

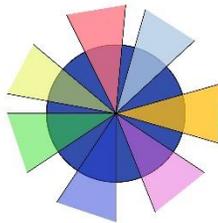
# **Book of Abstracts Volume 38**

**Euro conference Athens 2021**

**Stream Ethics in OR**

**on Zoom**

Dorien DeTombe, Alec Morton and Gerhard-Wilhelm Weber (Eds.)



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## Ethics in OR

### **The stream Ethics in OR**

#### **Operation Research and Ethics, Societal Complexity and Governance: The EWG OR and Ethics and Societal Complexity**

Since 2017 two Euro Working Groups (EWG), the EWG OR and Ethics and the previous EWG Methodology of Societal Complexity (MSC), went together due to a significant overlap of the content of their research field. Both EWGs focus at ethical subjects in doing research in the way of how to make the world a better place to live for all people. Giving that each researcher has only one life, the members of both these research groups decided to dedicate their lives, research capability, brains and efforts to improve the living conditions of all the people in the world. This idea of research often includes criticizing issues and circumstances that abuse privacy, like unethical use of data mining for companies, Google and Facebook, abuse health of people by the alcohol and tobacco industry, criticize unethical labor conditions like child labor, improving the position of women by emphasizing education of women, especially in developing countries, by being financial independent, by forbidding child marriages, and stimulate equal pay for equal jobs given that women rights are human rights.

Reflecting and handling these kind of complex societal ethical problems has been the focus of the researchers belonging to the EWG OR and Ethics and Societal Complexity. The latter one turned from a European to a worldwide one. In most complex societal problems some persons benefit while most people suffer. Given this reality the researchers of our EWG research group of OR and Ethics and Societal Complexity like a responsible bound of minimalizing the personal benefit of those who profits from complex problems, like the banks who created the credit crisis and the pharmacy industry who benefited for dangerous drugs and to maximize the situation of all people in a social based democracy where all people can be protected by the rule of law of a social based democracy.

The EWG Methodology of Societal Complexity (MSC) was a part of the International International Research Society on Methodology of Societal Complexity (MSC), founded and chaired by Prof. Dr. Dorien DeTombe, created in 1993. The International Research Society on Methodology of Societal Complexity (MSC) and the EWG Methodology of Societal Complexity (MSC) has since 1993 organized many conferences in all continents all over the world and published many books and articles in scientific journals, see <http://www.complexitycourse.org>. The EWG Methodology of Societal Complexity organizes each year special sessions on this topic on the EURO conferences of the Association of European OR societies along with the OR and Ethics.

Methodology of Societal Complexity focuses on methodologies, methods and tools for analyzing, structuring, guiding and evaluating complex societal problems. Complex societal problems are often policy problems that can occur in many fields, like in the agro-industry (water pollution by too much manure and fowl plague), in the transportation sector, in healthcare (Malaria, HIV/Aids, Flu), in water affairs and in economy (credit crisis). The field focuses on handling local safety

problems like large city issues and natural disasters as flood and hurricanes and global safety problems like war and terrorism. Although many of these issues have different causes, they have so much in common that they can be approached in the same way by using the Compram methodology, a methodology based on the use of experts and actors and the voice of the people in a democratic way.

Complex societal problems, as such, are unstructured, dynamical, constantly changing and have a large impact on society on macro, meso and micro level. Handling complex societal problems needs a special multi-disciplinary approach. The content knowledge comes from content experts. The process knowledge comes from facilitators. The power is in the hand of actors. The attention of the research of Methodology of Societal Complexity is on the methods and tools facilitators need for guiding these kinds of problems. The facilitators use methodologies specially created for the field of societal problems combined with methods and insights derived from fields like medicine, law, economics, societal sciences, methodology, mathematics, computer sciences, technology, engineering sciences, socio-cybernetic, chaos theory and operational research combined with content knowledge. Often a combination of methods is needed as is prescribed by the Compram methodology for handling complex societal problems.

The Operation Research (EURO) branch OR and Ethics: Operational Research and Ethics, was created in 2001 at EURO XVIII by Prof. Dr. Jean-Pierre Brands of the Free University of Brussels, Belgium. The goal of OR and Ethics is creating increasing interest on ethical issues in OR research, teaching, consultancy and practice. This can be reached by organizing OR and Ethics on the EURO and IFORS conferences.

On the 29<sup>th</sup> EURO conference in Valencia, OR and Ethics and Societal Complexity organized thirteen lectures and an Award session for the best paper. Former awards sessions took place in Rome (2013), Glasgow (2015) and Poznan (2016).

Co-Chairs of the EWG OR and Ethics and Societal Complexity

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Continuous Optimization, EWG OR for Development

Euro working groups related to EWG OR and Ethics and Societal Complexity are:

EWG EUROPT

EWG EURO Continuous Optimization

EWG OR for Development

EURO MCDA

Keywords: Governance, Methodology, Complex Societal Issues, Decisions, Sustainable  
Development, Healthcare, Economy

Amsterdam,

Dorien DeTombe, Alec Morton and Gerhard Wilhelm Weber

**The stream Ethics in OR within the conference in Athens in 2021 has several Sessions**

**A Ethics, health, medicine and food**

**B Digital Ethics & Governance**

**C Ethics, Societal Complexity and Governance**

**D Modelling the value of medicines, vaccines and social interventions to tackle infectious diseases 1**

**E Modelling the value of medicines, vaccines and social interventions to tackle infectious diseases 2**

Subsequently we present these sessions along with their abstracts.

## A Ethics, health, medicine and food

### **The impact of External Reference Pricing on the health care system: a hybrid simulation exploration of equitable drug access, affordability and availability**

1. **R Kazakov**

University of Strathclyde

2. **Susan Howick**

Dept of Management Science, University of Strathclyde

3. **Alec Morton**

Management Science, University of Strathclyde

#### **Abstract**

External reference pricing (ERP) regulation and its effects on equitable drug access, affordability and availability in the EU are explored using a hybrid scenario simulator. Two main counteracting behaviors are highlighted: one is connected to the goal of drug price regulators in using ERP to control medicine prices, while the other is connected to the drug suppliers counter behaviour to exploit or avoid the price regulation rules. This tactical game could result in undermining key health care objectives to provide equitable and affordable drug therapies to patients due to drug market entry delays, drug market exits or propagation of excessive drug pricing. The authors have developed a hybrid agent based and system dynamics scenario simulator to explore the effects of the ERP regulation. The construction of the hybrid simulation model was supported by the use of Resource Agent Maps, a novel qualitative modelling technique designed to analyse the interactive behaviour of agents and resources in a complex adaptive systems environment. The simulation results demonstrate that the intention of the ERP regulation to provide affordable medicine prices results in the counter effect of drugs overpricing or drugs unavailability. This brings forward to health care public agenda the question of how to maintain a balance between affordability and availability, and the challenge how to improve drug pricing regulation, in order to resolve this ethical problem and achieve balance.

**Keywords:** Behavioural OR; Agent Systems; Ethics

## **Interventions on the French wheat-to-bread food value chain and their effects on equitable value distribution: insights from a policy scenario simulator**

1. **Seán McGarraghy**

Management Information Systems, University College Dublin

2. **Rossen Kazakov**

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3. **Elise Huber**

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5. **Mircea Gherasim**

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7. **Pierremarie Aubert**

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### **Abstract**

This paper reports on the problem of procedural and distributional fairness along the French wheat-to-bread food value chain and the specific hybrid approach of qualitative and quantitative modelling and simulation which was undertaken to address the above issue from the perspective of socioeconomic sustainability of the supply chain system. The paper illustrates how techniques like cognitive mapping and agent resource mapping are used for system analysis, resource flows and agent rules definition. Secondly, we explore how these maps are transferred into a policy scenario simulator for policy experimentation and optional recommendations. This work is part of an EU-funded project focused on understanding European food value chains. Food value chain systems are viewed as complex adaptive systems emerging out of market agents' interactions, resource flows and market price setting. The goal of this hybrid agent modelling approach is to experiment and test various what-if policy and market interventions and to inform the development of transition pathways towards more environmentally sustainable and socially fair food value chains. This paper and the proposed scenario simulator include insights about food value chain actors' behaviour, the factors that influence actors' decisions connected to changes in supply and demand, the interactions among themselves and with the environment, and the factors influencing fair interrelations and fair value distribution.

**Keywords:** Ethics; Agent Systems; Sustainable Development

## **Simulation exploration of the North Italian tomato food value chain from the perspective of equitable relations and value distribution among market actors**

1. **Gianandrea Esposito**

ART-ER

2. **Rossen Kazakov**

Management Information Systems, UCD

3. **Antonella Samoggia**

University of Bologna

4. **Seán McGarraghy**

Management Information Systems, University College Dublin

### **Abstract**

Food value chain systems are viewed as complex adaptive systems emerging out of market agents' interactions and market price regulation; Managing such systems is explored through the stages of mapping their behaviour and then simulation of intervention scenarios. This work is part of an EU-funded project on understanding food value chains. We report on initial work on developing a qualitative food system model of the North Italian region tomato value chain market, applying a complex adaptive systems perspective. The paper focusses on the problem of fairness related to price setting and price distribution, and illustrates how techniques like cognitive mapping and agent behaviour mapping are used for system analysis and agent rules definition. The goal of this qualitative agent modelling approach is to support the conceptual, functional and technical specification for the quantitative modelling phase. This paper explores further how a value chain actor (agent) will behave in practice, what actors are there in a particular value chain, what influences their decisions (prices, regulations, etc), what are their interactions among themselves and with the environment, what are the factors influencing fair interrelations and fair value distribution, what are possible scenarios for public policy interventions in regards to improving the system from a more sustainable and ethic perspective? Included are preliminary results, considering simulation potential and limitations.

**Keywords:** Behavioral OR; Ethics; Sustainable Development

## **Impact of Ethical Business Practices on Organisational Competitiveness - A Study on Service Sector in India**

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### **2. Harish Handa**

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### **3. Pushpkant Shakdwipee**

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### **6. G. S. Bhalla**

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Fore School of Management

### **8. Narendra Dashora**

Management, PAHERU Udaipur / IGNTU Amarkantak

## **Abstract**

The Dissertation held from above study is that Regions with lesser Development in General, in terms of Business, Infrastructure and Economic Development and Lower or Negligible Development in Particular, in terms of Service Sector have more Significance in Existence of Ethical Business Practices, as well as have a Strong Belief that Ethical Business Practices have Positive Impacts on Business Growth & Organisational Competitiveness. Exceptions to the Above Statement are Duly Acknowledged in the Detailed Analysis of Study. The Hypothesis reconfirms to the Empirically proved statement that “ethical practices in business help to create favorable relationships with other organizations and establish long-term positive relationships with existing and potential future customers”. Hence, It is recommended for especially for the sampled start-up segment in service sector that "Companies must adopt and disseminate a written Code of Ethics, build a company tradition of ethical behavior, and hold its people fully responsible for observing ethical and legal guidelines to become able to innovate new solutions and values in a socially responsible way, are most likely to succeed (Labbai, 2013). A further research on Asian Perspectives on Growth and Scenario of Services may be an Eye Opener.

**Keywords:** Efficiency Analysis; Ethics; Service Operations

## **B Digital Ethics & Governance**

### **Ethics, fairness and governance and Digital Ethics**

#### **Introduction**

Operational Research (OR) is the discipline of applying advanced analytical methods to help make better decisions – in businesses as well as in societies and governance. By using techniques such as problem definition and problem structuring methods as well as mathematical modelling to analyze complex situations, OR allows to make more effective decisions and to build more productive and safer systems. The OR and Ethics EURO Working group is dealing with ethical dimensions of Operational Research (OR). By ethics we understand moral, (descriptive) normative, political principles, regimes and structures. Therefore, the group is particularly focused on using OR for the “common good”, to “make an impact”, and to address societal challenges. For more details see <https://www.researchgate.net/project/Operational-Research-for-Common-Good>

Especially in difficult times such as Corona you need to make moral decisions for a safe future for citizens and societies, whether you work on processes for schools, universities, hospitals, public transportation providers, companies or developing countries. You are welcome to join our streams whether you are scientists who have a business, politics, healthcare, societal complexity, development economics and philosophy research background. “Ethics, fairness and governance” deals with ethical aspects of OR which may relate to fairness considerations and good governance of companies and societies. “Digital ethics” relates to ethical aspects of algorithms and artificial intelligence.

## **Fracturing Common Sense: Profiling, Targeted content and Self-isolation**

### **1. Javier Lede**

Information Management, HNU

#### **Abstract**

During the COVID19 outbreak, physical distancing became a key public health strategy to cope with the spread of the virus. The growing ecological imbalance may result in new hostile environments, in which the practice of self-isolation become recurrent. Such scenarios make relevant to understand a juncture where reclusion measures collide with current information and communications technologies.

This paper explores the impact of digital platforms, whose business model is centered on profiling and targeted advertising techniques, in relation to self-isolation. To this end, a qualitative research was conducted under grounded theory methodology, based on a theoretical sampling of 25 in-depth interviews with 21 participants from the Metropolitan Area of Buenos Aires, Argentina, whose experienced long isolation policies as public health measures in the face of the pandemic. The research findings support the thesis that isolation accelerates a process in which algorithmic filters are fostering a dimension of social divide in which multiple mutually inconsistent narratives are build. The incongruence occurs on the basis of “alternative facts” that underpin new webs of meaning. This erodes “common sense”, because it creates parallel semantic networks with irreconcilable categories of “truth”, fracturing the rhetorical foundations on which democratic consensus can be built.

**Keywords:** Ethics; Artificial Intelligence; Algorithms

## **Digital teaching and learning - opportunities & threats and their ethical aspects**

### **1. Ulrike Reisach**

Information Management Department, Neu-Ulm University of Applied Sciences

#### **Abstract**

Digital learning has become a major practice during the Covid-19 lockdown, in most countries of this world. In order to classify different types of opportunities and challenges and evaluating their ethical aspects, this study uses a Strength/Weaknesses/Opportunities/Threats (SWOT) analysis to compare different approaches and where/how they are being used:

(S) Technologies, teaching and learning innovations;

(W) Issues with connectivity, regulations, privacy, digital literacy, grading modes;

(O) Goals, disciplines, course sizes, teaching-/learning styles, competencies to be acquired, and

(T) Challenges for motivation, holistic understanding, interaction and collaboration, fairness, physical and psychological well-being.

Based on the analysis, issues such as digital and societal divide, fairness, protection and regulation, consequences for learning results, freedom of science, and the role of universities will be discussed.

**Keywords:** Ethics; OR in Education; Education and Distance Learning

# Mobile Artificial Intelligence Applications for Skin Cancer Diagnostics: Preferences and Concerns of Digital Natives

## 1. Sarah Haggemüller

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### Abstract

Artificial Intelligence (AI) has shown potential to improve early skin cancer detection. However, translation of AI-based diagnostic tools into clinical practice can only be successful if they are accepted by potential users. Young adults as digital natives may offer the greatest potential for successful implementation into clinical routine, while at the same time representing the future generation of skin cancer screening. We conducted an anonymous online survey (n=728) to examine how and to what extent individuals below 35 years of age are willing to accept AI-based mobile applications for skin cancer diagnostics. Descriptive analysis and statistical tests were performed to evaluate participants' attitudes towards mobile applications for skin examination. An adaptive choice-based conjoint was integrated to assess respondents' preferences using hierarchical Bayes estimation. Potential concerns were evaluated using maximum difference scaling. Altogether, the majority of potential future users below 35 years of age was ready to accept AI-based diagnostic solutions for early skin cancer detection. However, for translation into clinical practice, participants' demand for increased transparency and explainability of AI-based tools seems to be critical.

**Keywords:** Health Care; Artificial Intelligence; Decision Support Systems

## Augmented Intelligence for Transparent Decision Making in Insurance Claims

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7. **Harvey Maddocks**

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8. **Miranda Chong**

Leap Beyond Group

### Abstract

An insurance claim decision requires claim handlers to understand the circumstances that give rise to the claim, knowledge of procedural rules and regulations, and critical reading and in-depth analysis of evidence from multiple information sources. Insurance claim processing is demanding for the handler and can be intimidating for the defendant and claimant. Many insurance companies have started to leverage the potential of AI to automate repetitive tasks and augment the cognitive capability to provide efficient and trustworthy decisions for improved customer experience.

This paper presents a methodology to capture and transform the claim handlers knowledge into the degree of belief for a set of decision-making rules. It is a transparent hybrid probabilistic expert system; a decision can be explained by the importance of the rules, weight of attributes, and the belief-degree in a decision inferred from the rules that are activated by the information of a given claim. The transparency of the decision-making system engenders trust in computer-aided decision making. Historical data may not contain rare claim circumstances. Therefore, a human expert can be leveraged to make decisions for such claims, which are then added to the training data for future machine learning from humans. This framework allows human experts and an AI system to work in partnership to enhance each other's capabilities.

**Keywords:** Decision Support Systems; Artificial Intelligence; Ethics

## C. Ethics, Societal Complexity and Governance

### Supporting government policy

#### 1. Dorien DeTombe

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International Research Society on Methodology of Societal Complexity Amsterdam, The Netherlands, Europe

#### Abstract

The pandemic SARS-CoV-2 creates in disastrous situations. Governments are confronted with crucial changing situations. Suddenly many measures have to be taken. Where to turn to for help and support? The governments asked first advice to healthcare specialists. They gave advice, based on their own expertise, for a lockdown to save intensive care. Later economic experts were included. In many countries the government policy was not optimal, not effective and not efficient. A pandemic is a complex societal problem, including more aspects. Therefore the government should consult also people from the field of law, psychology, educational, psychiatry, and sociology. These people should exchange their knowledge in discussing the best interventions. A complex societal problem should be handled according to the guidelines of the field of Methodology of Societal Complexity. This scientific field advises to create Knowledge Institutes, advocated by the OECD in 2006, that are ready to act as soon as a complex societal problem arrives. Then based on the Compram methodology they can start inviting experts and actors to discuss the problem and to decide, based on their models of the problem, which changes would be the most fruitful and sustainable. This scientific advice could help the government in its decision. In this way decisions of the governmental are based on democratic sustainable scientific advice. Handling this way the governments could save lives, sorrow and money.

**Keywords:** Complex Societal Problems; Critical Decision Making; Ethics

## Some Thoughts about The Covid19 Pandemics as an Ethical Problem

### 1. Cor van Dijkum

Methodology and Statistics, Utrecht University

#### **Abstract**

Recently the world is confronted with an urgent complex societal problem: the fast spreading of a virus originated in China with severe consequences. It is a prototype of a complex societal problem the world will face in the future more and more. The question is how central institutions handle this problem and how successful they are at last. We can look on open access data that are available about the spreading of the disease for different countries expressing confirmed cases of contamination, people that became sick, deaths, recovered patients that became immune. We have to look at the way central institutions such as governments handled the problem, in first instance with non-pharmaceutical interventions such as lock-downs, following by pharmaceutical interventions with a strategy of administering vaccines to the population. Thereby we have to look at the disadvantageous societal side-effects of the lockdowns such as people losing their work, delayed treatment of people with other severe sickness, young people lagging behind in their education, and so on. The question is how to explore and balance the effects of pharmaceutical and non-pharmaceutical interventions in a scientific and ethical responsible way. To investigate the answers to that question we analyze available data, also with the aid of system dynamic models originating from a (SIR) model of spreading of a disease in a population.

**Keywords:** Complex Societal Problems; Simulation; Health Care

# Combining Causal Loop Diagrams, Behavior-Over-Time Graphs, and Domain-Specific Languages to Structure and Explore Complex Problems

## 1. Adrian Stämpfli

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### Abstract

Causal Loop Diagrams (CLDs) are a flexible and valuable tool for diagramming the feedback structure of systems. In strategic decision-making and management, we use CLDs to structure and explore complex problems, to foster learning, as a basis for simulation models, and to communicate simulation results. Often we combine CLDs with Behavior-Over-Time Graphs (BOTGs) as an initial step to understanding the dynamic patterns and the quantitative scale of the problem under study. BOTGs are especially helpful in capturing dynamic, quantitative hypotheses about the problem at hand.

We present a Domain-Specific Language (DSL) that allows generating visual representations of CLDs enriched with BOTGs. With the DSL, we can illustrate the structure, dynamic patterns, and quantitative scale of the problem under study step-by-step, allowing exploration and reflection by a broad audience.

The DSL approach lowers technical barriers and is accessible to modeling experts with little programming experience. A simple mechanism allows deploying the visual representations in the form of small web apps. We implemented the DSL in R, an open-source programming language and software environment designed for statistical computing, data science, and graphics, uniquely well suited to host DSLs.

A first application uses the DSL to generate small web apps showcasing CLDs and BOTGs of typical burnout-dynamics. Possible further developments include simulation capabilities.

**Keywords:** Problem Structuring; Modeling Systems and Languages; Complex Societal Problems

## **Examining the philosophical underpinning of public sector benchmarking**

### **1. Eftychia Kessopoulou**

Business Administration, University of Macedonia

#### **Abstract**

Benchmarking has been observed to be more challenging than a purported reply to the budget, quality and time issues that modern public organisations face. Early publications, which are mainly practitioner-driven, transformed our thinking at the level of methodology but provide divergent conclusions on the utility and effectiveness of public sector benchmarking. To overcome this challenge benchmarking research requires a focus on the ontological, epistemological and axiological gaps pertaining to its study. This work reviews the literature by examine the ontological, epistemological and axiological underpinnings of public sector benchmarking. Moreover, it addresses the problems of traditional and contemporary public sector benchmarking approaches, concluding that though useful, they raise doubts about the necessity of determining and controlling contingent factors of benchmarking to change organizational performance, since these methods cannot explain why and how benchmarking-mediated performance change occurs.

**Keywords:** Quality Management; OR/MS and the Public Sector

## **D. Modelling the value of medicines, vaccines and social interventions to tackle infectious diseases 1**

### **Spread of Covid-19 Via Staff Working Across Different Care Homes: A Hybrid Simulation Model**

**1. Le Khanh Ngan Nguyen**

Management Science, University of Strathclyde

**2. Itamar Megiddo**

Management Science, University of Strathclyde

**3. Susan Howick**

Dept of Management Science, University of Strathclyde

#### **Abstract**

Evidence on the increasing risk of SARS-CoV-2 infection in staff working across different care homes has emerged. As a result, new regulations proposed by the UK Government would ban staff from moving between care homes in an attempt to halt the spread of COVID-19. These types of interventions need to be thought through as they may lead to unintended consequences and they need to be balanced against outcomes that are not related to Covid-19. Care homes in the UK are heavily dependent on the use of agency or bank staff due to the long-standing problem of staff shortages in the health and social care sector, which has been worse amid the pandemic. Understaffed care homes could lead to lower quality of care for residents, and a lower staff-to-patient ratio can also increase transmission within care homes. There is limited understanding of the extent to which staff working in multiple care homes contribute to spreading the infection and which interventions targeting this group are effective. To address these issues, we have developed a hybrid simulation model that combines system dynamics and agent-based modelling methods to represent staff sharing in a network of care homes. The evaluated interventions in controlling the spread of COVID-19 across care homes include creating bubbles of care homes, routine testing of agency and bank staff, and ceasing agency and bank staff use.

**Keywords:** Health Care; Simulation; Agent Systems

## **A visual approach to the Economic Evaluation of vaccines: opening the health economic black box**

### **1. Alec Morton**

Management Science, University of Strathclyde

### **2. Enoch Kung**

UCL

### **3. Vittoria Bufali**

University of Strathclyde

## **Abstract**

**Objectives:** The economic evaluation of vaccines has attracted a great deal of controversy. In the academic literature, several vaccination advocates argue that the evaluation frame for vaccines should be expanded to give a more complete picture of their benefits. We seek to contribute to the debate and facilitate informed dialogue about vaccine assessment using visualization, as able to support both deliberation by technical committees about the substance of evaluation and communication of the underlying rationale to non-expert stakeholders.

**Methods:** We present two visualizations, an Individual Risk Plot (IRP) and a Population Impact Plot (PIP), both showing the beneficiary population on one axis and the degree of individual benefit and cost of an individual dose on the second axis. We sketch out such graphs for ten vaccines belonging to the UK routine childhood immunization schedule, and present our own analysis for the rotavirus and meningitis B vaccines.

**Results:** While the IRPs help classify diseases by morbidity and mortality, the PIPs display the health and economic loss averted after introducing a vaccine, allowing further comparisons. **Conclusions:** The visualizations presented, albeit open to provide an increasingly complete accounting of the value of vaccination, ensure consistency of approach where comparative judgements are most needed.

**Keywords:** Health Care

## Agent-based modelling to explore Covid-19 interventions in a care home

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3. **Susan Howick**

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4. **Robert van der Meer**

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### Abstract

Care homes have suffered an extremely high burden of disease from Covid-19, with over 40% of 2020 Covid-19 deaths attributed to care homes in many countries, including the UK and US. Plenty of research has been done on how to control infection outbreaks in hospital environments over the past couple of decades; however, research on what works in care homes has been very limited. Care homes are unique in that they act as a home in addition to a health facility, and imposing guidelines from the hospital setting is not practical. We explore what interventions work best within a single care home (interacting with its surrounding community), using an agent-based model that was developed in collaboration with colleagues working in care homes. Agents in the model include care home staff and residents. We explore interventions of personal protective equipment and hand hygiene, resident and staff testing and their frequency, cohorting of residents units, and limiting guest visiting along with the implications of the beginning of the vaccination campaign.

**Keywords:** Agent Systems; Simulation; Health Care

## **E Modelling the value of medicines, vaccines and social interventions to tackle infectious diseases 2**

### **Investigating a Subscription Payment Model for Antibiotic Purchasing**

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#### **Abstract**

Novel subscription payment schemes are one of the approaches being investigated to tackle the threat of antimicrobial resistance. One example is the scheme currently being piloted by the UK government separating overall payment of an antibiotic into a fixed lump-sum component and a component dependent on sales-volume. Intended to incentivise investment in development of new antibiotics, this scheme will enable the government to consider societal benefits when determining payments for antibiotic treatment. This payment scheme significantly increases the complexity of decision making for HTA bodies, ensuring that sufficient incentive can be provided to the pharmaceutical industry to encourage innovation, whilst managing the responsible use of the antibiotics developed, and maximising the benefits to society from investment in this innovation. We present a mathematical model of subscription payment schemes to estimate the total returned welfare, explicitly featuring fixed and volume-based payment components. Decisions to allocate antibiotic treatment and subsequently measure treatment benefits are modelled with individual-based and societal-based valuations, respectively. Treatment of Gonorrhoea is used to illustrate application of the model, and the impact of different pricing decisions on the optimal returned welfare.

**Keywords:** Health Care; Medical Applications; Economic Modeling

## Estimating the Impact of a Novel Gonorrhoea Therapy with Structured Expert Judgement

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## **Abstract**

Current Health Technology Assessment (HTA) methods do not capture the full range of costs and benefits related to antimicrobials, as they focus on treatment costs and health benefits accrued by an individual patient and miss population-level costs associated with the spread of resistance and benefits associated with reduced transmission and reduced selection pressure on other treatment options. These values cannot be directly obtained from a clinical trial or estimated through traditional disease models. An alternative approach is to use structured expert judgement. We develop a protocol to elicit future resistance rates in the context of a hypothetical new antimicrobial to treat gonorrhoea infections in the United Kingdom. Using Cooke's Classical Model of structured expert judgement also allows us to assess the statistical accuracy and informativeness of the experts to validate their assessments and combine them into a performance-based aggregated assessment. The outputs from the structured expert judgement process can be used to estimate additional costs and benefits of a new antimicrobial, making them useful for a HTA evaluation. Qualitative information on the rationales for the experts' assessments and their understanding of the causes of changing resistance patterns more generally can also help disease modellers better understand the factors that contribute to the emergence and spread of resistance, improving future modelling capacity in this area.

**Keywords:** Health Care; Risk Analysis and Management