**EXPERT JUDGEMENT TO ENHANCE HEALTH DECISION MAKING**

**MALTA 7th to 9th October 2015**

**Session 1: Risk of contamination and disease transmission Session Chair: Dr. Richard Zammit**

1. ***Valuing the risk of emerging infectious diseases for blood transfusion safety***

W. Oei, Rabin Neslo, Mart P. Janssen

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**Background:** Novel emerging infectious diseases (EIDs) pose a potential threat to blood transfusion safety. Despite the fact that little evidence is available, safety interventions may be required. But what should decision makers base their decisions on? A model was developed that allows valuing the risk of an EID for blood safety as derived from a group of experts. For the assessment the model only requires four estimates of disease characteristics and an indication of the accuracy of these estimates.

**Study design and methods:** Sixteen selected experts ranked 24 hypothetical diseases (six groups of four diseases). Each disease comprised of a quantitative estimate of four characteristics: transfusion transmissibility, length of asymptomatic infectious phase, prevalence of infection and disease impact. Each of the characteristics was expressed at one of six predefined levels, with varying uncertainty ranges. The risk model was derived using probabilistic inversion methodology and was applied to value the risk for most currently known EIDs relevant to blood transfusion.

**Results:** The model showed that transmissibility and prevalence are the most important risk drivers. However, disease impact and likelihood of transmission during the asymptomatic phase of infection are more important whenever there is lack of knowledge on disease characteristics. In the ranking of currently known EIDs, all diseases that are currently known pose a serious risk to blood transfusion appeared in the top of the ranking list.

**Conclusion:** With the current model the relative risk of EIDs for transfusion safety can be determined for both known and unknown diseases, even when little information is available. Extension of the expert base, further model development and validation and continuous updating of the model is recommended.

1. ***Expert judgement in pandemic alerts***

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Emerging infectious diseases pose a difficult global challenge for public health decision-makers. In the initial stages, significant uncertainty exists over the lethality of an emerging disease, and also its transmissibility from human-to-human. The diagnosis of an emerging disease may be fraught with error, especially if the general symptoms are similar in many respects to those associated with common diseases such as cholera.

At various stages in the evolution of an infectious disease epidemic, there would be value in undertaking a formal elicitation of expert judgement on key metrics such as the case fatality rate, and the basic reproductive number, which is the expected number of people infected by another in a human infection chain. Epidemiologists, whose judgements are elicited, need to be knowledgeable not just with issues of virology, but also with the underlying social network behavioural factors that drive contagion of infectious disease in urban and rural areas.

The 2014 Ebola epidemic in Guinea, Sierra Leone and Liberia, evolved in a manner that strained the limits of epidemiological forecasting skill. Both the evolution of the crisis and the tipping point towards epidemic control were forecast poorly. A review of this crisis highlights future opportunities for the structured elicitation of expert judgement. Specifically, improved estimates of the likelihood of alternative outcomes would have benefitted risk-informed decision-making on logistical planning and resourcing, and on risk mitigation measures such as quarantining and border screening.

**Management Committee – IS1304 Progress Meeting**

**Invited speaker #1**

1. ***Adapting Expert Elicitation Methods for Global Study of Foodborne Disease***

Sandra Hoffman

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Abby Colson

Research Associate, Dept. of Management Science, University of Strathclyde, Glasgow

There is increasing interest in using large expert panels to elicit probability judgments about global health problems.  This presentation discusses adaptation of the Cooke Classical model for use in a global expert elicitation study conducted for the WHO, Global Burden of Foodborne Disease Initiative.  The scale and global reach of this effort pushes on existing methods in multiple ways.  First, cost and logistical concerns imposes limitations on conducting elicitations in person, as has been done in the past.  Second, structuring the elicitation and calibration in ways that capture both global variation.  Third, need for transparency and reproducibility creates an opportunity to explore the implications of alternative criteria for selection and recruitment of expert panel members.  The talk will examine the adaptations made to address these challenges and their impact on expert model performance.

**Session 2: The challenges of health technologies – perceptions & values**

**Session Chair: Luis Dias**

**Invited speaker #2**

1. ***Elicitation of stakeholder preferences in early models for Health Technology Assessment***

Maarten IJzerman

University of Twente, Netherlands

**Background**

Early health economic modelling is an emerging new field of research, which is used to determine the health economic value of medical products early in the development stage. Early Health Technology Assessment (HTA) aims to inform R&D and health policy about future use and benefits of medical technologies by making assumptions and uncertainties more explicit. In this presentation, early health economic modelling will be introduced as an approach to estimate the potential health impact of implementing new diagnostic technologies. The presentation will briefly present the need for rigorous elicitation methods in HTA, present three cases and will conclude with some general experiences and future research initiatives.

**Cases**

At least three cases of early HTA will be presented eliciting the views of different stakeholders. The first case considers a molecular screening test for colorectal cancer and estimates patients’ preferences for screening using a discrete choice experiment (Groothuis et al 2014). Among the choice sets is a hypothetical new screening modality. A second example is concerned with the development and potential purchase of new medical imaging device for screening and breast cancer diagnosis (Hilgerink et al, 2011). A multicriteria decision framework was used to estimate stakeholder interests and directions for further research. Finally, we introduce the development of new biomarkers for detection of metastatic disease and for monitoring therapy progression and response. Using this case, we will share some experiences with the elicitation of diagnostic performance using radiology experts (Haakma et al, 2014).

**Conclusion**

Early HTA is an emerging new field of research with potential applications in R&D and horizon scanning of new emerging technologies. Despite the many approaches for handling uncertainties in health economic models, expert elicitation is particularly valuable to obtain a rough estimate of the minimum performance. Expert elicitation –e.g. preference modelling- may also be used to estimate the marginal utility of new products compared to standard of care. As expert elicitation in (early) HTA is relatively new, there is a huge potential for improvement by interacting with leading research groups in the field.

**References**

* Groothuis-Oudshoorn CGM, Fermont JM, van Til JA, IJzerman MJ. Public stated preferences and predicted uptake for genome-based colorectal cancer screening. BMC Med Inform Decis Mak. 2014 Mar 19;14(1):18.
* Haakma W, Steuten LMG, Bojke L, IJzerman MJ. Belief Elicitation to Populate Health Economic Models of Medical Diagnostic Devices in Development. Appl Health Econ Health Policy. 2014 12(3): 327-334.
* Hilgerink MP, Hummel MJ, Manohar S, Vaartjes SR, IJzerman MJ. Assessment of the added value of the Twente Photoacoustic Mammoscope in breast cancer diagnosis. Med Devices (Auckl). 2011 Jul 15;4:107–15.

1. ***Exploring cost-effectiveness of prophylactic treatment strategies for severe haemophilia: results from an updated micro-simulation model***

K. Fischer, Mart P. Janssen

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**Background:** Severe haemophilia requires life-long treatment with expensive clotting factor concentrates; modelling techniques are used to compare effects of different treatment strategies over decades. A previously developed simulation model was updated to explore strategies for switching between prophylactic and on demand treatment according to different prophylactic dose levels.

**Design and Methods:** a previously developed computer simulation model was updated with data obtained by a formal expert elicitation. Additional information included life expectancy, treatment of minor bleeding episodes, and prophylactic dose needed to control bleeding according to the patients’ onset of joint bleeding. The model was used to simulate individual patients’ life time joint bleeds, radiological outcome (Pettersson score, max 78 points) and concentrate use according to different treatment strategies. Based on the cost effectiveness (maximum % of patients with a Pettersson score <15 at a minimum cost) different strategies for switching between prophylactic and on demand treatment according to prophylactic dose levels of 1500-3500 IU/kg/yr were explored.

**Results:** a life-long prophylactic regimen with a dose of 2000 IU/kg/yr was most cost effective, maintaining a Pettersson score of <15 points at the end of life in 62% of patients. Including switching to on demand treatment reduced this proportion slightly to 60%. Optimum switching criteria were similar across prophylactic dose levels: After switching to on demand treatment, the optimum criteria for re-starting prophylaxis were: ≥8 joint bleeds in any year, ≥6/yr in two subsequent years, or ≥4/yr in three subsequent years while treated on demand.

**Conclusion:** The present model suggests that optimum criteria for switching between prophylaxis and on demand treatment are independent of prophylactic dose and that prophylaxis at 2000 IU/kg/yr is most cost effective.

1. ***A pilot study to assess feasibility of value based pricing in Cyprus through pharmacoeconomic modelling and assessment of its operational framework: sorafenib for second line renal cell cancer***

Panayiotis Petrou

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PhDc, HealthCare Management Program, Open University of Cyprus

Background: The continuing increase of pharmaceutical expenditure calls for new approaches to pricing andreimbursement of pharmaceuticals. Value based pricing of pharmaceuticals is emerging as a useful tool and possesstheoretical attributes to help health system cope with rising pharmaceutical expenditure.

Aim: To assess the feasibility of introducing a value-based pricing scheme of pharmaceuticals in Cyprus and explore the integrative framework.

Methods: A probabilistic Markov chain Monte Carlo model was created to simulate progression of advanced renal cell cancer for comparison of sorafenib to standard best supportive care. Literature review was performed and efficacy data were transferred from a published landmark trial, while official pricelists and clinical guidelines from Cyprus Ministry of Health were utilised for cost calculation. Based on proposed willingness to pay threshold the maximum price of sorafenib for the indication of second line renal cell cancer was assessed.

Results: Sorafenib value based price was found to be significantly lower compared to its current reference price.

Conclusion: Feasibility of Value Based Pricing is documented and pharmacoeconomic modelling can lead to robust results. Integration of value and affordability in the price are its main advantages which have to be weighed against lack of documentation for several theoretical parameters that influence outcome. Smaller countries such as Cyprus may experience adversities in establishing and sustaining essential structures for this scheme.

1. ***Decision rules for allocating of finances to health systems strengthening***

Alec Morton

Professor of Management Science, University of Strathclyde, Glasgow

A key dilemma in global health is how to allocate funds between disease-specific "vertical programmes" on the one hand and "horizontal programmes" which aim to strengthen the entire health system (for example by training staff, developing information systems, such as systems of vital registration, investing in distribution systems and infrastructure) on the other. While economic evaluation provides a way of approaching the prioritisation of vertical programmes amongst themselves, it provides less guidance on how to prioritise between horizontal and vertical programmes. We approach this problem by formulating a mathematical program which captures the complementary benefits of investing in both vertical and horizontal programmes and discuss the role of expert judgement in parameterising such a model.

1. ***Consumer acceptance of functional foods and novel food technologies***

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Consumers perceive the benefits of functional foods and have not significant concerns about possible risks. Their views on functional foods vary depending on the base product and the specific functional ingredient added to the food or related health claim. In recent years, functional foods become more familiar and their consumption increase due to innovations in food science and technology, population aging with growing health concerns, an evolving regulatory environment allowing health claims on foods and increased marketing of functional food products. Attitudes are generally more positive than towards novel food technologies. The category of novel food processes covers a range of technologies and consumer acceptance vary depending on the specific technology (high pressure, pulsed electric field, ultrasound, nanotechnology) as well as the product it is applied to. Attitudes towards novel food processes interact with other factors such as price, taste and perceived naturalness. Consumers have very limited knowledge of novel technologies. Attitudes towards novel processing technologies could become more accepting while become more familiar and less novel. Consumers’ risk perception may differ from experts’ assessments. Trust in institutions, food industry and regulatory bodies is an important factor influencing perception of novel food processing. Therefore, it is very important that the consumers be informed and educated about potential benefits of novel food technologies.

**Session 3: The challenges of health technologies – benefit/risk evaluation of medicinal products**

**Invited Speaker #3**

1. ***The EU Risk Management Plan – a tool to address the uncertainties at the time of approval, and manage the risks of medicines***

Emil Cochino

Scientific Officer, Scientific and Regulatory Management Dept., European Medicines Agency

The Risk Management Plan (RMP) is an essential tool for risk management planning throughout a medicinal product's lifecycle, for medicines approved and used in the European Union. Its purpose is to identify or characterise the safety profile of the medicinal product concerned, to indicate, where required, how to further characterise the safety profile, and to document measures to be implemented for preventing or minimising the risks associated with the medicinal product, including the proposals for the assessment of the effectiveness of those interventions.

The European Medicines Agency (EMA) is a decentralised agency of the European Union, responsible for the scientific evaluation of human and veterinary medicines for use in the European Union. An RMP is submitted with all initial marketing authorisation applications in EU. For centralised applications, the RMP is assessed by the EMA. A centralised marketing authorisation, valid in all European Union (EU) Member States, as well as in the European Economic Area (EEA) countries, is granted by the European Commission upon receiving a positive EMA scientific opinion.

This presentation highlights the main principled of risk management and the RMP structure and content, for medicines approved and used in EU.

1. ***Is there a role for expert judgement in the medicines use process?***

Patricia Vella Bonanno

Advanced Pharmacist Practitioner, Health-Office of the Superintendence Public Health, MEH, Malta

The medicines use life-cycle involves a series of processes which are interdependent. These processes include research and development, the licensing of new medicinal products on the market, manufacturing and supply, reimbursement decisions for use of medicines within national health systems, prescribing, administration to patients and post-authorisation monitoring of quality, safety and effectiveness.

Each process involves the interactivity of structural and human resources, activities which include decision making based on evaluation of the benefits and the risks as well as other factors. The main outputs are public health and competitiveness and there is a delicate balance between them. Different stakeholders are involved including patients/consumers, industry operators, health care professionals and regulators. These processes result in outcomes including access, availability, affordability, quality safety and effectiveness and rational use of medicines. These outcomes can be viewed from different stakeholder perspectives. The different pharmaceutical activities involved in the medicines use chain are governed by regulation and principles of good practice, as relevant to the specific process and activity. The information required for each decision is based on scientific evidence as well as other information relevant to the specific process.

Modelling of each of these processes as well as the logical relationship between them gives a framework which supports understanding of this complex system. This framework will enable the study of the possible role for expert judgement in these processes.

**Session 4: The challenges of health technologies – Expert Elicitation Exercise**

**Session Chair:** **Alec Morton**

**Session Overview:** Medical regulation and health technology assessment are complicated processes, made even more difficult by the challenge of antibiotic resistance. Although resistance to a new antibiotic is inevitable, when resistance will evolve, how fast it will appear, and how many patients will be affected are all uncertain. These uncertainties make decisions about antibiotics, including whether they should be developed and how much a payer should be willing to pay for them, very difficult. The objectives of this sessions are:

1. To introduce the meeting to the problem of antibiotic resistance and in particular the regulatory and reimbursement aspects of this problem
2. To explore how scientific uncertainties can be captured and communicated in this setting

*10 minute talks The Problem of Antibiotic Resistance*

Abby Colson, University of Strathclyde, Glasgow, UK

*Overview of the health technology assessment process, with a discussion of key uncertainties*

Miriam Azzopardi, Ministry for Energy and Health, Malta

*Antibiotic Resistance: A health technology challenge*

Michael Borg, Mater Dei Hospital, Malta

*Overview of the medical regulations process, with a discussion of key uncertainties*

Emil Cochino, European Medicines Agency

*20 minutes Panel Discussion*

*45 minutes Break-out groups to discuss:*

1. What information would inform decisions in this context
2. How best to structure and communicate the scientific uncertainties to inform regulatory and reimbursement decisions
3. What are the key issues in the particular countries of the network

*45 minutes Feedback from the break-out groups and large group discussion*

**Session 5: Methodologies and their applications**

**Session Chair: David Rios**

1. ***Methods to elicit experts’ beliefs over uncertain quantities: application to a cost effectiveness transition model of negative pressure wound therapy for severe pressure ulceration***

Marta Soares

University of York

Health care resources are scarce, and decisions have to be made about how to allocate funds. To support decisions, models are often used to establish cost-effectiveness, quantify uncertainty regarding the adoption decision and provide estimates of the value of further research. In many cases, the existence of only limited data with which to populate a decision model can mean that a cost-effectiveness analysis either does not proceed or may misrepresent the degree of uncertainty associated with model inputs. An example is the case of negative pressure wound therapy (NPWT) used to treat severe pressure ulceration, for which the evidence base is limited and sparse. There is, however, substantial practical experience of using this treatment and its comparators. This knowledge can be quantitatively captured by eliciting beliefs from experts. This presentation describes an elicitation exercise to generate estimates of multiple uncertain model inputs and validate analytical assumptions for a decision model on the use of NPWT. It focusses on aspects the design and conduct of the exercise, but it will also demonstrate the impact of using the elicited evidence on the cost-effectiveness results.

1. ***Health information at the service of policy: strengths and weaknesses of a small country***

Neville Calleja

Director Health Information & Research, MEH / Lecturer - Public Health, UoM

Most health registers in Malta have been in place for a minimum of twenty years, together with a number of epidemiological surveys over a similar span of time. Register data is identified via the national identity card number allowing secure linkage between registers and administrative records for generating evidence. This person level databank allows for the generation of intelligence required for policy planning. Planning strategies requires identifying areas for action together with the quantification of costs and potential benefits. Cost benefit analyses of potential policy actions can be carried out. The same data sources allow for the monitoring of the implementation of a said strategy.

Nevertheless, analytical capacity is quite limited, especially when compared to similar structures in larger countries. This is mitigated by making anonymized datasets available for the generation of such intelligence by academics and experts contracted by the Ministry responsible for health. Maltese register data is well-known for its precision in various epidemiological circles in Europe, which precision arises mainly from the centralized arrangement of the local health system and the awareness that misdiagnosing a rare condition could introduce wild fluctuation in annual trends. For this reason, Maltese registers collaborate heavily with international consortia to generate further evidence. Most Maltese registers are still missing key care-related variables as capturing this information would require substantial investment. This is typically bridged using foreign analyses applied to Maltese figures. This lack of data manifests mostly in health technology assessments for new drugs prior to their introduction on the formulary of free medication.

Examples illustrating these opportunities and threats shall be provided.

1. ***Interactivity for e-health stakeholder empowerment by means of expert judgement technique***

Birute Mikulskiene

Institute of Management, Faculty of Politics and Management, Mykolas Romeris University, Vilnius

New e-Health instruments have opened more channels for both patient and healthcare professionals in pursuit of common goals of improving patient quality of life. However, gained benefits have created a number of problems which are fundamental by their nature and are widely reported internationally. Moreover, these issues are faced by every organisation and could be grounded in social context within society, which may be represented through stakeholder needs and awareness. E-health development problems in some extent can be solved if stakeholders are engaged in e-Health processes and are empowered to voice their concerns. However to make stakeholder voice readable for policy makers is a long standing goal, which could not be solved by one way hierarchical linear call for stakeholder opinion. Collective Awareness Platforms (CAPs) with integrated various analysis tools (expert judgment technique for instance) to ensure feedback of interaction could be a solution. “Collective” means that the instrument is open for everyone, i.e. is inclusive, and encourages to act together. “Awareness” refers to knowledge management starting from access to information, then approaching different attitudes, assessing expert opinions, creating new ways of thinking and sharing collective understanding. A word “platform” is used as a web-based library of components that can be assembled to generate a design at a particular level of abstraction.

Development of CAP (the main features, preconditions, technological solutions) with integration of structural expert judgment technique is discussed. Two compete streams of communication: between experts and between other stakeholders, are structured according different rules and aggregation of individual stakeholder thinking is incorporate in CAP with the purpose to propose the compete source of knowledge for emergency of collective intelligence.

1. ***Handling equitable preferences*** Özlem Karsu¹, Alec Morton², and Nikos Argyris³

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²Professor of Management Science, University of Strathclyde

³Loughborough University

In this talk we are going to consider a problem that policy makers or social planners face: evaluating a set of distributions (of income, of wealth, of health, of service levels) across a population, in which individuals are considered preferentially indistinguishable. An example case occurs when alternative health care interventions, each of which results in a different health benefit distribution to a population, are evaluated. The social planner’s aim could be to choose the “best”distribution (i.e. the “best” intervention) in a given set or rank the distributions.

We consider the case where there is some limited information about social preferences and we make use of this information to detect the dominance relations between the alternatives. While detecting dominance, we draw on some axioms from economic theory, which help us to formalize the social planners’ concerns for equity.

We propose an interactive decision support procedure for ranking a given set of distributions. The procedure gets preference information from the social planner by asking questions such as "given (health benefit) distributions a and b; which one would you prefer?" and uses the answers to refine the ranking of the distributions.

1. ***Simulation exercises as vehicles to address risk and uncertainty in chemical preparedness***

Mark Zammit¹, and Roberto Debono²

¹ Advanced Pharmacy Practitioner, Central Procurement and Supplies, Ministry for Energy and Health, Malta

² Office of the Superintendent of Public Health, Department of Health Regulation, Malta

1. ***The different dimensions of medical expert judgement from the point of view of ethics and philosophy***

Jacob Dahl Rendtorff

Roskilde University, Denmark

This paper provides an analysis of the different dimensions of medical expert judgment from the point of view of ethics and philosophy. We begin by presenting the different levels of medical judgment as suggested by the French philosopher Paul Ricoeur who distinguishes between the level of prudential judgement, deontological judgement and reflective judgement. This is the basis for understanding the relation between technical expert judgement and reflective judgement in medicine in order to avoid ethical indifference in medical expert judgement. With this presentation of the foundations of medical expert judgement we continue by suggesting an ethical decision-making model to be integrated in medical expert judgement. This decision-making model is constituted by the following basic elements: 1. Phenomenological and hermeneutic interpretation of the technical facts of context of meaning of a specific situation of decision-making. 2. Analysis of ethical dilemmas in the perspective of different ethical theories: utilitarianism, deontology, virtue ethics, existentialist ethics, communication ethics. 3. Analysis of the ethical dilemma from the point of view of different ethical principles: autonomy, dignity, integrity and vulnerability 4. Application of ethical guidelines for medicine in order to understand the ethical dilemma in question 5. Proposal of possible decisions and application, including evaluation and discussion of implied consequences of specific decisions.

**Session 6**

**Session Chair: Jacob Dahl Rentdorff**

1. ***Recent advances in multiple criteria decision making: applying the aggregation-disaggregation theory in healthcare***

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The most common problems faced by hospitals across the globe are associated with the complexity of healthcare services, the inability to forecast demand, the lack of resources and more over the lack of integrated methodologies for improving decision aiding, services evaluation etc. The scope of this presentation is to demonstrate how the combination of simulation techniques and the aggregation-disaggregation theory in the context of multiple criteria decision analysis can contribute to the decision making process in health care services reengineering, business strategy and performance. More specifically, we demonstrate how simulation techniques can be used in order to reengineer a hospital facility. On the other hand, we show how the combination of simulation and aggregation-disaggregation theory can improve the decision making process. For practical reasons in order to present the applicability of our approach, we develop three integrated methodologies named MEDUTA, S-MEDUTA and G-MEDUTA. MEDUTA combines simulation, multiple criteria satisfaction analysis and aggregation-disaggregation techniques in order to evaluate the effect of each alternative (solution) on criteria like waiting time, length of stay etc. S-MEDUTA assists the decision maker to find the optimal strategy for the organization by combing the simulation with the balanced scorecard approach. Finally, G-MEDUTA has been designed in order to enable more stakeholders for the improvement of healthcare services. It should be noted that G-MEDUTA methodology has the ability to determine potential inconsistencies among the DMs and moreover to define potential interactions that may achieve a higher group consistency level. Finally we will demonstrate how process mining techniques can discover, monitor and improve the real processes aiding the developer of the simulation model to build it faster with more accuracy.

1. ***Expert judgement for dependence elicitation: A literature review and future research directions***

Christoph Werner¹, Anca Hanea², and Oswaldo Morales Napoles³

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**Abstract:** In various applications, probabilistic risk assessment exhibits high complexity so that in addition to uncertainty about marginal distributions, interdependence needs to be modelled in order to improve its understanding. Nevertheless, often historical data on the dependence information is not available or simply too costly or time-intensive to obtain. In this case, the only option is to elicit expert judgements. In expert judgement studies, a structured approach to eliciting variables of interest is highly encouraged so that subjective uncertainties can be viewed as scientifically robust. For univariate query variables, such as marginal probabilities, guidance on the choice of formats is provided through reviewing theoretical research and empirical experiences. For higher dimensions however, only little such guidance exists if at all, which is why this paper offers a systemized review of the current literature on eliciting dependence in terms of strength of association.

**Motivation:** The motivation for this review comes from the fact that whenever a probabilistic model in a risk assessment cannot be quantified with historical data, relying on expert judgement might be the only option. However, in contrast to eliciting information from experts to parameterise marginal distributions, neither guidance nor a clear research direction for eliciting multivariate distributions exists. The need for such guidance is however clear, as dependence modelling itself is an active research area and experts’ opinion is often used to parameterise multivariate models. Therefore we aim to offer a systemized way of comparing different format choices for variables of interest and their use in dependence models (based on both theoretical concepts as well as various case studies). This in turn will offer guidance to researchers and practitioners in making robust choices in terms of which summary of expert knowledge on joint distributions to elicit, and how to incorporate it in a dependence modelling context. Thereby we outline how much is understood about the feasibility of quantities' format choices within modelling and the cognitive assessment burden for experts. This not only gives an overview of the current theoretical and empirical contributions, but also facilitates the formulation of future research directions.

1. ***Estimating the position of political parties: comparison between an expert survey and a candidate survey***

Ioannis Andreadis

Assistant Professor, Laboratory of Applied Political Research, Department of Political Sciences, Aristotle University Thessaloniki, Greece

In this paper I compare two methods of positioning political parties on the political issues. The first method uses experts on political parties; the second method uses the candidates of these parties. The comparison is done on 31 political issues that have been used in HelpMeVote Greece 2015. HelpMeVote is a Voting Advice Application (VAA) i.e. a web application that is used by voters to compare their political preferences with the position of the political parties. In order to position the parties, I usually send invitations to a number of Greek political parties experts (faculty and researchers from public opinion polling companies) and ask them to participate to a web survey and to code the position of each party on each of the issues. Experts may face difficulties while coding parties especially when the judge newer or smaller parties on issues that these parties do not have a clear position. As an alternative approach, I have sent invitations to candidates running for the Greek Parliamentary elections 2015 and I have asked them to position themselves on the same issues. By using the candidates I have the information by the source itself, but at the same time I overcome the disadvantages of asking only the leadership of the party (i.e. non-response, manipulation of the position to make their party appear closer to the most popular positions, and lack of any measure of uncertainty). The comparison of the two methods is done with regard to i) the location of the estimate and ii) the uncertainty of the estimate in order to test i) if the estimates are different and ii) if the uncertainty of experts corresponds to larger variability of the candidates’ opinions.