



## EURO PhD SUMMER SCHOOL

# 'OPERATIONAL RESEARCH FOR VALUE-BASED HEALTH CARE'

September 1-8, 2019

Lisbon, Portugal



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## 1 General information

### 1.1 Aim and scope

The EURO PhD Summer School 'Operational Research for Value-based Health Care' offered a scientific program designed to be a unique forum for PhD students and young researchers working in OR in health (<http://orvalueinhealth.tecnico.ulisboa.pt/>).

Participants had the opportunity to get acquainted with multiple topics which are relevant to address health decision-makers needs and to generate sound operational research methods, knowledge and tools aligned with value-based health care. The school resulted from a partnership between the University of Lisbon (Portugal) and the Public University of Navarra (Spain). It benefited from the financial support of EURO, the Association of European Operational Research Societies. It received the academic support of ORAHS, the European Working Group on Operational Research Applied to Health Services and from Portuguese and Spanish Operational Research societies (APDIO and SEIO).

To answer to the challenge of bridging the gap between OR and value-based health care, the consortium also integrated health care providers and pharmaceutical companies. Among those the North Lisbon Hospital Centre, Hospital Compound of Navarre, Janssen-Cilag and NOVARTIS assumed key roles; the four organisations provided real challenges for school participants working upon, and their health professionals participated in discussions and working as advisors to students working on challenges. The pharmaceutical companies also provided extra financial support: Janssen-Cilag (Gold) and NOVARTIS (Silver).



The summer school was a joint initiative of these organizations

### 1.2 Dates and venue

The school took place at Instituto Superior Técnico (IST) Campus Alameda (Av. Rovisco Pais 1, 1049-001 Lisbon), on September 1-8, 2019. IST is the engineering school of the Universidade de Lisboa. Lectures and classes took place mainly in rooms QA1.1 and Q4.2 of the South Tower.

### 1.3 Organizing committee

The organizing committee was formed by:

- Mónica Oliveira (CHAIR), Técnico, University of Lisbon
- Fermin Mallor (CO-CHAIR),
- Ana Vieira, Técnico, University of Lisbon
- Inês Marques, Técnico, University of Lisbon
- Mário Amorim-Lopes, Faculty of Engineering, University of Lisbon
- Marta Salgado, Faculty of Medicine, University of Lisbon

### 1.4 Scientific committee

The scientific committee was formed by the school lecturers and by representatives of APDIO and SEIO:

- Sally Brailsford; University of Southampton, England (CHAIR, outgoing Coordinator of ORAHS)
- Alec Morton; University of Strathclyde, Scotland
- Carlos Bana e Costa; University of Lisbon, Portugal
- Erwin Hans; University of Twente, Netherlands
- Emilio Carrizosa Priego; University of Sevilla, Spain (President of SEIO)
- José Fernando Oliveira; University of Porto, Portugal (President of APDIO)
- Martin Utley; University College London, England
- Roberto Aringhierj; University of Torino, Italy

### 1.5 Fees and participants support

The maximum number of students was established in 32, with 30 students being supported by EURO and with two students paying a full fee.

A registration fee of 200€ was included for participants supported by EURO, and of 700€ for the other two participants. Living costs were subsidised by the Summer School – fees included all accommodation, meals (breakfast, coffee break, lunch, and dinner), transport to IST, and social activities. Travel costs from the participant country until Lisbon were set to be covered by participants.

Some specific funding was available to waive the fees of participants requesting financial support.

The accommodation was provided in double rooms in the students' residence Engenheiro Duarte Pacheco from IST.

## 2 Scientific programme

### 2.1 Overview

The scientific program was set to have an intense program made up of a variety of learning activities, including theory and methods, case studies, software tutorials, and experiments. Each day was devoted to a different topic with a prestigious internationally known expert. An overview of the program follows, with a description of the content being then presented.

Day	9:00-12:00	13:30-14:30	14:30-15:30	16:00-17:00	17:00-18:00	18:00-19:00	Lecturers and discussants
1						Get together	
2	From modern health care challenges to OR methods and approaches	<u>Case studies</u> Emerging approaches					Sally Brailsford, USouthampton (Mónica Oliveira, ULisboa)
3	What is and how to measure value in health? How to model stakeholders and decision-makers views for OR modelling?	<u>Case studies</u> Cases of value measurement applications in health settings		<u>Tutorials</u> Designing and implementing web-Delphi platforms to interact with stakeholders and experts (Welphi)			Carlos Bana e Costa, ULisboa (Ana Vieira, ULisboa)
4	How to use simulation to produce key information for health decision-making?	<u>Case studies</u> Simulation studies involving real decision-makers and discussion of related decision support systems		<u>Case studies</u> Successful cases of implementation of simulation studies			Erwin Hans, UTwente (Fermín Mallor, PUNavarra)
5	Social day						
6	How to achieve decision-makers objectives through mathematical programming?	<u>Tutorials</u> Designing and implementing goal programming mathematical programming models (GAMS)		<u>Case studies</u> Successful mathematical programming applications			Alec Morton, UStrathclyde and Tânia Ramos, ULisboa (Inês Marques, ULisboa)
7	How to properly combine methods to solve real health care challenges and promote value-based health care?	<u>Case studies</u> Practical OR applications of value-based health care applications				Walk in Lisbon	Martin Utley, UCL (Mário Amorim Lopes, UPorto)
8	Presentations of challenge competition	Award to the best challenge and farewell lunch					Roberto Aringhieri, UTurin (all organizing committee)

Overview of the main scientific activities

The overview of activities should be read with the following legend of colours:

	Lectures, Room QA1.1 (day 7 in Room Q4.2)
	Tutorials and real cases of application, Room Q4.2 (days 3 and 6 also in room LTI 5.2)
	Participants' presentations and discussions, Room Q4.2
	Social programme
	Challenge competition (group-based work), Room Q4.2

#### 2.1.1 2<sup>nd</sup> September

**Morning Lecture and Afternoon Case Study:** From modern healthcare challenges to OR methods and approaches

Professor Sally Brailsford, University of Southampton

Operational Research has been around since the 1940s, and for most of these 75+ years it has been applied to healthcare-related problems. Many of these same problems (crowded Emergency Departments, long waiting lists for surgery, appointment scheduling) are still with us, despite all the OR effort that has gone into tackling them over the years, but the 21<sup>st</sup> century has brought many new challenges. In developed countries, advances in medical technologies have made treatments possible that were unheard of in the past but are often hugely expensive. Globally, ageing populations have led to a seemingly unbounded need for both medical and social care, while the workforce that provides care is decreasing relatively in size. As a result of the internet and social media, patients are now more informed (although not always better informed!) about healthcare related issues: they are more demanding, and do not always trust medical advice in the way their parents' generation did. In this session some of these challenges were discussed and how OR can help to address them.

### 2.1.2 3<sup>rd</sup> September

**Morning Lecture:** What is and how to measure value in health? How to elicit stakeholders and decision-makers concerns and value judgments in health settings?

Professor Carlos Bana e Costa, Universidade de Lisboa

Health systems are increasingly concerned with the delivery of value-based health care. While traditionally at the core of value-based health care has been the measurement of health outcomes and the use of tools to operationalise the measurement of health through Quality Adjusted Life Years, there have been recent attempts to develop and adapt tools to measure multidimensional value in health settings. These tools make use of concepts from multicriteria decision analysis (MCDA) and value measurement and are being applied to multiple contexts (including health technology assessment and performance measurement). This lecture described how sound MCDA tools can be used to measure multidimensional value in health and health care, and to elicit health stakeholders and decision-makers concerns and value judgments with friendly protocols of questioning. Examples of development of methods and tools in real settings in the contexts of health technology assessment and patient preference elicitation were provided. The use of health stakeholders and decision-makers concerns and value judgments within classical OR models were discussed.

**Afternoon Case Studies:** Structured participatory processes to capture the views of health stakeholders and experts

Professor Carlos Bana e Costa, Universidade de Lisboa

At the core of value measurement is the involvement of health stakeholders and experts and the elicitation of their value judgments. This talk discussed how decision conferencing and Web-Delphi processes can be

used to involve and model health stakeholders' views and value judgments. Real examples of involving health policymakers, patients, and health experts in public or corporate contexts through decision conferencing and Delphi processes were presented and discussed.

**Afternoon Tutorial:** Designing and implementing web-Delphi platforms to interact with stakeholders and experts

Professor Carlos Bana e Costa and Dr. Ana Vieira, Universidade de Lisboa

In this session students followed a tutorial to learn how to create and manage a web-Delphi process in the Welphi platform. The aim was to promote an understanding on the steps and issues that arise in the design and application of web-Delphi processes.

### 2.1.3 4<sup>th</sup> September

**Morning Lecture and Afternoon Case Studies:** How to use simulation to produce key information for health decision-making?

Professor Erwin Hans, University of Twente

The following topics were addressed during the lecture:

- when to use simulation?
- the power of visualization;
- a taxonomy of simulation methods;
- advantages and disadvantages of simulation;
- a stepwise approach;
- common mistakes;
- experiment design;
- stakeholder engagement and involvement in simulation studies;
- simulation as a tool in serious games;
- the scientific value of simulation.

### 2.1.4 6<sup>th</sup> September

**Morning Lecture:** How to achieve decision-makers objectives through mathematical programming?

Professor Alec Morton, University of Strathclyde

A common decision rule in health services is to invest in interventions which are “cost-effective”, which meet deliver a specified health gain at or below a threshold cost. Although this decision rule is underpinned by

common sense, it can also be understood as a heuristic approach to solving an optimisation problem. First, drawing on experiences in the English NHS, it was shown how health inequalities can be modelled using multiobjective programming. Second, drawing on work with a major donor of development aid for health, it was shown some of the ways in which optimisation can be used to model dependencies between projects, particularly when projects draw on a common “platform” such as a shared information system or physical facility. Third, again drawing on work from the development sector, it was discussed how optimisation and game theoretic approaches can suggest decision rules when there are multiple parties involved in financing the health sector (for example, a donor and a national government). The general message of this session was that the optimisation approaches allow a deeper and richer modelling of the complexities of healthcare resource allocation, which generalise the simple and intuitive decision rules of cost-effectiveness analysis.

**Afternoon Tutorial:** Designing and implementing mathematical programming models using GAMS

Dr. Tânia Ramos, Universidade de Lisboa

GAMS (the General Algebraic Modeling System) is a high-level modeling system for mathematical programming problems. This tutorial aimed at modelers who are new to GAMS and are looking for a quick introduction to the core features of GAMS. This session exploited the power of this algebraic modelling language to solve optimization problems in health care context like nurses’ scheduling, routing problems in home health care, etc. The students learned how to use GAMS for formulating, solving, and analysing single and multi-objective health care optimization problems. No matter how large the problem/instance at hand, it possesses a simple, exploitable algebraic structure, meaning that the input file would remain unchanged even if a much larger problem is considered.

**Afternoon Case Studies:** Successful mathematical programming applications

Professor Alec Morton, University of Strathclyde

Although it is a resource intensive industry, healthcare has been relatively slow to deploy OR methods at scale as part of its routine management practice. Some case studies of OR in healthcare and related areas were introduced in the context of the UK National Audit Office and in the UK NHS. Those case studies showed that the OR methods do have the potential to add value in health service management and policy. However, OR practitioners do have to do a better job of deeply understanding health services and what makes the sector so distinctive and different if their methods are to be used at scale. In health services, objectives are always contested, and customers are poor assessors of the quality of service and depend heavily on professional advice. Tentative implications for the use of OR methods in the sector were drawn.



## 2.1.5 7<sup>th</sup> September

**Morning Lecture:** How to properly combine methods to solve real-world health care challenges and promote value-based health care.

Professor Martin Utley, UCL Clinical Operational Research Unit

In this session it was discussed:

- how OR interventions in health care almost always involve some combination of problem structuring, descriptive analysis, statistical analysis, model building, output visualization and client engagement techniques;
- how the balance across these may need to be different when addressing real-world challenges than when conducting an academic project;
- and how this relates to differing perspectives on what it means to “solve” a problem.

Drawing on reviews of the literature, it was presented the motivations, characteristics and reported outcomes of Operational Researcher interventions that have been labelled as “multi-method”, with a particular focus on the combination of “soft” and “hard” OR approaches. It was then discuss whether and how mixing soft and hard OR approaches can enhance the capability of OR to promote value-based health care.

Individual and group exercises were designed to encourage participants to explore and reflect upon what they consider to be the role of OR within health care and their strengths as Operational Researchers.

**Afternoon Case Studies:** Practical OR applications of value-based health care applications

Professor Martin Utley, UCL Clinical Operational Research Unit

It was presented three short case studies where authors have discussed the combination of methods to address real world challenges in health, two where a soft OR approach was formally adopted along with a hard OR approach and one where a combination of hard OR approaches was deployed. Drawing on work developed by the lecturer it was also presented a “successful” single method project that led directly to some real-world health care challenges.

## 2.2 Lecturers

### 2.2.1 Sally Brailsford, University of Southampton



Professor Sally Brailsford is Professor of Management Science within Southampton Business School at the University of Southampton.

Sally obtained a BSc in Mathematics from Kings College London, and then worked for several years as a nurse in the NHS before obtaining an MSc and then a PhD in Operational Research from Southampton. Her research is in healthcare simulation modelling: to evaluate treatments and screening programmes, or to redesign and improve service delivery. Sally has worked for over 25 years in many different disease fields, including diabetes, cancer, mental health, and HIV/AIDS, in addition to emergency care and end-of-life

care. From 2012-15 she was Vice-President 1 of EURO, the Association of European OR Societies, and from 2010-19 she was Coordinator of the EURO Working Group on OR Applied to Health Services (ORAHS). She is one of the Editors-in-Chief of the UK OR Society's journal Health Systems and is on the editorial boards of Health Care Management Science, the Journal of Simulation and Operations Research for Health Care. She is the only person ever to have won the OR Society's Goodeve Medal three times: in 2004 for modelling emergency healthcare services in Nottingham, in 2006 for modelling chlamydia infection, and in 2015 for modelling the supply and demand for dental care in Sri Lanka.

### 2.2.2 Carlos Bana e Costa, University of Lisbon



Carlos A. Bana e Costa is a Full Professor of Decision and Information at Instituto Superior Técnico (University of Lisbon) and a Researcher at the Centre for Management Studies of Instituto Superior Técnico (CEG-IST). He is also head of I&D projects at CEG-IST, having a large experience in leading health-related projects. Professor Bana e Costa's primary interests are in the fields of Management and Decision Sciences, namely Multicriteria Decision Analysis and Decision Conferencing. He has widely published in these areas (<http://web.tecnico.ulisboa.pt/carlosbana/>), and he co-authored the MACBETH approach for decision-aiding (<http://www.m-macbeth.com>). He has also been developing consultation in public strategic decision-making processes, policy appraisal and bid and performance evaluation worldwide, following the socio-technical facilitation perspective shared by the members of the International Decision Conferencing Forum. He is also a senior partner of BANA Consulting (<http://www.bana-consulting.pt>).

webpage: <http://web.tecnico.ulisboa.pt/carlosbana/>

### 2.2.3 Erwin Hans, University of Twente



Erwin W. Hans is a Full Professor Operations Management in Healthcare at the University of Twente in the Netherlands. He has an MSc (1996) and PhD (2001) degree in Applied Mathematics, specializing in Mathematical Programming and Operations Research. Since 2003, his research area is Healthcare Operations Management and Operations Research. In 2007 he co-founded the Center of Healthcare Operations Improvement & Research (CHOIR, <https://www.utwente.nl/en/choir/>), the leading Netherlands' research center for OR/OM in healthcare. He works closely with several (university) hospitals in the Netherlands, and has studied many applications like the operating theatre, ICU, and radiology departments. He is a lecturer of Healthcare OR/OM courses at all academic levels, and for healthcare professionals, nationally and internationally. In 2015 he was awarded University of Twente's best lecturer and was runner-up in the national final in 2016.

### 2.2.4 Alec Morton, University of Strathclyde



Professor Alec Morton has degrees from the University of Manchester and the University of Strathclyde. He has worked for Singapore Airlines, the National University of Singapore, and the London School of Economics, has held visiting positions at Carnegie Mellon University in Pittsburgh, Aalto University in Helsinki, the University of Science and Technology of China (USTC) in Hefei, and the National Audit Office and is a member of the International Decision Support Initiative. His main interests are in decision analysis and health economics. His research is funded by the European

Commission, the Department of Health, the Medical Research Council and Engineering and Physical Sciences Research Council, and the Chief Scientist's Office of the Scottish NHS.

Alec has been active in the INFORMS Decision Analysis Society, EURO and ISPOR. He is on the Editorial Board of Decision Analysis and is an Associate Editor for the EURO Journal on Decision Processes, the Transactions of the Institute of Industrial Engineers, and OR Spectrum. Past consulting clients include the National Audit Office, the Department of Health, the Environment Agency, the Nuclear Decommissioning Authority, and the Global Fund to Fight AIDS, Tuberculosis & Malaria. His papers have won awards from the International Society for Pharmacoeconomics and Outcomes Research and the Society for Risk Analysis. His book Portfolio Decision Analysis with Jeff Keisler and Ahti Salo won the INFORMS Decision Analysis Society publication award in 2013 and his paper "CUT: A Multicriteria Approach for Concavifiable Preferences" (with Nikos Argyris and Jose Figueira) was a finalist for the same prize in 2016.

### 2.2.5 Martin Utley, University College London



Professor Martin Utley is Researcher in Residence at Care City in North East London and Professor of Operational Research at the UCL Clinical Operation Research Unit (CORU). Founding Editor of the journal Operations Research for Health Care, Martin has published widely on Operational Research methods related to demand, capacity and flow within health care and on the use of clinical outcome data in quality assurance and

quality improvement. In addition to his research and teaching, Martin has worked as a consultant to a range of NHS bodies and international clients including The Global Fund to fight AIDS, Tuberculosis and Malaria.

Martin joined UCL in 1996 following a PhD in Particle Physics and has devoted over 20 years to developing, adapting, and applying operational research techniques to help those designing, running, and evaluating health services. In this time, he has held honorary positions with Great Ormond Street Hospital and University College London Hospitals and has acted as Scientific Advisor to the UK National Confidential Enquiry into Patient Outcome and Death.

### 2.2.6 Other lecturers



Dr. Tânia Ramos is an Assistant Professor of the Department of Engineering and Management at the Department of Engineering and Management at Instituto Superior Técnico. She has a PhD in Engineering and Management (IST), a MSc in Operational Research and Engineering Systems (IST) and a BSc in Enterprise Organization and Management (ISCTE – IUL). Parallel to her academic career she has been developing consultancy activity in projects in the areas of hospital and primary care, and in logistic and

supply chain management. She is also a specialist in Project Management. She has been publishing in international peer-reviewed journals and books. She has received awards by her teaching activity and been previously an Assistant Professor at ISCTE – ISCTE Business School.

In the Summer School Dr. Tânia Ramos led a tutorial session on the GAMS optimization decision support system.



Dr. Ana Vieira is a post-doctoral fellow at the Center of Management Studies of Instituto Superior Técnico (CEG-IST). Her research includes the design of social processes to assist the development of evaluation models in contexts of multiple stakeholders. She is currently involved in the development of new web-based platforms and technologies (based upon Delphi processes) to enhance collaborative value

modelling and to promote consensus and learning. She has been involved in several European health-related projects and developing her research in real public and private contexts. She has a background in Veterinary Medicine and a PhD in Veterinary Sciences in which she developed tools to enable animal welfare measurement.

In the Summer School Dr. Ana Vieira led a tutorial session on the WELPHI Web-Delphi platform.

### 2.3 Summer school challenges

A distinctive learning activity of the school was making participants to work on two challenges to test and develop their capacities on teamwork and real problems.

Hospital Compound of Navarre challenged participants to address the problem of no shows in specialist consultations, while the pharmaceutical company Janssen-Cilag suggested taking on improving pathways of oncology patients. Challenges were set to open, having no optimal solution existing, nor being defined with precision. Participants worked hard along the week and could work on data and qualitative information, having the opportunity to consult health practitioners and academics in the development of their work.

A jury composed of three Operational Research experts and health stakeholders from the school health partners – led by Roberto Aringhieri – selected the most valuable answer to each of the challenges. Symbolic prizes and diploma were given to the winner groups.



Winner participants of the real challenges placed by *Janssen-Cilag* (left) and by *Hospital Compound of Navarre* (right), with jury members.

In order to address the challenges, students had the opportunity not only to digest data and build models with appropriate decision support tools but also to interact in different formats with experts and decision-makers with different perspectives concerning Operational Research for Value-based Health Care.

Name and professional background	Institution
Isabel Rodrigo – Public Health Manager	Hospital Compound of Navarre (Spain)
Amaia Ibarra – Health Professional	Hospital Compound of Navarre (Spain)
Pedro Laires - Head Health Economics & Outcomes Research	NOVARTIS
Leonel Luís – Director Otorhinolaryngology Service	Centro Hospitalar Lisboa Norte

Name and professional background	Institution
Carlos Moreira – Internal Medicine Physician	Centro Hospitalar Lisboa Norte
Carma Gouveia – Nurse and manager	Centro Hospitalar Lisboa Norte
Helena Ramalhinho Lourenço – Operational Research Academic	Universitat Pompeu Fabra, Professor
Klára Dimitrovová – Public Health Academic	University of Lisbon
Daniel Santos – Operational Research Academic	University of Lisbon
João Condeixa – Corporate Affairs Manager	Janssen-CILAG

## 2.4 Participants' presentations

All participants had the opportunity to present during the summer school their research in a 5-minutes oral presentation that was followed by 5 minutes for discussion from discussants and the audience. Before the start of the summer school participants were informed about the day in which they will present their research.

The summer school had participants representing a wide range of problems and methodologies, with participants being provided with guidelines. Each presentation should make sure that it explains the major aspects of the research project, including the description of the addressed problem, the main assumptions and the methods used, allowing everyone who is not an expert in the topic to follow the presentation. In addition, to enable a fruitful discussion, the presentation should also inform about the expected results and how they can impact and/or provide value to the health system or organisation. Students in the final stages of their PhD research should also briefly show the dissemination and publication strategy.

## 3 Participants

### 3.1 Call for participation

The call for students was set between 14<sup>th</sup> January and 14<sup>th</sup> February 2019, and announced in the conference website, and the ORAHS and EURO websites, and the call was announced in a wide range of mailing lists related with the school topics.

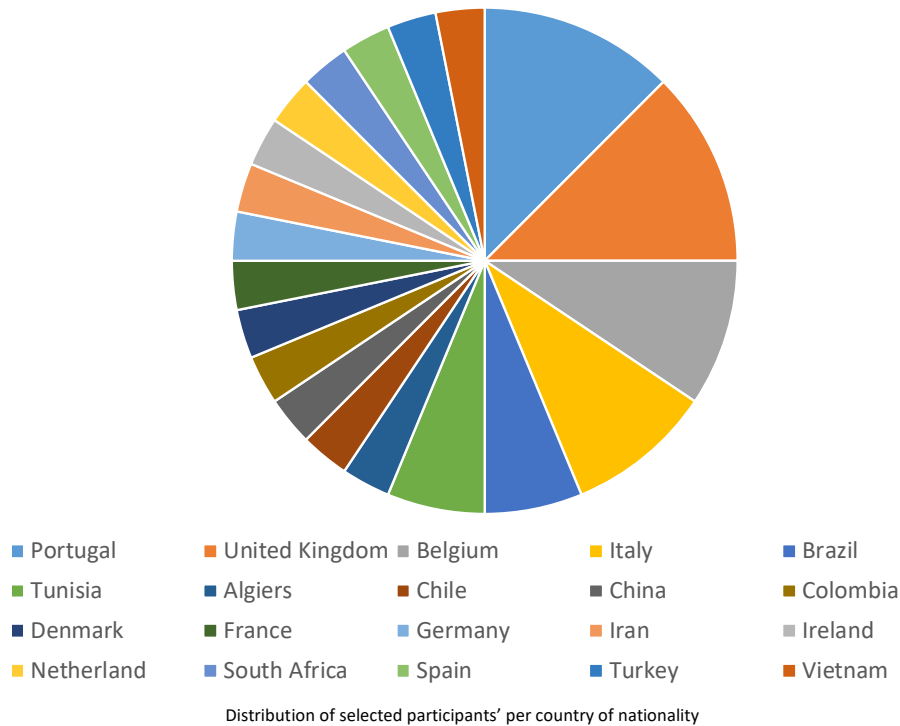
### 3.2 Students requirements

In the call, it was announced that participants had to be from a EURO member society country or studying in a EURO member society country. They had to be enrolled in a PhD Program or to be an early career researcher:

- interested in getting an in-depth understanding of concepts, methods, and tools to the development of OR for value-based health care;
- motivated for having an impact with their OR in health research;
- eventually interested in presenting and discussing their research ideas;
- interested in building their research network.

### 3.3 Admissions

The school attracted broad attention from the community with 45 applications and 32 students accepted (30 from EURO countries and two extra from other countries). This was a highly international and diverse group, composed of participants from 20 nationalities and located in universities from 14 countries.



### 3.4 Attendees

The following students were accepted to participate in the summer school:

Name	Institution where participants develop their research
Alexis Robbes	Université de Tours, France
Andreia Pereira	ISCTE-Instituto Universitário de Lisboa, Portugal
Cristiano Fabbri	University of Bologna, Italy
Daniel García de Vicuña	Public University of Navarra, Spain
David Ferro	University of Southampton, UK
David Olave-Rojas	Karlsruhe Institute of Technology, Germany
Edgar Mascarenhas	Instituto Superior Técnico, Universidade de Lisboa, Portugal
Emily Williams	Cardiff University, United Kingdom
Emma Aspland	Cardiff University, United Kingdom
Fatma Ben Amor	University of Sfax, Tunisia
Henrik Bøgedal Breddam	Technical University of Denmark, Denmark
Jakob Heins	University of Augsburg, Germany
Jeroen van Kasteren	Vrije Universiteit Amsterdam, Netherlands

Name	Institution where participants develop their research
Karen Moons	Katholieke Universiteit Leuven, Belgium
Kim de Boeck	Katholieke Universiteit Leuven, Belgium
Le Khanh Ngan	University of Strathclyde, United Kingdom
Lien Wang	Katholieke Universiteit Leuven, Belgium
Liliana Freitas	Instituto Superior Técnico, Universidade de Lisboa, Portugal
Marco Leonessi	University of Bologna, Italy
Maria van Zyl	University of Twente, Netherlands
Mariana Oliveira	Instituto Superior Técnico, Universidade de Lisboa, Portugal
Marie Baratto	Université de Liège, France
Mary Conlon	National University of Ireland Galway, Ireland
Meetal Kakad	Akershus University Hospital, Norway
Mohammad Hossein Reihani	Western University, Canada*
Naila Mekhaldi	Polytechnic University of Hauts-de-France, France
Nicola Irvine	University of Strathclyde, United Kingdom
Paula Medeiros do Valle	University of Sheffield, United Kingdom
Rosa Lucchetta	Universidade Federal do Paraná, Brazil*
Saidi Ons	Université Jean Monnet, France
Sirma Karakaya	Middle East Technical University, Turkey
Tommaso Giovannelli	University of Rome, Italy

\* Non-EURO participant.

## 4 Social program

### 4.1 Scientific-related social activities

During the Summer School the students had multiple opportunities to meet and chat with very experienced scholars, practitioners and experts working in OR and the interfaces of OR and health. Selected social activities are as follows:

Day	When	Opportunities
1	Diner	Meeting with the Heads of the Portuguese and Spanish OR Societies (José Fernando Oliveira and Emilio Carrizosa) and the President of the Summer School Scientific Committee (Sally Brailsford)
2	Welcome session	Meet the representatives from IST (the Presidents of Técnico, of the Engineering and Management Department of Técnico, and of the Center for Management Studies of IST) and from the Universidade Publica de Navarra (representing the university, Fermin Mallor)
2	Diner	Social challenge (with awards): Who knows who in the summer school?
3	Diner	Social challenge (with awards): Who knows more about OR?
4	Diner	Social challenge (with awards): Medical ethics – who wins the argument?

2 -8	During the lectures	Meeting with several OR and health experts and our Sponsors' representatives from Janssen and NOVARTIS that played the role of advisors to the challenges, as well as members of the Organizing Committee.
8	Lunch and farewell	Meeting with the Co-Coordinator of ORAHS (Inês Marques and Roberto Aringhieri) and with representatives of the summer school hospital and pharmaceutical partners

## 4.2 Social day

The social day took place on the 5<sup>th</sup> September. In the morning, in the Ericeira picturesque town on the western coast of Portugal (about 35 km northwest of Lisbon), the participants had the opportunity to spend some time at the beach, walk around and watch and/or do some surfing. In the afternoon, there was a visit to the National Palace of Mafra and see some of the nearby attractions. This Palace, together with the Basilica, Convent, Cerco Garden and Hunting Park (Tapada), form the Royal Building of Mafra which was inscribed on the 7<sup>th</sup> of July 2019 as a UNESCO World Heritage Site.

## 5 Communication

Information of the school, previous and during the event, was made available through the school webpage at <http://orvalueinhealth.tecnico.ulisboa.pt/>. Questions and comments regarding the school could be sent to the school email account [orvalueinhealth@tecnico.ulisboa.pt](mailto:orvalueinhealth@tecnico.ulisboa.pt).

Previous to the summer school, several electronic documents, including informational and scientific bullets, were produced and disseminated across participants.

During the summer school all relevant daily information – both scientific and social – was made available in the webpage and was also disseminated in an interactive format in the SLACK web platform.

A short report of the summer school has been prepared for the IFORS News publication – it is planned to be published later in 2020.

## 6 Survey about the school experience

Twenty-seven out of the 32 school participants replied to an anonymous survey carried out to collect feedback about the school. We underline three key messages:

1. above 80% of participants strongly agreed or agreed that the content of the school met their expectations and enabled them acquiring new knowledge;
2. above 80% of participants felt more encouraged to consider other approaches to their research, as well as more enthusiastic about bridging the gap between research and practice;
3. and almost all participants found the school useful for networking and stated to plan to keep in touch with other participants/lecturers. Regarding the challenges, participants highly recognized both the opportunity to



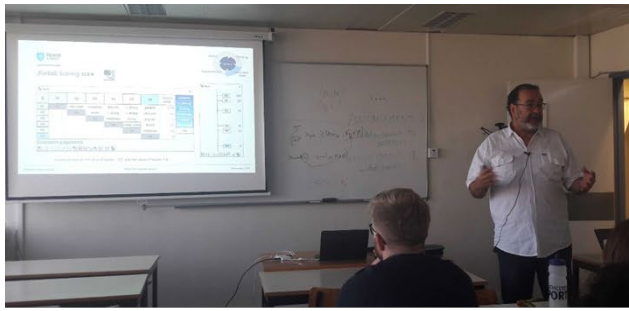
work within a multidisciplinary team, and the contact with the different advisors to be important for their value-based health care learning process. However, participants also commented on the time pressure they were under to meet the challenge which is a learning to be considered in future events in order to find real challenges with adequate complexity, and feasible within the school time.

Key results from the survey are available as an appendix to this document.

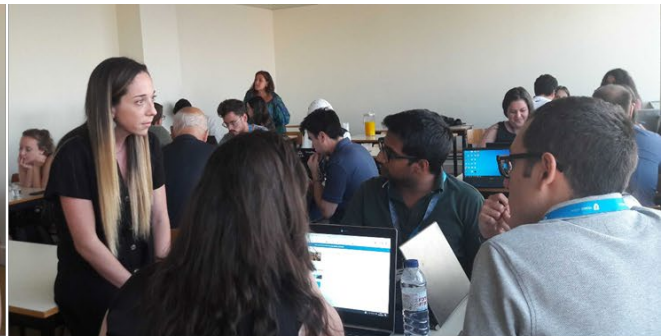
## 7 Quick tour of the the school in pictures



All school participants



Pictures of lectures and classes



Work on case studies and challenges, and interacting with health experts



Social events, around the clock (in Ericeira beach, celebrating awards from diner challenges, visiting an old fashion hospital, and the Heads of SEIO and APDIO)

## 8 Financial report

TBC...

### Appendix: Results from a survey to participants

In this section we present results from a survey carried out to all participants, including lecturers and members of the organizing and scientific committees, which should be taken into consideration when analysing the results of this report.

#### Introduction

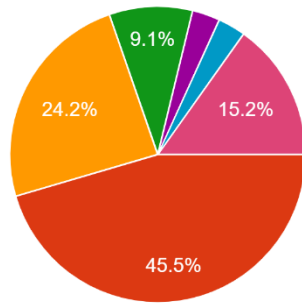
This survey aimed at collecting participants views about the 'EURO PhD Summer School Operational Research for Value-based Health Care'. The survey was organised in 9 sections - each focusing on a different thematic and was anonymous. The overall aim of the survey was to help the Organising and the Scientific Committees to reflect about the work done, to report the result of the school to EURO and ORAHS, as well as to inform future event organisers. This report is organised by the same 9 sections and enumerates all the questions done.

In this survey report, we include the 33 responses collected – see 'General' to know the categories of respondents. Out of these 33 responses, 27 were from students from the school. The survey was available between the 17<sup>th</sup> of September and the 15<sup>th</sup> of October 2019.

#### General

I attended the summer school as (mark the relevant category):

33 responses

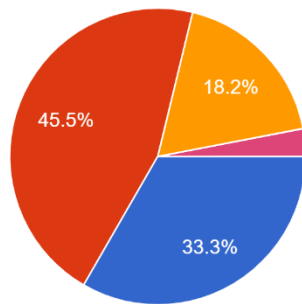


- Speaker
- 1st-year PhD student or researcher
- 2nd-year PhD student or researcher
- 3rd or 4th-year PhD student or researcher
- 5th-year PhD student (or more) or Pos...
- Advisor
- Organizer
- Scientific Committee
- Other (please specify)

**Overall summer school feedback**

I acquired new knowledge

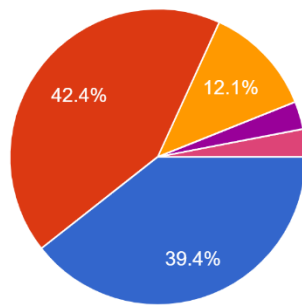
33 responses



- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Don't know/Don't want to answer
- Does not apply

The content met my expectations

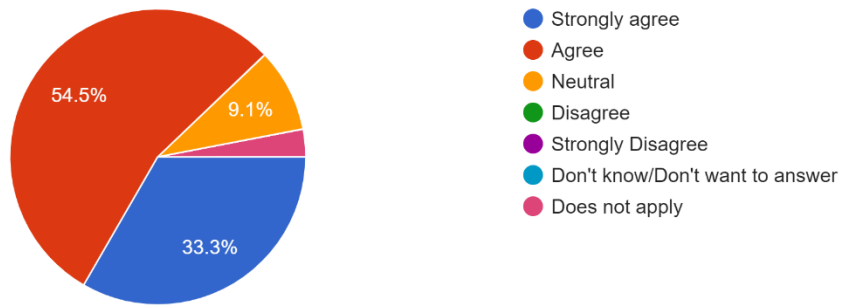
33 responses



- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Don't know/Don't want to answer
- Does not apply

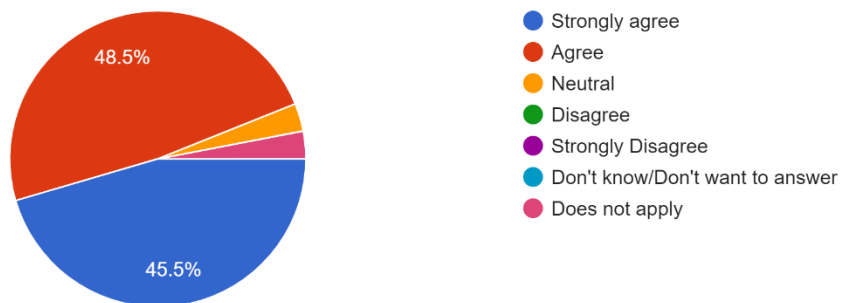
Lecturers generally communicated ideas clearly and effectively

33 responses



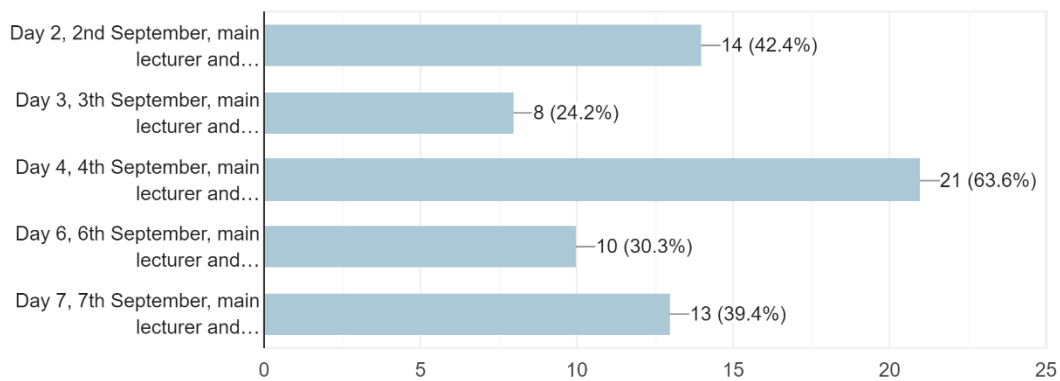
Lecturers were engaging and inspiring

33 responses



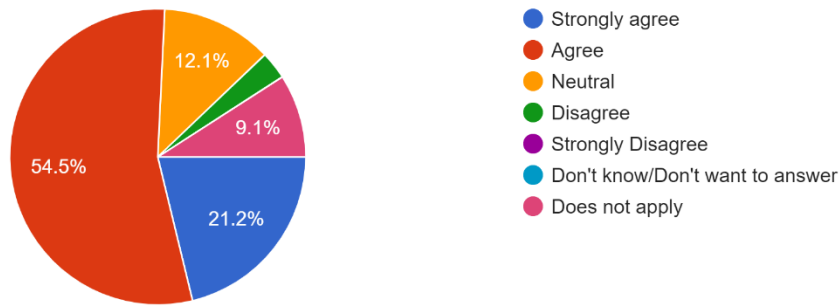
Which lecturing topics did you like the most? (Please select the two most preferred topics)

33 responses



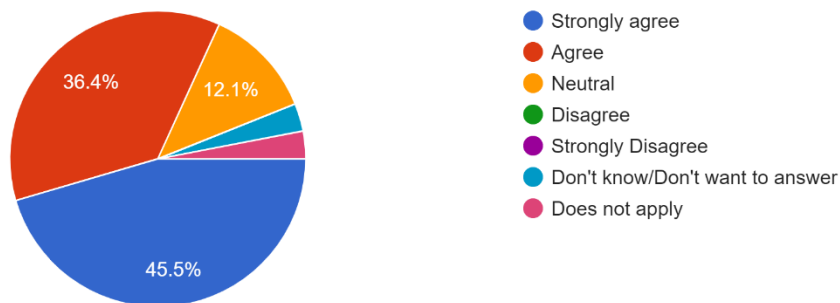
The content encouraged me to consider other approaches to my research

33 responses



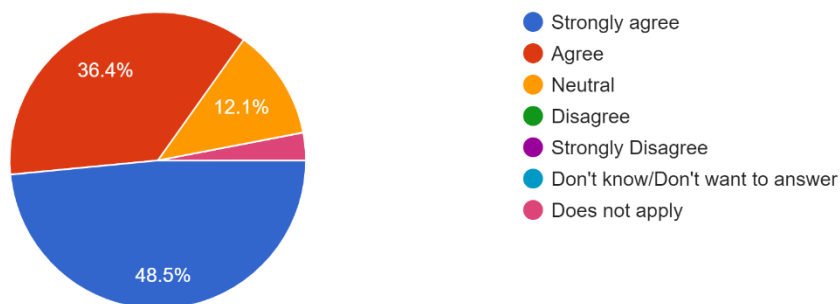
I feel more enthusiastic about healthcare OR

33 responses



I feel more enthusiastic about bridging the gap between research and practice

33 responses



Please comment on your overall feedback about the scientific program of the school

16 responses

Although my research is mostly based on theoretical curiosity, the school learned me everything about actual implementation of models in health care. It covered a wide range of subject with a lot of interesting case studies. Besides this, all lectures of the other PhD students were very insightful and motivational. I'm glad I attended this school, I hope it will be organised again for the next cohort of new PhD students.

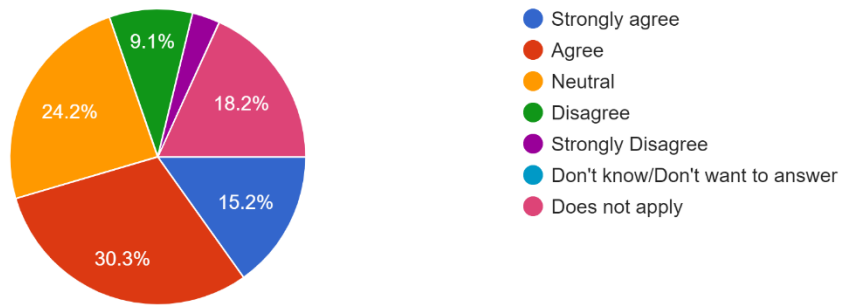
I greatly enjoyed every one of the lectures and feel as if I have gained a lot of insight into some of the characteristics and oddities of doing OR in health care. However, with my project being focused on value-

<p>based health care I was hoping for a more of a focus on VBHC and how the "VBHC way of thinking" affects OR.</p> <p>What I got out of the summer school was instead an idea of the common challenges for OR in health care (be it VBHC or regular old HC :-)</p>
<p>Despite the "negative finding", I am very happy as it helped me finally make the decision to switch my focus to the question of how to get OR implemented in health care.</p>
<p>A small note to the scientific program is that I think that tutorials were not hands on enough and too "class taught" where you as a student did not really get to "play" with the software. Keeping in mind that most students have done some sort of linear programming and many also know GAMS, the session was not really of value to many of the participants. I think that the GAMS tutorial should instead be a newer technology e.g. like Julia/JuMP and then taught in a way that people could solve problems at their own pace.</p>
<p>The sessions were very long, and the information could have been condensed into a smaller time frame. This would have allowed for more time to work on the project, or to offer more tutorial style practical sessions.</p>
<p>I think, it was really well organised, showing the hole picture and complexity of health care problems and how to face it</p>
<p>It was a little heavy but also rewarding, not only from a scientific point of view but also from the point of view of getting to know other people from different places but with similar concerns and in the same work phase.</p>
<p>I expected more about economic evaluation and value-based health care.</p>
<p>The scientific program was well designed and covered all the main topics that have been recently addressed in the literature on OR applied to Health Care.</p> <p>I guess it would have been nice to see more about health economics.</p> <p>Even though I was excited to engage in every activities I think sometimes it was a bit tiring to do so, especially during dinner time.</p> <p>Apart from that, I think everything was amazing. Very organised, inspiring lectures with consistent content, helpful organising committee, good accommodation. Will definitely recommend for colleagues.</p>
<p>I feel perhaps more tutorials/lab sessions would have been beneficial, giving us a chance to actually use new software or methods and breaking up the lecture sessions.</p>
<p>I wish I had done this at an earlier stage. It was a great mix of theory and application.</p>
<p>It was engaging and diverse.</p>
<p>The planning was well done and very rich.</p>
<p>I really appreciated. It was varied and nice. I little bit too heavy though.</p>
<p>The school was very beneficial in terms of reflecting different problems in healthcare systems and approaches that combine OR tools with the practice. However some lectures did not make any sense to me since I took the related courses and already have the background about the topics. (For example: simulation and Gams.). Instead of theoretical background I would prefer to learn more about the use of these tools in real life. As another criticism, I think challenges were really good in terms of understanding how the things work in practice but I think the study time for the challenges should not have been at the end of the day. The school was very demanding and we were so tired to focus on the challenge. That is why I believe nobody could give enough importance to challenge. Instead study time for the challenge should be set to a morning session. Lastly,</p> <p>the school can be extended to 8-9 days and the school hours can be shortened because from 9:00 to 19:00 attending the lectures actively is not so easy.</p>
<p>Rich and diverse.</p>
<p>I might think of having the challenges schedule changed in one day, or in the beginning part of each day since they needed more creativity and energy.</p>

### Challenge competition feedback

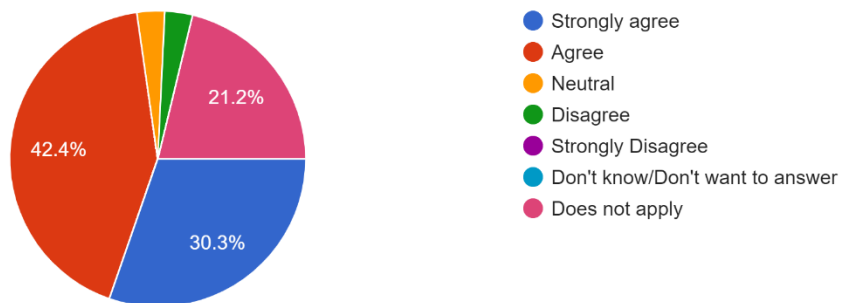
The challenges were comprehensive

33 responses



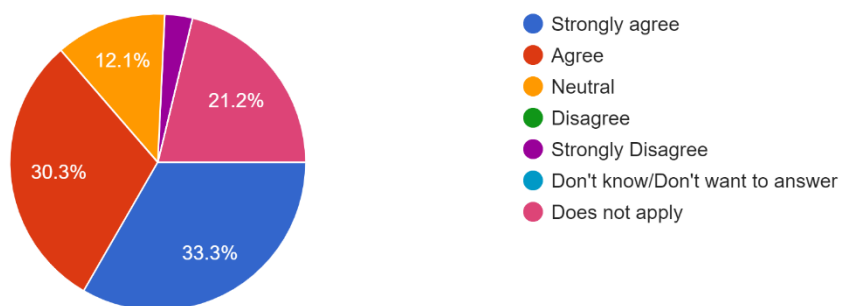
I enjoyed the opportunity to work within a multidisciplinary team

33 responses



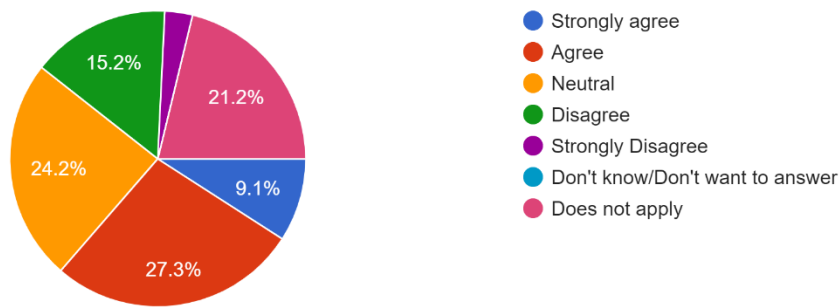
I found the contact with the different advisors valuable for the challenge itself and for the overall Value-based Health care learning process

33 responses





The challenges were an opportunity to apply and further explore the new knowledge acquired  
33 responses



**Please comment on the challenge competition**

9 responses

<p>I agree it is generally a very nice teaching strategy to have a practical application of the stuff that you have you been taught. However, I think that these challenges ended up having a very negative impact on the learning experience of the summer school.</p> <p>From a practical point of view, having 1-hour to form, storm, and norm and then perform (Tuckman) on the challenges, at the end of a very long day with new people, places, and interesting but long lectures, was simply excruciating. This left many people with having to do work late into the night, really inhibiting the socialising, which is, in my opinion, one of the key elements of a summer school like this. As an example, most people were labouring with PowerPoint Saturday night, rather than saying a proper goodbye to each other and Lisbon. I would much rather prefer a full challenge day, that leaves time for getting properly introduced, giving the challenge material a good read-through and then brainstorm on how the issues can be tackled.</p> <p>With the timeframe in mind I think the challenges was much too comprehensive and posted in way were many group were in doubt about what was expected of us. This made it very difficult to ask good questions and I had the impression that we got answers pointing in every direction depending on which of the advisors we spoke to.</p>
<p>There was not enough time to work on the challenges as they were scheduled for the last portion of the day which was frequently cut short due to overrunning. The opportunity to discuss the challenges with the advisers was great, but this then took up most of the time set aside to work on the challenges, meaning we had to work on them outside of the already very long days.</p> <p>This short time frame also didn't allow us to apply any of the new knowledge we acquired.</p> <p>I really liked the idea, but for future i think it would work better to have one full day dedicated to the challenges.</p>
<p>There was not much time to do a deeper work and be able to further apply the knowledgwe acquired, but despite these circumstances, it was really good to work in the multidisciplinary teams that were formed.</p>
<p>The challenge competition provided a good opportunity to improve our teamwork skills, which are of utmost importance in our research career, and to share our knowledge among the team members. Yet, we felt that the time for doing and properly discuss the challenges could be longer. In particular, regarding the cancer pathway challenge we found that the description of the challenge by the Janssen representative could be more aligned with the respective word document.</p>
<p>Me and my group worked on oncology challenge and as we didn't find that the expected results were very clear, we have spent some hours discussing that, which was complicated because it was tiring to work on that by the end of the day and we didn't have many days to do so.</p>
<p>I think not enough time was allocated during the day to the challenge, as often the last session would run over, and also as it was at the end of very long days, I was tired and less productive and creative. Perhaps a</p>

whole day set aside for a challenge would be a good idea - with the presentations the same evening, so there was less stress and work involved outside of the already long busy days.

To me, it was not necessary to add a challenge and work group in addition to the already busy schedule

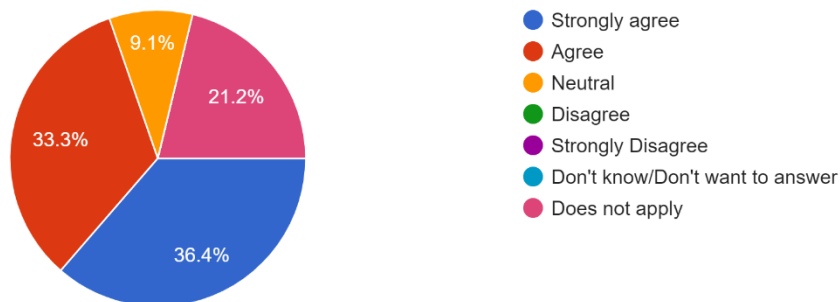
Interesting but the time allocated to work on it was too short

the timing - end of the day - was not so good. Also, it was too time consuming if some wanted to come up with a good work. For example, eventhough our team won the prize, we couldn't present the whole work - which was included tool (software) to predict the risk of no shows, and appointment suggestions - due to the huge work we had to do in terms of cleaning the initial dataset in the beginning.

### Students' presentations feedback

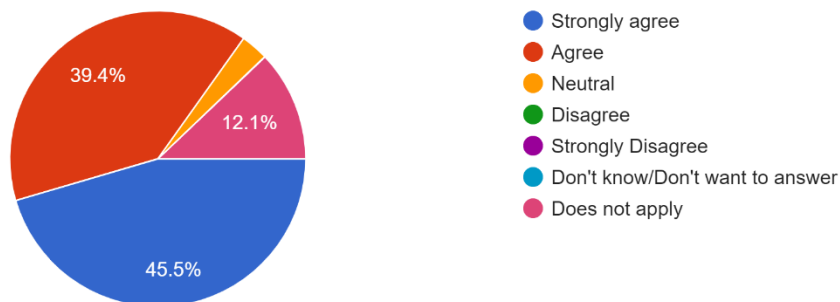
I enjoyed presenting my work and received valuable feedback

33 responses



I enjoyed listening to other students' presentations – they were an opportunity to learn more.

33 responses



### Please comment on the students' presentations

10 responses

This part is essential in the summer school, a PhD students research shows indirectly the whole research of the group that PhD student is part of. Via this presentations we got a total overview of almost all recent research being done in VBHC and OR, very insightful!

I think this was a very valuable part of the school. Unfortunately i think that the five minutes was much too short. This was both as a presenter but also as a listener, where you have to understand everything in a very short timeframe. Adding to this many students tried to cover to much and slides flew past your eyes like scenery on a bullet train.

I think the solution might be to create parallel sessions or something similar.

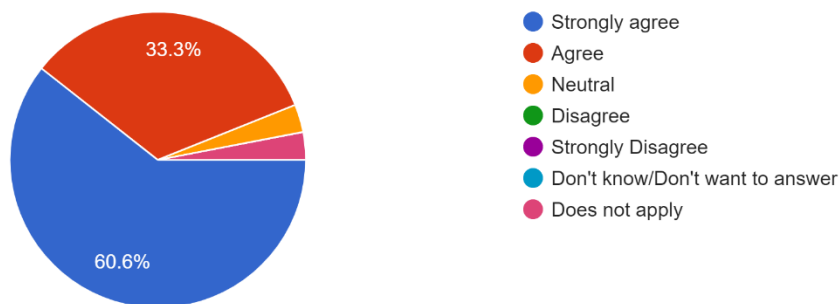
The student presentations were a really great way to find out more about what everyone was researching, and the time frame of 5 minutes to present and 5 minutes for feedback was great!

I think, one of the valuable things is to see the different scopes and approaches for, sometimes, the same problem.
There was not much time for us to present, but I think it was a good exercise to learn to be concise.
It was a good opportunity to know which topics are other students investigating within the broad field of OR in health care.
It was difficult to absorb information at the end of the day and the presentations were always so intense and fast.
Great! 10 minutes would have been nice too but I understand that because of the large number of students it might not be possible.
Presentations were good to gain idea about diferent studying areas but 5 minutes is not enough to understand the problem definition and the solution approaches
Inspiring and motivating

### Networking feedback

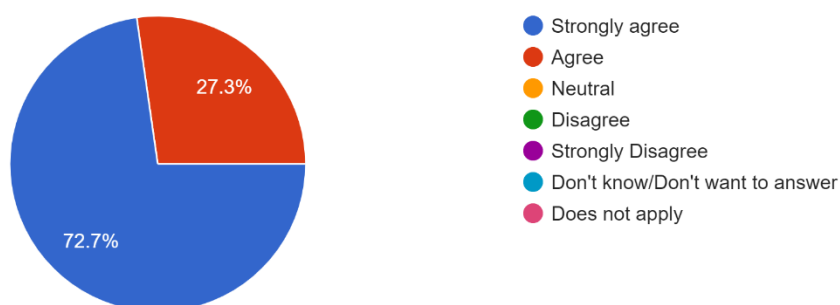
Summer school was useful for networking

33 responses



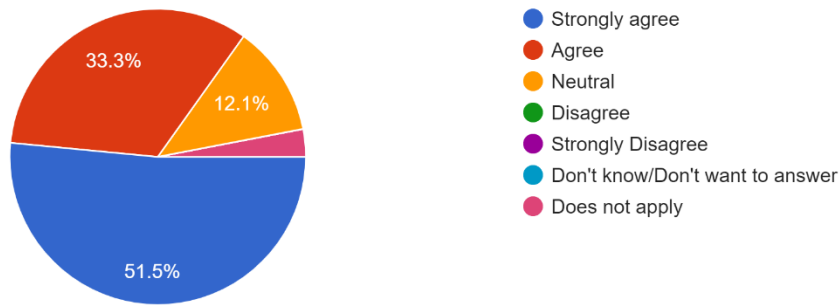
I enjoyed the diversity in participants' backgrounds, research areas and countries

33 responses



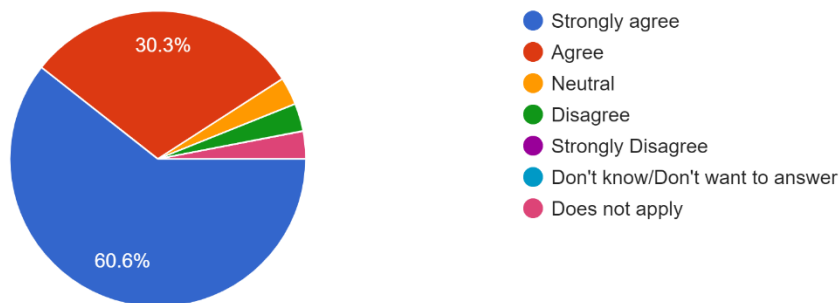
I had stimulating discussions with other participants/lecturers

33 responses



I plan to keep in touch with other participants/lecturers

33 responses



**Please comment on networking**

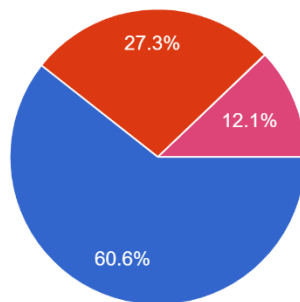
5 responses

Ask me over 10 years, then I can comment on how much the connections of this summer school brought me. The social day is essential for this! However, all lecturers were clear: networking will enrich you in a most valuable way, and I think that is true in every way.
I greatly enjoyed meeting everyone at the school and only regret that there much to little time to socialise :)
In my perspective is one of the main advantages of participating in a PhD summer school. Having the opportunity to share knowledge and engage in fruitful discussions with your colleagues, and eventually establish potential partnerships for future work, constitutes an invaluable asset for a young PhD researcher.
I have found a bit difficult to interact or keep in touch with other students in general (few exceptions). I think it would have been nice to have an informal environment on more days even though the social day helped on that.
It was a fantastic way to meet a diverse group. Several life long friends made.

## Organization feedback

The summer school was well organized/executed

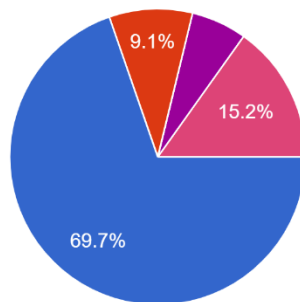
33 responses



- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Don't know/Don't want to answer
- Does not apply

The registration fees were affordable

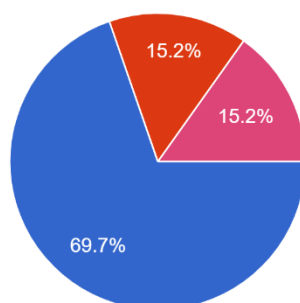
33 responses



- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Don't know/Don't want to answer
- Does not apply

Sufficient notice and general information were available in advance via various media

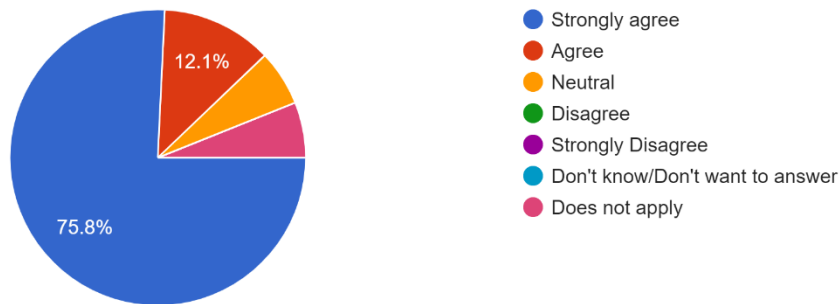
33 responses



- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Don't know/Don't want to answer
- Does not apply

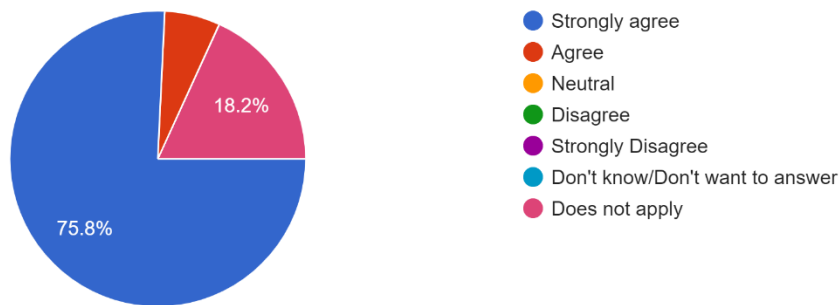
The Slack platform was useful to enhance communication among participants and between participants and organizing committee

33 responses



The summer school organizers/administrators were accessible and helpful

33 responses



**Please comment on networking**

10 responses

They are the best! The fact that all accommodations and dinners were planned added a lot of value in two ways: there was more time to focus on the school (because you did not have to think about where you were going to eat or sleep) and everybody stayed during dinner, making networking very easy. Every dinner went as planned and every day was precisely filled with interesting presentations and time to network. They communicated in a very nice, direct and also modern (slack) way with us. (I only want to note that I would have liked one more hour of sleep per day). The committee was very engaged in the whole process, were always there and I learned a lot from them and always could ask any question. (As a side note: The fee was extraordinarily affordable, so, I did not have to think about if it was worth it, because it was worth 10 times as much.)

I think that the organising committee did a fantastic job. The school was very well organised. The school extremely affordable, the rooms were nice, and the food was great (I was expecting something on a very different level when I saw the registration fee ;))

I think everybody was working very hard, but I would like to give a special thanks to Monica who seemed to be everywhere at once!

In my feedback I might sound a little harsh, but it is only because I believe that good work deserves good and constructive feedback.

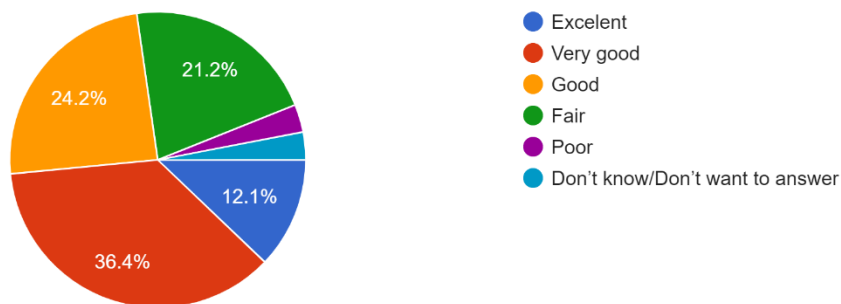
The organisation was excellent! From the information we received before arriving, to small requests being met and continuous updates.

The slack platform worked exceptionally well, especially for the group challenges.
thank you for everything. Everyone was there to help us if necessary. Really well organised in my opinion.
Great work!
The Summer School was very well organised. Perhaps more time could be allocated for visiting Lisbon.
It would have been nice to receive some updates in more advance but I guess it can be complicated sometimes. Apart from that, everything was perfect for me
Could not have been more thoughtful and considerate.
Perfect :)
Great organisation!

## Services feedback

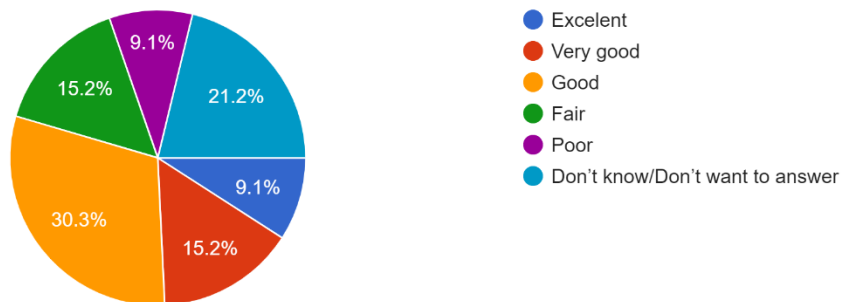
### Classrooms

33 responses



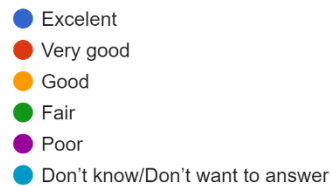
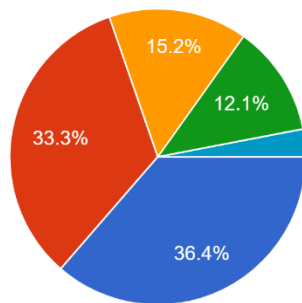
### Accommodation

33 responses



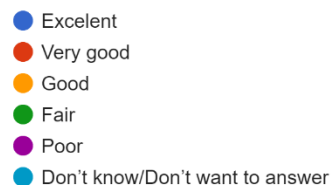
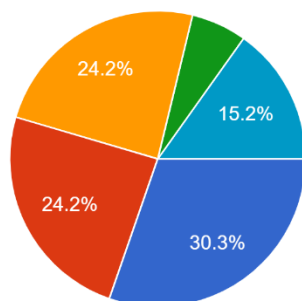
Food

33 responses



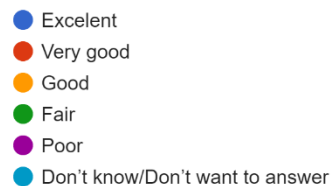
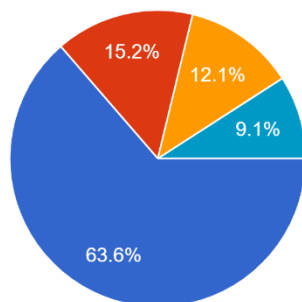
Transportation

33 responses



Social day (Ericeira and Mafra)

33 responses



**Please comment on services**

8 responses

Classrooms were big enough (and every problem like the speaker not being audible was solved before I even noticed it! Good job comity!) Besides the mosquito's, the accommodation saved me a lot of money and was nice to have all participants together. The food was every time on time and more than enough for everyone. Transportation was nicely described in the booklets. The social day is essential for networking, the most important part (as most lecturers put it) of the school!

The food was great and the social day was very nice. The only problem was the temperature and air quality of the afternoon classroom, which made it difficult to concentrate for the first couple of days.



<p>The classrooms were a bit uncomfortable for how long we were sitting in them.</p> <p>The accommodation was fine, but it would have been nice to have clean towels half way through the week.</p> <p>The food did its best to accommodate for the dietary requirements, which i am grateful for, but there was little variety, and no suitable options provided during the breaks.</p> <p>Transportation to the social day was good. The pre-loaded travel cards were much appreciated, and the transportation was easy to use. However the distance between the accommodation and the school was too far.</p> <p>The social day was great! very well planned and organised, with lots of activities but didn't feel like too long of a day, as having dinner back near the accommodation was a good choice.</p>
<p>Residence was old and a bit far away but for the total price of 200€ more than okay :-)</p> <p>Dinner was good, lunch was okay</p>
<p>The only problem I faced with services was regarding to the temperature of both the classroom due to the air conditioner issue and at the accommodation due to the lack of a fan or something like that, but both bearable. Social day and the food of all days were perfect</p>
<p>The accommodation was very far from the venue, which was sometimes a struggle, making the days longer and more tiring.</p>
<p>The afternoon room was a bit small.</p>
<p>Next time give us 1 or 2 afternoons to see Lisbon individually :)</p>

### Last questions

**How did you hear about EURO PhD summer school 'Operational Research for Value-based Health care'?**

22 responses

Personal network – 40%

Supervisor – 27%

EURO website – 14%

ORAHs 2018 – 14%

Belgian OR society – 5%

**Was the opportunity to receive European Credit Transfer and Accumulation System (ECTS) important to consider applying to this summer school?**

13 responses

Yes – 15%

No – 54%

NA – 31%

**How does this summer school compare to other similar student meetings that you have attended?**

20 responses

<p>Till now, there is nothing comparable for me. The only note I can make is that it was very intense, every minute of the day was used for lecturers, assignments or networking. Every minute was well spend, I like that.</p>
<p>Nothing similar to compare to.</p>
<p>It was my first real meeting</p>
<p>The scientific programme was much better than at other similar events.</p>
<p>I have never been in other student meeting, so i think, i can not answer this question, but for me is clear that it was a great decision attending the Summer School</p>
<p>It was heavier but promoted more interactions between students</p>
<p>My first one</p>

Lower, considering the lack of relationship of the content with the school name (OR for value-based health care)
It was the first student meeting that I have attended
It was my first
No similar events attended
much better
Better
It was more demanding (it is not a critique).
It was my first time
It was more efficient to be in relation to researchers working on Health care in general
It was very demanding but at the same time more beneficial compared to the others. Also I believe there were more chance to make new networks.
In this summer school the interaction with the students is very strong.
This is my first one
More organised

**Do you consider the opportunity to contribute with a paper to a special issue to be organised in an attractive operational research for health care journal?**

14 responses

Yes – 72%

No – 14%

Maybe – 14%

**Suggestions for future meetings? How could we improve your experience?**

14 responses

Try to repeat it like you did it this year, I think that is already a challenge on itself. However, the challenge was very soft OR and I'm more in actual theoretical studies and learning about the mathematics behind it. But, I would say that this is not applicable, because some participants had (almost) no experience in mathematics.
I think that making more time for socialising and for everyones brains to relax and absorb all the new knowledge :)
I would like to study more theoretical aspects of the discipline
More tutorials, slightly shorter days and challenge on one day.
It should be better if the accommodation is closer to the lecture venues
Also a little bit of free time ;)
Dissemination of the content of each class before application
Suggestions: more time for the challenges, more involvement by the advisors, more time for leisure (visiting the city).
Maybe supporting more informal meetings or activities to help people interact
Slightly shorter days and evening food closer to the accommodation.
Keep contact with participants in conferences of common interest. To do so, there should be a platform where we could all connect.
Add more practical exercises
To me, the schedule was too busy. Otherwise it was really great!
adjust the registration fee for those coming from outside Euro

**If you met the organiser of a future meeting, which requests would you do?**

9 responses

I think it would be better to offer students the context of the challenge and a better description of the variables
More mathematics and (hard) OR techniques and in depth.
Do a simpler challenge. Make the tutorials more hands on and less "class taught". Make room in the program to breathe.
The schedule was quite intensive and we did not have a lot of time to work on the challenges
Social Day in Lisbon would be good.
Have more time to discuss the challenges with my team
I think 6 days is long enough for the school. More hands-on approach workshops. In one summer school I attended we had a workshop delivered by Sally where we would experiment with a system dynamics software.
- To have more than 5 minutes to talk about our work - to organise challenges more affordable considering the time we have and the dynamics into team working (it need time to build a productive team)
Instead of staying with another I would like to stay alone even the accomodation fee increases. Maybe two 35someone35t offers can be made: fee for staying with 35someone and fee for staying alone.

**If you had the opportunity to add some extra topics to the school (for OR for value-based health care), which two topics would you add?**

12 responses

Implementing a Linear Programming to make a schedule for an actual hospital and a presentation from multiple doctors or pharmacist who tell about what they expect / want from OR, data analytics and mathematics.
maybe something about data analysis or data parsing (very useful for first year PhD students) and maybe more multidisciplinary work experience?
A session on what value based health care is.
Value-based health care (data collection, analysis, benchmarking, cases involving technology or provider payment)
Behavioral OR, Game Theory, Decision Support Systems
Health economics
OR for biology and theoretical physics
Maybe some mock stakeholder interviews with an expert present to gather consensus on objectives and value?
OR for assisting in strategic and policy decisions.
The application of these methods on a real case study and involve the participants in this work, New challenges of OR for value-based health care
Because my thesis topic is related with stochastic programming I would like to add this topic. Also some data mining topics can be included to show how can we collect and analyse the data when we are working with a company and /or hospital.
Markov Chains, Game Theory