blood collection are needed, in which blood is collected at donor's homes. However, they require ad-hoc a decision support tools for their management.
We proposed a decision support tool that consists of an integrated matheuristic framework with three decision stages: a planning model to create the donation slots that will be assigned to donors, an online allocation of these slots using a flexible set of criteria, and a Multi-Trip Vehicle Routing Problem with Time Windows (MTVRP-TW) to route the bloodmobiles that collect blood at donors' homes.
The goals are to balance the production of blood units between days, to minimize the distance traveled by the bloodmobiles, and to immediately provide a list of slots to choose from when a donor makes a booking request. The proposed framework has been tested on data from a large Italian provider, i.e., the Milan branch of the "Associazione Volontari Italiani del Sangue" (AVIS).

Bio:
Since October 2020 he is a tenure-track professor at the Department of Management, Information and Production Engineering of the University of Bergamo, Dalmine (BG), Italy.
He is also a research collaborator at the Institute for Applied Mathematics and Information Technology “E. Magenes” (IMATI) of the National Research Council of Italy (CNR), Milan, Italy, where he worked as a researcher from 2011 to 2020.

He is member of the CIRRELT (Centre Interuniversitaire de Recherche sur les Reseaux d'Entreprise, la Logistique et le Transport), Montreal and Quebec City, Canada.
He is member of the β–Lab (Laboratory of Biomechanics for Endovascular Treatments of the Aorta), belonging to Universit`a degli Studi di Pavia, CNR-IMATI and Policlinico San Donato.
He is on the board of directors of the Milan section of the Associazione Volontari Italiani del Sangue (AVIS) since 2021.
His research activities focus on three main areas: bioengineering (mathematical models applied to bioengineering problems, e.g., the study of the cardiovascular fluid-dynamics and the biomedical image analysis); optimization and operations research (research focused on robust and stochastic optimization approaches, with applications in health care, e.g., home care, blood donation system, ambulance location); stochastic models (modeling the evolution of patient conditions and demand for care in several health care facilities and estimating parameters in complex dynamic systems).

Gilberto Montibeller

Professor Gilberto Montibeller
DSc (UFSC/Univ. of Strathclyde), MSc(UFSC), BSc (UFSC)

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Title of the lecture:

Decision Analysis for Health Security Decisions

Abstract:
In this talk I introduce the use of Decision Analysis to support health security decisions and deal with the many complexities that these decisions bring, such as the involvement of many stakeholders, the multiple impacts caused by health threats, the uncertainties associated with a volatile environment, the biases that may affect judgments of experts and decision makers, and the limited resources available for health preparedness and risk management.
I describe these concepts applied to a range of health security projects that I have led in this field and reflect on how Operational Research can further support enhancing global health security against emerging and re-emerging health threats.

Bio:
Gilberto Montibeller is Professor of Management Science at Director of Professional and Executive Education at the Loughborough University (UK) and a Senior Research Fellow at the Center for Risk and Economic Analysis of Threats and Emergencies, University of Southern California (USA).
Prof Montibeller is an expert in behavioral decision analysis and decision analysis. He is Associate Editor of the Informs Decision Analysis journal. He has published widely in in decision sciences, authoring or co-authoring more than fifty peer reviewed articles and book chapters. The quality of his research has been recognized by best publications awards from the INFORMS Decision Analysis Society, the Society for Risk Analysis, and the International Society on Multi-Criteria Decision Making.
His main areas of application are security decision analysis and health risk management, having led projects for the World Health Organization, Pan-American Health Organization, UK

Department for Environment, Health and Rural Affairs (DEFRA), UK Department of Health, the Food and Agriculture Organization of the United Nations (FAO), the United States Agency for International Development (USAID), among others. The excellent of his decision analysis projects has been recognized by the INFORMS Decision Analysis Society Practice Award and the EURO Excellence in Practice Award.

Dr Montibeller has been a visiting scholar at the Massachusetts Institute of Technology (MIT, USA), the London School of Economics (LSE, UK), the International Institute for Applied Systems Analysis (IIASA, Austria), and CNRS Lamsade at Paris Dauphine University (France).

Nadia Lahrichi

Nadia Lahrichi, Professeur,
Mathématiques et génie industriel,
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Title of the lecture:

Testing the capabilities of labs (COVID 19) and similar applications

Abstract:
In this talk, we present a discrete simulation approach used to understand and assess the efficiency of laboratories in the US and Nepal. Testing is critical to mitigating the COVID-19 pandemic, but testing capacity has fallen short of the need in the United States and elsewhere, and long wait times have impeded rapid isolation of cases. Operational challenges such as supply problems and personnel shortages have led to these bottlenecks and inhibited the scale-up of testing to needed levels.
The simulation models support analyses that identify process steps which create bottlenecks, and evaluate “what-if” scenarios for process changes that could expand testing capacity. This enables virtual experimentation to understand the trade-offs associated with different interventions that increase testing capacity, allowing the identification of solutions that have high leverage at a feasible and acceptable cost. The models are also used to estimate the impact of demand variability on laboratory performance and the minimum equipment and personnel required to meet various target capacities, assisting in scale-up for any laboratories following the same process steps. In sum, the results demonstrate that by using simulation modeling of the operations of SARS-CoV-2 RT-PCR testing, preparedness planners are able to identify high-leverage process changes to increase testing capacity.
We also briefly discuss the use of discrete event simulation in other applications to show how it can be used and its benefits.

Bio:

Nadia Lahrichi holds a PhD in applied mathematics from Polytechnique Montréal. She is currently a full professor at the department of Mathematics and Industrial Engineering at Polytechnique Montreal. She is also a member of CIRRELT and IVADO. Her research is mainly focused towards applying modeling and operational research tools to improve patient flow in the healthcare system. She uses exact, metaheuristics and discrete event simulation approaches to tackle patient and resource scheduling problems. She has received the award for outstanding application of operational research (from the Canadian Operational research society) for solving the home health care routing and scheduling problem.

Parvathy Krishnan

Parvathy Krishnan
Data Science Consultant
PhD candidate at Eindhoven University of Technology

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Title of the lecture:

Optimising Stroke Care Access in Vietnam

Abstract:
The Vietnamese National Stroke Association estimates that there are a total of 200,000 strokes each year and 104,000 deaths from stroke. Accessibility is a huge concern for those seeking treatment for stroke as the patients have to reach a stroke specialist facility within what is known as the golden hour. This case study demonstrates the use of open-source datasets to identify the population lacking access to stroke centers within certain thresholds of travel time and then using optimization techniques prescribed in which existing hospitals should new stroke care units be started to ensure much better coverage for the population in Vietnam.

Bio:
Parvathy Krishnan is a Data Science Consultant in the public sector working for organizations such as the World Bank and UNDP to employ data science tools and techniques to accelerate the achievement of Sustainable Development Goals. She has a Bachelor of Technology in Electrical and Electronics Engineering, a Master of Technology in Energy Management & Climate Change Technology, and a Professional Doctorate in Engineering (PDEng.) in Data Science. Under the guidance of Prof Dick den Hertog and Prof. Joaquim Gromicho, she is also pursuing a part-time external Ph.D. in Analytics for a Better World.

Derya Demirtas

Derya Demirtas
Assistant professor,
IEBIS, University of Twente

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Title of the lecture:

Allocation of casualties to ambulances and hospitals in a mass casualty incidence: Evaluation of Medical Disaster Planning Exercises

Abstract:
During a mass casualties incident (MCI), treatment capabilities of the regional hospitals are overwhelmed. In the Netherlands, emergency care networks prepare their regions for an MCI by organizing analog simulation exercises called Emergo Train System (ETS) exercises. In 2019, two separate emergency medical teams simulated the allocation process of casualties to ambulances and hospitals using ETS. The results differed significantly between the teams. Although the ETS exercises are widely used in the world, the optimal solutions are not known before or after, leaving how much better a team could perform a mystery. In this research, we propose an integer linear programming model that allocates each casualty of an MCI to an ambulance and a hospital. We demonstrate the effectiveness of our models by comparing our results to the outputs of the ETS exercises of 2019 and provide sensitivity analysis.

Bio:
Derya Demirtas is an assistant professor at the Center for Healthcare Operations Improvement & Research (CHOIR) in the Department of Industrial Engineering and Business Information Systems at the University of Twente. Her research focuses on operations research, optimization and data analytics, location theory and their applications to healthcare and public services.
Dr. Demirtas received her BSc in Industrial Engineering with a double major in Computer Engineering from the Middle East Technical University, Turkey (2008). She then obtained her MMath in Combinatorics & Optimization from the University of Waterloo, Canada (2010), and her PhD in Industrial Engineering from the University of Toronto, Canada (2016).
Dr. Demirtas is a recipient of the NWO (Dutch Research Council) Veni grant (2019), American Heart Association (AHA) Young Investigator Award (2015), and the Best Poster Award by the

National Association of EMS Physicians (2016). She also won the second place in the INFORMS Case Competition (2020) and second place in the INFORMS Section on Public Sector Operations Research best paper competition (2012). Her research has been published in top journals such as Management Science, European Journal of Operational Research, Journal of the American College of Cardiology, and Circulation. She was a visiting faculty in the Industrial and Systems Engineering and in the Center for Health & Humanitarian Systems at Georgia Tech in 2018, where she worked on disaster response.

Melanie Reuter-Oppermann

Dr.-Ing. Melanie Reuter-Oppermann
Technical University of Darmstadt

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Title of the lecture:

Primary care logistics - Importance, challenges and case studies

Abstract:
Primary care, which is usually provided by general practitioners (GPs), is crucial for people's welfare. Patients benefit from having easy and timely access to GPs in close proximity, often to their home, but sometimes to other places like their place of work. Despite the importance of primary care, GP shortage is an internationally alarming issue. This is especially true for many rural regions, even in countries like Germany or New Zealand. One cause is the aging population that needs more medical care. In addition, there are often not enough medical students wanting to pursue a career in general medicine and those who do usually favour bigger cities and group practices that offer a better work-life balance. Different strategies against the shortage have already been applied including advertising the GP profession to medical students at the universities or offering an additional payment for taking over a practice in a rural district. Open collaborative practices in which GPs would be employed rather than owning the practice are another promising idea. Due to several changes, newly qualified GPs often tend to work in teams rather than in single handed practices. Therefore, new practices offering this kind of working condition will be more attractive.
In this talk, we will discuss relevant planning problems within primary care logistics including location and layout planning. As a case study, we have assessed the coverage of GPs for the New Zealand region of Northland, a rural area in the very north of New Zealand's North Island. By adapting a spatial optimisation framework, we used a decision support system to determine potential GP locations together with the resulting coverage areas and expected driving times of patients, assuming that patients attend the closest GP in relation to their home. In addition, we have applied location models considering existing practices, patient demands and driving times now and in the future for a rural region in the south-west of Germany. A GIS-based decision support tool can be used to visualise the solutions, e.g. for decision makers. In

addition, we developed a layout for group practices in Germany taking several different aspects (e.g., walking distances for staff and patients, and a set of soft factors) into account.

Bio:
Dr.-Ing. Melanie Reuter-Oppermann is a Postdoc at the Technical University of Darmstadt working mainly on optimisation for healthcare logistics, service design and artificial intelligence. She is currently leading three funded research projects on blood logistics, emergency services and disaster management. Since 2021 she is a joint coordinator of the EWG ORAHS and speaker of the scientific advisory board of the German Society for Paramedicine (DGRe). She received her PhD from the Karlsruhe Institute of Technology in 2017 on optimisation for emergency logistics. Her research focus is on emergency services, primary care logistics, blood logistics, radiotherapy and disaster management.

Pre-EMS Services & Volunteer Alert System (Reuter-Oppermann and Demirtas)

This is a joint talk given by Melanie Reuter-Oppermann and Derya Demirtas. Check their bio following the links.

Title of the lecture:

Pre-EMS Services & Volunteer Alert Systems

Abstract:

In this joint talk, we will address the two topics, namely pre-EMS services and volunteer alert systems.
First, we present the results of a review paper on pre-EMS services, i.e. services that help patients in case of an emergency before an ambulance arrives. The paper summarizes studies that are focused on the use of new types of resources, such as volunteers and drones, for daily medical emergency responses. These resources are used in daily medical emergencies if they can arrive earlier than emergency medical services. This work includes a total of 258 papers published in operations research / operations management and medical journals and conference proceedings. It investigates these studies from technical, logistical, and medical perspectives and gives an application-based and methodological overview of them.
In the second half of the talk, we will talk about volunteer alert systems in general as well as a specific case in the Netherlands. In many countries, (semi-) organized volunteer systems are used for enabling quick first response to cases of out-of-hospital cardiac arrest (OHCA). Such systems rely on mobile phones to notify the volunteers in proximity of the OHCA patient and to dispatch them to the patient. The volunteers are assigned to one of the two tasks: either going directly to the patient (to perform CPR) or picking up a stationary automated external defibrillator (AED) en route to the patient. Recently, an innovative idea was proposed: Using mobile AEDs to decrease time to defibrillation. Instead of volunteers fetching an AED on their way to the patient, AEDs can be delivered to the location of the patient, saving time. In this talk, we focus on a volunteer dispatch system in the Netherlands, which has recently started a pilot program in which a small set of volunteers own AED-equipped cars. Using simulation, we assess the benefits of including mobile AEDs (i.e., privately owned cars equipped with AEDs) in terms of improving AED delivery time and survival. We test different dispatch strategies and compare new dispatch strategies both with and without mobile AEDs to the existing dispatch method.

List of mentors

During the school, mentoring will be provided to the participants in order to allow further discussions on the different topics dealing with public health emergencies. Two different types of mentoring will be provided.

The first one is for the participants (attenders and proposers) in such a way to discuss the topic(s) of each lecture, and will be offered by the speaker of the lecture and by a junior faculty in accordance with the list reported below.

The second one is for the proposers. Each proposer submitted an abstract describing a public health emergency project during the application process. A team of mentors will be associated with the project in order to support its development. The final outcome of this work will be presented in the last week of the school.

Mentor	Lecture	Link
Davide Duma University of Pavia, Italy	Models for dealing with medical emergency: from the ambulance to the emergency department	here
Parvathy Krishnan	A bird's eye flight over the Python analytics landscape	here
Fulvio Lopane University College London	Primary care logistics - Importance, challenges and case studies	here
Marzieh Ghiyasinasab Polytechnique Montréal	Testing the capabilities of labs (COVID 19) and similar applications	here
Hannah Bakker Karlsruhe Institute of Technology	Health Care Logistics	here
Robin Buter University of Twente	Allocation of casualties to ambulances and hospitals in a mass casualty incidence: Evaluation of Medical Disaster Planning Exercises	here
Gotz Giering Loughborough University	Decision Analysis for Health Security Decisions	here
David Barrera Ferro University of Southampton	Facility location and capacity boosting for public health emergencies: laboratory testing	here
Martina Doneda Politecnico di Milano	Blood donation towards service delocalization: new models and new challenges	here

Niki Matinrad Linköping University	Pre-EMS Services & Volunteer Alert Systems	here
Jamaliatul Badrodin University of Southampton	General mentorship on Operational Research	