Editorial: IMA health 2016

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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 in hospitals, general practitioners or long-term care settings. Yet running health and social care systems efficiently and effectively is crucial to improving or even maintaining our quality of life.

Over the years, extensive research has been conducted to find immediate and long-term solutions to issues that are routinely faced by health and social care professionals, such as waiting lists and bed capacity, hospital redesign, workforce planning and scheduling, patient flow, performance management, disease monitoring, and health care technology assessment. In addition, there has been an exponential growth in the generation of data whether routinely for administrative or financial purposes or more specifically for clinical or research purposes including through devices and sensors.

Quantitative modelling and computer simulation techniques have been shown to be increasingly valuable in providing useful information to aid planning and management however studies have often been limited in their attempts to exploit the wealth of data.

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 Care since 1995. The aim of the conference is to bring together health care managers, clinicians, management consultants, and mathematicians, operational researchers, statisticians, health economists,

computing and data scientists 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 eighth chapter of this conference (IMA Health 2016) was held at Asia House, London, UK between 21 and 23 March 2016, and chaired by Prof Thierry Chausalet, professor at the University of Westminster. The conference had a theme around “challenges and opportunities in a Big Data era” and featured five keynote speakers, 45 oral presentations organised in 12 parallel sessions and 16 poster presentations. The keynote speakers included (in order of presentation):

- Professor Jeremy Wyatt, Professor of Digital Healthcare & Director, Wessex Institute of Health & Research, Faculty of Medicine, University of Southampton, UK: “Five Big Challenges for Big Health Data”
- Dr. Geraint Lewis, Chief Data Officer, NHS England, UK: “Challenges and Opportunities in the Era of Big Data”
- Professor Mike Carter, Director of the Centre for Research in Healthcare Engineering, University of Toronto, Canada: “Challenges with Implementing Modelling Methods in Healthcare”
- Professor Terry Mills, Honorary Statistician at Bendigo Health, Emeritus Professor at La Trobe University, Australia: “Cancer Services Research”
- Dr. Sasha Karakusevic, Visiting Senior Fellow, Nuffield Trust, UK, previously COO and Director of Strategy and Transformation at North Bristol NHS Trust, UK: “Measurement, Management and Meaning”

2 HCMS special issue

This is the sixth Health Care Management Science special issue devoted to papers presented at IMA Health conferences [1–6]. Only half of the papers submitted for consideration of publication in this special issue survived the rigorous review process of the journal and are included in this issue.

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The ten papers of this special issue have been grouped into three broad categories. First, we have included three papers that deal with urgent or critical care problems. The next four papers are more concerned with aspects of and systems for elective care. The three remaining papers develop and apply approaches to profile or predict health service utilisation and outcomes.

2.1 Urgent and critical care

Discrete event simulation (DES) is often used to tackle complex problems such as service redesign with a high level of uncertainty in arrivals and service times therefore it is not surprising that all three urgent or critical care papers use simulation as their main modelling approach. *Tuson et al.* modelled the impact on workforce planning of the introduction of a new single '111' helpline number for urgent medical concerns which would in effect be the merger of two existing systems. *Rachuba et al.* developed a discrete event simulation model to investigate how the introduction of new high-sensitivity troponin tests to assess the likelihood acute myocardial infection affected current practice at hospitals in the South West of England. The DES model built by *Bahou et al.* shows that the bottleneck in the critical care pathway for cardiothoracic surgery in a Scottish hospital came from the use of the high dependency unit and was used to develop an enhanced schedule to reduce patient cancellations.

2.2 Elective care

Looking at the next four papers, first *Rejeb et al.* propose a formal approach to evaluating health information systems combining DES with a micro-costing methodology. Validated it in the context of cancer consultations, the approach is sufficiently generic to be applicable in other outpatient care context. In order to improve hospital information systems design, *Gartner et al.* show that the problem of cognitive workload for order set optimisation could be significantly reduced using either a mathematical programming or a clustering (*k*-means) approach. *Niroumandrad et al.* develop a stochastic tabu search algorithm to find a weekly cyclic schedule that improves patient flow and physician satisfaction and reduces the duration of the pre-treatment phase for cancer. *Smith et al.* apply logit models to study the key hospital attributes that drive patient choice and found that distance appears more important than hospital statistics about size, performance, etc.

2.3 Health service utilisation and outcomes

The remaining three papers use Markov or semi-Markov based models to predict outcomes such as length of stay,

admission or mortality. *Gordon et al.* combines conditional phase-type distributions and survival tree to tackle variability and improve the prediction of length of stay in cohorts of elderly patients. The paper by *Grossetti et al.* explores the potential benefit of using administrative data in improving the prediction of survival based on a multi-state model in the context of chronic heart failure. Finally *Bottle et al.* use a multi-state modelling approach to compare admissions for heart failure and mortality in England and Lombardy, a northern region of Italy.

3 Concluding remarks

The conference showed again that there is strong interest in developing quantitative models to address problems in health and social care systems across the world. It also showed that there is an equally strong interest in the potential use of modelling by health and social care professionals. However it is clear that we are still some way from seeing modelling and analytics being routinely used to solve health and social care problems whether related to waiting times, bed capacity, hospital redesign, scheduling, or patient flow, to name a few. While there is always scope for improving models e.g. with better integration with other academic disciplines, routine model use and implementation is more likely to come from more active engagement of the modelling community with the health and social care community from grass root to policy level. With promising initiatives such as the PLETHORA (Planning for Effective Transformation of Healthcare using Operational Research and Advanced Analytics) project in the UK [7] funded by the Health Foundation, there is credible scope for achieving that goal.

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