Issue 5.4

Nosokinetics News

August 2008

Bi-monthly Newsletter of the UK Nosokinetics Group
Past issues at http://www.nosokinetics.org/

Highlights:

- Chris Bain's initiative to start an Online Discussion SIG
- Mark comments on the ubiquitous exponential in young dementia
- Some papers from the Group and Statistical data sources.
- Not forgetting the Springer book deadlines

Congratulations to Dr Eren Demir

His doctoral thesis — *Modelling Readmission: Defining and Developing a Framework for Profiling Hospitals* — was accepted with minor alterations. Eren is from the Health and Social Care Modelling Group (HSCMG) led by Thierry Chaussalet at the University of Westminster, London, UK.

For me the beauty of his research is that it reveals clinically understandable groups. The standard UK definition of an unplanned readmission is 28 days, and his literature review also found thirty to ninety days. However, Eren's methodology gives a different picture. Whereas 28 days is relevant for cardiac failure and chronic obstructive pulmonary disease, in stroke illness and fractured neck of femur the greatest risk for readmission is one day after discharge.

The policy focus on 28 days is on inappropriate admissions, whereas, for stroke illness and fractured femur we may be seeing inappropriate discharge. The data comes from the English NHS Hospital Episode Statistics data. Continuous-time Markov models capture the readmission process; optimal time windows are computed using Bayes theorem and a minimum classification error approach.

In the context of performance ratings frameworks, there are hundreds of clinical conditions. To address, this issue, length of stay in the community is clustered into groups. Using the estimated time window for each sub-group, readmitted patients are classified into "high" and "low" risk groups (binary response). The categorical response is used in predictive modelling and in the profiling process.

Furthermore, a transition model is adopted, which allows the incorporation of patient's past history of readmissions. Extension into a multilevel transition model enables individual hospitals propensity for first, second and third readmissions (and so on) to be measures of performance. Using these measures, from the 167 NHS acute and foundation Trusts in England, the worst performing hospitals for cluster 2 patients were in London.

Given the importance of patient readmissions in the NHS, the models and findings in this thesis should be of great interest to the department of health in other countries, healthcare commissioners in England, health and social services planners, and purchasers and providers of healthcare.

Where to next?

Eren's thesis is the ninth PhD associated with the Nosokinetics Group and five more are on the way. My database, which I know is incomplete, contains 188 references since 1991 relevant to modelling health and social care systems. This is our 28th Newsletter, and 2010 will see our third international conference.

Like a mushroom growing in the dark, sometime, someplace, somewhere, somehow we should breakthrough and be seen in the light. It's certainly not a forest fire more like water dripping on a stone. In 1972 we first recognised a problem with the measurement of hospital inpatient activity. 37 years later it's still there. If everyone knows the world is flat, how do we convince them it's round?

SHMIC Discussion Group - Australasian Initiative

Special Interest Group in Health care Management Informatics and Computing

Dr Christopher Bain

Chris writes: Given that many of the major problems confronting the Australian health care industry are management problems, rather than problems directly in clinical care provision (Armstrong *et al*, 2007), which is generally of a world leading standard, there seems to be a distinct lack of coordinated effort in terms of understanding what role information technology (IT) can have in supporting solutions to these problems. This is particularly the case when compared with the myriad of activity in the clinical informatics domain.

More specifically are the following unanswered questions in this regard:

- What are the key information and decision support requirements of health care managers?
- How do we harness some of the groundbreaking work in scheduling, forecasting, data presentation (Duckett *et al*, 2007) and other relevant areas (Stevermeur *et al*, 2007) happening in pockets, often in research environments. In particular, how can such innovations be operationalized and /or incorporated into robust, integrated IT systems?
- Are there standard definitions for management concepts such as "occupancy" and "congestion", for example; and how do we represent them in a way that IT practitioners and developers can incorporate them into practical IT systems?
- How do we ensure that HR, finance, PAS and predictive systems can work in an inter operable fashion given the complex and intertwined relationships between issues such as staffing, finance and bed management in health care organizations?

In response to this need there is now a forum dedicated to these problems, the newly established SHMIC (SIG in Health care Management Informatics and Computing) discussion group. This web based group is designed to advance health management (vs. clinical) informatics in Australasia by acting as a forum for communication between technologists, vendors, researchers, clinicians and health managers with an interest in improving the management of health care organizations of all types through the better use of IT. Members have already signed up from Australia, New Zealand, Singapore, Japan, Hong Kong, China and Taiwan.

This group is an accessible forum for interested people dedicated to advancing these issues, and it is designed to operate in a complementary fashion with the Nosokinetics group given the excellent technical work already undertaken under that banner.

Anyone interested in joining the group, or in establishing similar groups in other regions should contact Dr Christopher Bain at Christopher.Bain@wcmics.org or else visit http://www.health-mic.org.

Reference

Armstrong B et al (2007) Challenges in health and health care for Australia. *MJA*; 187 (9): 485-489.

Duckett S et al (2007) Identifying variations in quality of care in Queensland hospitals. *MJA*; 187 (10): 571-575.

Stevermuer TL et al (2007) Priority Rating for Community Care. *Aus Health Rev*; Nov; 31 (4): 592-602.

Young dementia and bed occupancy time: Well fitted by a single exponential with a constant

Mark Mackay sent us this interesting finding concerning the ubiquitous exponential.

Data - Effectively a single day census of seven younger patients with dementia, as part of a larger service (older persons mental health)

Method - Fitted in Excel®. Ran solver until no further parameter changes to avoid stopping before optimum reached (twice). Model fitting looks reasonable (see figure)

Results - Best fit equation: a single exponential fit, $y = Ae^{-Bx} + C$, where $A = 6.077$, $B = -0.001177$, and $C = 0.96$. The constant indicates that one long-stay patient effectively blocks the bed.

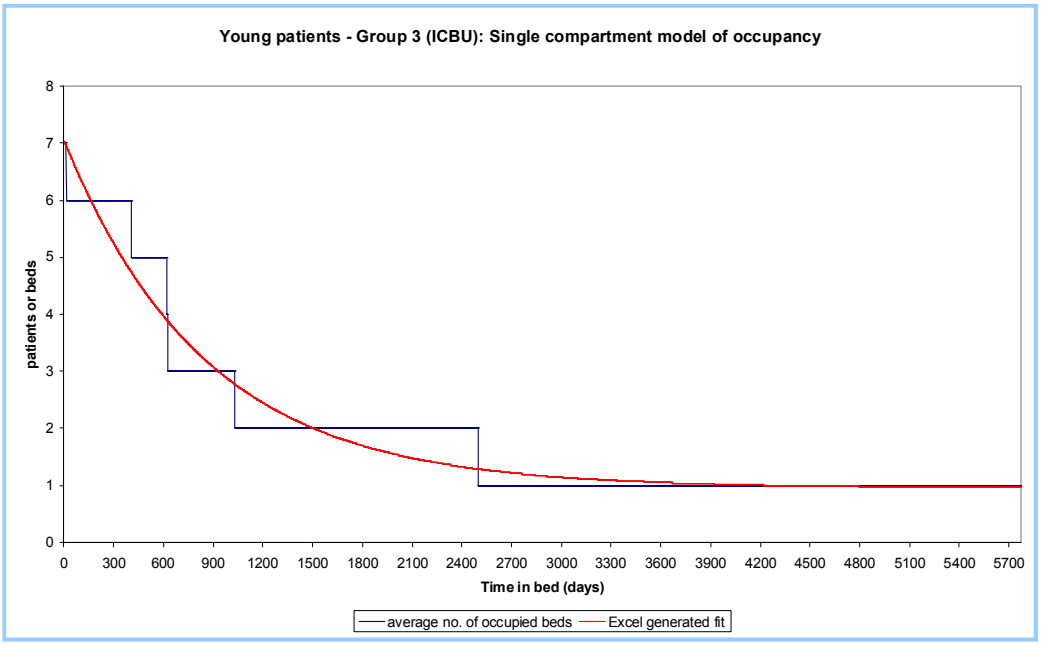
Modelled resource utilisation results

OVERALL		
Admissions (day)	=	0.007
Derived Total	=	6.07
Expected Length of Stay	=	849.9

ONE COMPARTMENT		
Number of inpatients	=	6.1
Release Rate	=	0.00118
Release Rate (patient/day)	=	0.007
Expected Length of Stay (days)	=	850
Percentage of Beds Occupied	=	100
Half-Life (days)	=	589
Rehabilitation Benefit	=	1
Percentage of Patients Treated	=	100

Discussion

Effectively getting 3 patients per year. Risk is that these patients are young enough that the expected stay is understated. To overcome this problem, the analysis should also be conducted on the discharged patients (presumably dead). Assuming the service has not changed greatly, this would enable the past occupancy time of younger patients with dementia to be taken into account. And the actual survival time in the system to be computed.



Editor's comment:

See FLoSC - Forecasting Length of Stay and Cost - Nosokinetics News Issue 4.5 page 3 to find a method of using cohort data to estimate survival and cost.

Simulating Surgical Processes

Using the Statecharts paradigm for simulation of patient flow in surgical care. Sobolev B, D Harel, C Vasilakis and A Levy. *Health care management science* 11:79 (2008).

Statecharts were originally developed to represent reactive systems by extending the formalism of finite state machines. Key concepts are hierarchy, parallelism and broadcasting of events. Hierarchy as one state can have many states. Parallelism implies more than one state can be active at any given time. Broadcasting of events allows a state to detect changes in another state. The beauty of this approach is that it describes the behavioural interactions within the process of care.

A simulation study of scheduling clinic appointments in surgical care; individual surgeon versus pooled lists. Vasilakis C, BG Sobolev et al. *Journal of the Operational Research Society* 58:202 (2007).

Tackles the problem of scheduling surgical outpatient clinics, when the availability of surgeons depends on other factors. Discrete-event simulation was used to determine the likely impact of scheduling methods on number of patients waiting and time to clinic and surgery. Statecharts were used to define states and transitions within each care delivery process. Results suggest that pooling referrals, so that clinic appointments are scheduled for the first available surgeon, has a differential impact on patient flow and surgical priorities.

Modelling the Cost of Care

Estimating the costs for a group of geriatric patients using the Coxian phase-type distribution. Marshall A, B Shaw and S McClean. *Statistics in medicine* 26:2716-2729 (2007).

Develops a methodology which estimates the 'spend-down' costs of cohorts of inpatients. The data comes from a Northern Ireland department of geriatric medicine. Involves 1392 patients between 2002 and 2003. The model should assist hospital managers, as it enables the costs of future decisions and policy changes to be tested, before the decisions are carried out on a real ward.

Modelling the flow of congestive heart failure patients through a hospital system. Shaw B and AH Marshall. *Journal of the Operational Research Society* 58:212 (2007).

Models the length of time heart failure patients spend in hospital. Uses a special type of Markov model, wherein the flow of patients in three stages, namely, short, medium and longer term care. Discharge triggers new admissions. The model enables changes in case-mix and turnover to be investigated. Hospital admissions to a Belfast hospital in Northern Ireland, between 2000 and 2004 are used to illustrate the model.

Where to treat the older patient? Can Markov models help us better understand the relationship between hospital and community care? McClean S and P Millard. *Journal of the Operational Research Society* 58:255 (2007).

The hypothetical outcome and cost of two contradictory policies of care is modelled. Therapeutic, wherein policies operating in acute hospitals given inpatients time and appropriate care, which enables them to be 'fit' for discharge, hence reducing the need for long-stay care. Prosthetic when early discharge needs community supportive services to succeed. Uses a Markov reward model for a healthcare system with Poisson admissions and an absorbing state, typically death. Develops a Markov reward model. Length of stay in hospital and community is described by a phase-type distribution, thus durations and costs in hospital and community can be costed. Facilitates the planning of health and social care systems and a holistic approach to costing.

Monitoring Decision Making

A simple graphical decision aid for the placement of elderly people in long-term care. Xie H, TJ Chaussalet et al. *Journal of the Operational Research Society* 58:446 (2007).

Constructs a graphical decision tool to aid placement decisions of a multidisciplinary review panel for admissions to long-term care in a London borough in the UK. A prediction model of placement decisions was based on an applicant's attributes. The composite model has syndromic decision rules followed by a two-stage hierarchical logistic regression model. The model was robust in differentiating cases needing residential home care and nursing home care. Placement outcomes generated by the model are represented graphically on a triangle plot. This approach could potentially be used as a decision support tool by managers of long-term care for continuous monitoring and assessment of the appropriateness of placements with respect to residents' needs.

Australian hospital statistics 2006-07 (available on-line)

Australian hospital statistics 2006-07 continues the comprehensive reporting of statistics on Australian hospitals by the Australian Institute of Health and Welfare . Presents a detailed overview of public and private hospital activity in 2006-07 with summaries of changes over time. Statistics presented on admitted patient care include information on patient diagnoses, procedures, lengths of stay, and waiting times for elective surgery. Emergency department activity statistics include information on triage categories, waiting times and the duration of care. Clinic level information on outpatient care is also presented. A range of hospital performance indicators are reported as well as information on public hospital expenditure, resources and bed numbers. This report is a useful resource for health planners, administrators and researchers with an interest in Australia's hospitals.

AIHW catalogue number HSE 55 Available from Can Print for $42.00 (1300 889 873)
http://www.aihw.gov.au/publications/index.cfm/title/10587

UK Economic and Social Data Service: On line data availability

ESDS has created a suite of web pages to aid researchers looking specifically for data on health and health behaviour:www.esds.ac.uk/themes/health/

As a theme, 'health' covers a wide range of topics and cuts across many academic disciplines: the boundaries of what constitutes health data and health research are both fuzzy and shifting. Data have been collected and are made available via the ESDS on topics as varied as the experience of illness, child development, access to care, lifestyle behaviour, subjective physical and mental well-being, diet and nutrition, immunisation programmes and attitudes towards health service provision. Data on health can cover not only a person's status, behaviour, attitudes and expectations but also the provision of health care, including the mechanics of policy making, government expenditure and service coverage.

The ESDS thematic health pages contain case studies, pointers to key data sources, ready-made searches demonstrating how to find health-related data, and web-based videos to showcase ESDS's online data exploration tools. The ESDS resources section contains overview and work-through guides and presentations. The presentations are from workshops organised by ESDS where expert speakers talk about data they have created or re-use of data.

The web-based videos demonstrate how researchers can view frequencies, conduct simple online tabulations, and produce graphs and subsets for a selection of health-related data, all using ESDS's online data exploration tools.

Health Atlas Ireland: Open source mapping, database and statistical system

http://www.epractice.eu/cases/healthatlas

Developed to bring health related datasets, statistical tools and GIS together in a web environment to add value to existing health data. The application enables controlled access to maps, data and analyses for service planning and delivery, major incident response, epidemiology and research to improve the health of patients and the population. Health Atlas Ireland is built upon open source software allowing it to capitalize on worldwide expertise without software licensing cost. Web access to powerful statistical, geographical and database components provide a cost-effective solution to health intelligence. Health Atlas is a ‘voyage of discovery’ for health service planning and health event data analysis. The purpose of the system is to help answer questions related to health events, emergency response, health services and demographics, initially in the Republic of Ireland and eventually worldwide as related to Irish Health Services.

Issue 5.4 **Nosokinetics News** August 2008

Bi-monthly Newsletter of the UK Nosokinetics Group 6

Call for Papers

The Second International Health and Social Care Modelling Conference (HSCM2008) has been a great success (see http://info200.infc.ulst.ac.uk/events/hscm2008/).

A special volume of Studies in Computational Intelligence, published by Springer, on Intelligent Patient Management will be published as post conference proceedings and is open to quality papers not presented at the conference. All submitted papers will undergo the normal peer review process.

We welcome papers in the broad areas of computational patient-centred practical and theoretical approaches for measuring and modelling, managing and evaluating health and social care systems. Topics include but are not limited to:

- Capacity /Resource planning
- Planning
- Community Care Management
- Disease Monitoring and Management
- Early Diagnosis and Screening
- Forecasting
- Forward planning
- Impact of E-Health and Smart technology on patient management
- Implementing Change
- Length of stay modelling
- Long Term Care
- Long Term Planning
- Patient flows
- Queues and occupancy
- Resource Usage
- Strategic planning
- Waiting List Management
- Workforce Planning

Important dates

- Deadline for paper submission: End of July 2008
- Deadline for the first round of refereeing: End of October 2008
- Deadline for submitting revised papers: End of December 2008
- Publication: Late 2009

Please submit by email (PDF or Word file) to Sally McClean si.mcclean@ulster.ac.uk
Final versions of accepted papers should follow the Springer style, available at: www.springer.com/series/7092

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Nosokinetics News is the newsletter of the UK Nosokinetics Group

Nosokinetics is the science / subject of measuring and modelling the dynamic aspects of patient and client movement (flow) through health and social care systems. From the Greek, literally, *noso* (sickness) and *kinetics* (movement).

The group collaborates to organise conferences and disseminates news of our and others research and practical use of modelling to enhance decision making in health and social care systems.
Past issues in PDF at http://ww.nosokinetics.org/

Thanks to IMS our web archive of full texts of submitted papers between 2006-2007 is at:
http://www.iol.ie/~rjtechne/millard/index0.htm

To receive a personal copy follow the instructions at

http://www.jiscmail.ac.uk/lists/NOSOKINETICS-NEWSLETTER.html