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The 7th IMA International Conference on Quantitative Modelling in the Management of Health and Social Care: IMA Health 2013 Special Issue

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1. Background

Health and Social Care systems are facing major challenges worldwide, due in part to changes in demography and advances in technology and in part to changes in the structure and organisation of the system whether they are hospitals, general practice or long-term community care settings. Yet running health and social care systems efficiently and effectively is crucial to improving or even just maintaining our quality of life. Over the years, extensive research has been conducted to find immediate and long-term solutions to wide ranging issues that are routinely faced by health and social care professionals including waiting lists and bed capacity, hospital redesign, location analysis, workforce planning and scheduling, patient flow, performance management, disease monitoring, and health care technology assessment.

Mathematical modelling and computer simulation techniques (statistical analysis, stochastic processes, queuing theory, mathematical programming, heuristics, discrete event simulation, system dynamics, etc), often assisted by qualitative research and soft methods such as problem structuring methods have shown to be increasingly valuable in providing useful information to aid planning and management.

The Institute of Mathematics and its Applications (IMA, www.ima.org.uk), the UK's learned and professional society for mathematics and its applications, has been

organising the IMA International Conference on Quantitative Modelling in the Management of Health and Social Care since 1995. The aim of the conference is to bring together health care managers, clinicians, management consultants, and mathematicians, operational and health service researchers, statisticians, health economists, computer scientists etc from across the world with a view to bridging the gap between the respective communities and to exploring recent developments and identifying fruitful avenues for further research.

The seventh instalment of the conference (IMA Health 2013) was held at Woburn House, London, UK between 25 and 27 March 2013. Chaired by Prof Thierry Chausalet, professor at the University of Westminster and co-chaired by Dr Christos Vasilakis, then with the UCL Clinical Operational Research Unit and now at the School of Management, University of Bath it featured six keynote speakers, 42 oral presentations organised in 11 parallel sessions and 16 poster presentations. The keynote speakers included (in order of presentation):

- Prof Martin Utley, Professor and Director, UCL Clinical Operational Research Unit (title of talk: Can numbers fill the empty words, the meaningless diagrams?);
- Dr Charles Alessi, Chairman of the National Association of Primary Care and former Director of Medicine and Clinical Governance for the British Armed Forces (Implications of personalisation: The new health care);
- Prof Stephen Chick, Professor of Technology and Operations Management, Novartis Chair of Healthcare Management, INSEAD, France (New challenges and opportunities for health modelers);
- Prof Peter Smith, Professor of Policy and co-Director of Centre for Health Policy, Imperial College London. (Quantitative modelling and health policy: mutual friends or hard times?);
- Dr David Paynton, FRCGP, DMS, MBE, Practicing GP, Clinical lead for Out of Hospital care at Southampton City Clinical Commissioning Group and National Clinical Lead for the Royal College of General Practitioner's Centre for Commissioning (Leading System Change - the Challenge facing Clinical Commissioning Groups);

- Dr Geoff Royston, President of the OR Society (Measures, models and management - who cares?).

The conference was attended by delegates from Australia, Austria, Brazil, Canada, Germany, Greece, Hong Kong, India, Italy, Netherlands, Nigeria, Singapore, Spain, UK and the USA. It was sponsored by Dr Foster® Intelligence, Apteligen and Simul8 Corporation.

2. HCMS special issue

There have been five previous Health Care Management Science special issues devoted to papers presented at IMA Health conferences [1-5]. Twenty papers were submitted for consideration to be included in this special issue following the conference, of these eight survived the rigorous peer review process of the journal and are included in this issue.

The eight papers of this special issue have been grouped into two broad categories. First, we have included five papers that report on studies conducted in or relevant to care provision within hospitals. The three remaining papers concern studies aimed at problems related to care provided outside the hospital including long-term care, community based care services and public health.

In the hospital group of papers, the first three concern research related to outpatient services. The paper by Legrain and colleagues from Montreal, Canada report on a study that developed a hybrid method combining stochastic and online optimisation to schedule patients in a cancer treatment facility for radiation therapy. Their experimental results showed the new hybrid method outperformed the algorithm currently in use by the healthcare centre collaborating in this project. Nguyen *et al* formulated and then solved with a Branch and Cut algorithm a mixed integer programming model to help in the planning of capacity requirements that will satisfy a number of waiting time targets as set by the government. They tested the model with data from urology outpatient hospital in the collaborating hospital in Singapore. Pan led a research team that developed a discrete event model to represent both patient and information flow in the ophthalmic outpatient clinics of the Singapore National

Eye Centre. Using simulation experiments they evaluated the likely impact of a number of improvement strategies on patients' turnaround times.

The next two papers address issues associated with inpatient care. Gaudoin and colleagues, in their technical paper, used routinely collected hospital admission data (Hospital Episode Statistics) in England to test a novel method for deriving accurate estimates of the probability of belonging to one of a number of classes (e.g. patients from a particular group developing some disease or not). The method, called splined empirical probabilities, is based on the receiver operating characteristic and could potentially complement and improve on other methods of risk estimation. Ieva et al propose a graphical diagnostic tool using the well-known funnel plot to detect outliers among hospitals that treat patients with acute myocardial infarction (AMI). They used data collected from hospitals in the northern part of Italy to compare institutional outcomes and in particular in-hospital mortality after an AMI.

Outside the secondary care setting, this special issue includes three papers that address issues in a range of different settings. Worrall and Chausalet present a structured review of modelling demand in long-term care. Among their findings, they concluded that very few modelling efforts included informal care arrangement that is known to be a very important aspect of long-term care provision. Bowers and colleagues report on a study that used a variant of the travelling salesman problem algorithm to examine the allocation and routing of midwives in the community. The algorithm was coded into a computer simulation to assess the likely impact of a number of organisation factors on continuity of care, in this context defined as a patient having interactions with as few staff as possible. They concluded that although perfect continuity of care is impractical, flexibility in the visit schedule can help achieve better results. Finally, Knerer et al formulated a compartmental model to represent diseases transmission dynamics using parameters appropriate for dengue fever in Thailand. They used the model to assess the potential impact of a number of strategies that could potentially be used to contain such an epidemic. They concluded that an imperfect vaccine can help reduce disease spread, especially if it is part of a combined method to combat dengue fever transmission.

Concluding remarks

The IMA 2013 conference showed that there is still a lot of interest from academic and other researchers to develop and apply quantitative modelling techniques in the management of health and social care. It was also a great opportunity to hear from some of those who are the most likely beneficiaries of modelling findings, namely clinicians, health managers and policy makers. We believe that going forward, we need not only to focus our efforts in developing new and improving the performance of existing algorithms, but also in achieving better integration with qualitative research methods and with various relevant strands of the social sciences (ethnography, organisation behaviour etc.). In addition, supplementing hard mathematical modelling methods with soft operational research methods can often help in implementing the findings of modelling studies and to provide solutions that are more sensitive to context. Perhaps such efforts will be eventually articulated through the emerging sub-discipline of Behavioural Operational Research (BOR), which seeks to extend the range of traditional OR to encompass key aspects of human and social behaviour in service implementation and which is attracting increasing levels of attention [6]. In any case, collaborative projects which engage directly with those involved both in delivering and receiving health care is key if modelling is to make a difference in tackling the messy and complex problems of health and social care. Such engagement seems essential if making a positive impact on patients and people in general is our ultimate aim.

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