Issue 5.5

Nosokinetics News

October 2008

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

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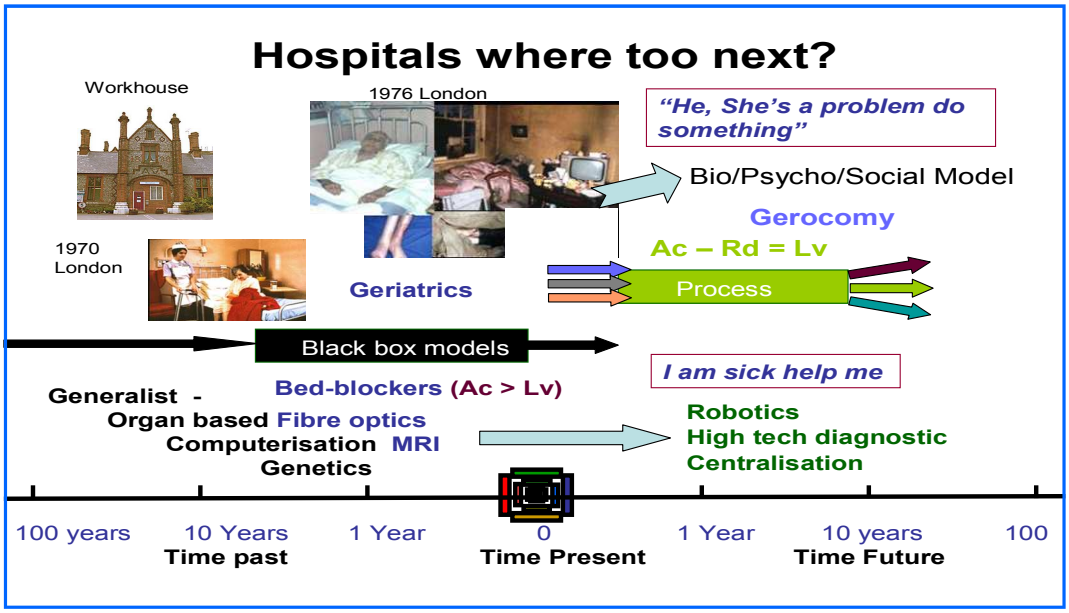
Hospitals where to next?

In September I was invited by Dr Alfonso J. Cruz-Jentoft, President of the European Union Geriatric Medicine Society to attend the European Summit on Age Related Diseases, hosted by Prof Dr Andrzej Milewicz, in Wrocław –Poland. My brief was to discuss Hospitals, in a workshop on Clinical Sciences. Other workshops were on Basic Research and Clinical Sciences. A European Silver Paper is in final completion (more later). Here seeking discussion and reader responses I simply present the opening slide of my presentation.



Two streams of clinical endeavour, with an enormous gulf, for one is rooted in the workhouse, the other in medical science. Both with distant roots in Hippocrates. First in duties, "to help, or at least to do no harm".[1] Second, in teamwork, for Hippocrates first Aphorism states, "Physicians must ensure that the patient, the attendants and the externals co-operate with them in treatment".[2]

General medicine has a long and distinguished history, whereas geriatric medicine is short lived. In 1948 the Operational Plan which created the National Health Service made Regional Hospital Boards responsible for the care of the chronic sick. In 1954, 54,000 hospital beds were blocked.[3] Consultant physician leadership was introduced into the long-stay wards, to attack bed rest, and in so doing, to free acute hospital beds for citizens who were doing useful productive work.[4] From this beginning geriatric medicine began.

Now the increasing sophistication of organ based medical care demands that access to hospitals providing acute medical care should not be denied on grounds of age alone. However, the return of bed-blocking, delayed discharges and inappropriate admissions to acute hospitals demands that the 'Top-Down', *man machine model* of acute hospital care (Ac>Lv)[5] needs a new, separate, acute hospital based 'Bottom-Up' *bio/psycho/social model* of care for the dependent sick (Ac-Rd=Lv)[6] for the benefit of the strong.

The world population is ageing. To meet these challenges, to provide open access to acute medical care, 21st Century acute hospitals need to invest in purpose designed and staffed acute hospital departments to deal with the social presentation of disease and bed-blocking at the interface between hospital and institutional care. New problems need new ideas: not geriatrics, gerocomy.[7]

(References overleaf page 2)

Readers Write

Australian data available

Hi, Peter --

I enjoy getting the Nosokinetics newsletter. Hope you can keep it going! The research you and your team are doing is really interesting, and is starting to enter the psyche of managers and administrators who are now looking at the flow of patients through the system.

Going whereto?

Managers are now looking at the hourly peaks and troughs of admissions and discharges by ward at several hospitals here in Australia, and the patient care teams are actually working together to think about ways to improve this flow, rather than just complain about the system.

The topics in the newsletter often spark some new ideas at the operational level. We then test some of these against our multi-hospital inpatient database, which now adds about 3 million episodes a year. We would welcome other researchers who want to test some hypotheses against a real-world dataset.

Would be delighted for people to do some work with it see.

http://www.healthroundtable.org/Home/tabid/77/Default.aspx

for info on research requests.

David Dean, (david *dot* dean *at* healthroundtable *dot* org)
General Manager, The Health Roundtable

Order within disorder

Dear Peter,

Once a publication is started, with any luck it will grow. A lot depends upon contributors but there is always something that catches ones interest and it may be different items for different people. I remember the Institute of Measurement and Control publication, I used to wonder what planet some of the contributors were on.

I came to Measurement and Control via Electrical and Electronic engineering. However it was me that gave talks and drafted and ran a winter refresher course at our local Tech College.

I do read Noso and frequently print it out. Perhaps you should have itemised pages for say, 'Recent Developments', 'Ideas on Trial', 'Readers Write', Sort of specific contributed items in their own designated pages. You know, like; 'End Column'. 'Last Word'. 'Readers Enquiries'. I like structure and turn to my favourite pages first.

I am sure you know of the value of worms in the intestines as we always had until fairly recently, and the latest study of the maggots of Greenbottle Fly who's mucus fights of 4 types of C Diff?

I write under two Headings in two Magazines, 'As I was Saying' and 'My View From Here'. I don't know who got our new Vicar to ask me to contribute to the 'Three Parish' Magazine, but I seem to have developed a fan club and have been at it for three years now.

Best regards, Fred Hall

Hospitals where to next? References

1. From *Epidemics*, Bk. I, Sect. V. ic http://en.wikipedia.org/wiki/

2. From Sydenham Edition — RSM Library seeking exact words, which were singular, masculine (cooperate with him)

3. Graham, B (1982) *Compassionate strangers*. London, Counsel and Care.

4. Cochrane, AL (1971) *Effectiveness and efficiency: random reflections on health services*. London, Nuffield Provincial Hospitals Trust.

5. Ac=Lv is the stable state, wherein the number of inpatients being converted to long stay care equals the rate of bed availability (usually death) of long stay patients. Ac>Lv implies that the demand for long term care is greater than the supply .See Harrison, GW and PH Millard (1991) Balancing acute and long-term care: the mathematics of throughput in departments of geriatric medicine. *Methods of Information in Medicine* 30(3):221-8

6. Ac-Rd=Lv implies that a therapeutic rehabilitative and community supportive service is introduced between the demand and supply of long-term institutional care. See Millard, PH and C Lee (1997) The biochemistry of health care. *CME Bulletin Geriatric Medicine* 1(1):5-6. Bear in mind it takes five to six years to reach a new stable state. See El-Darzi, E, C Vasilakis, et al. (1998) A simulation modelling approach to evaluating length of stay, occupancy, emptiness and bed blocking in a hospital geriatric department. *Health Care Manag Sci* 1(2):143-9

7. Millard, PH (1991) A case for the development of departments of gerocomy in all district general hospitals. *Journal of the Royal Society of Medicine* 84:731-733.

Measurement is without: Change is within : Peter Millard

Between 1948 and 1978, turnover in UK departments of geriatric medicine increased from one patient per bed per year to 4.5 patients per bed per year (D.H.S.S. 1981). Why? In this, the first of three contributions, I return to the text of my 1988 MD thesis to consider the concepts which underpin behavioural models of flow through health and social care systems

Consulting the oracle

'The Book of Changes - *I Ching* - is unquestionably one the most important books in the world's literature. Its origins go back to mythical antiquity, and it has occupied the attention of the most eminent scholars of China down to the present day'.[1] Everyone recognises the Yin and Yang, but few know that 64 hexagrams, reflecting seasonal change, underpin the wisdom of the ancients.

Hexagrams (Figure 1)

In the I Ching, the six lines are either broken or unbroken. Here, metaphorically, the lines represent the beds and the events represent admissions. In six line models, events can be placed anywhere in the model. They can be placed regularly in each line, randomly in any line, or even in a regular fashion in changing lines.

When change is occurring randomly, i.e. the number of events in one line increases, then there has to be some form of connection between the lines, if change is to be predicted. Diagrammatically interrelation is unlikely, but it remains a possibility.

Geriatric medicine (Figure 1)

In the UK geriatric medicine began in the long stay wards. All services had to be developed. Clearly change was not occurring in a regular fashion, as in column A, because, if it was, the predictions based upon a single line mathematical model would still hold true. So change must be occurring in only some of the allocated beds, either randomly, column B or in a constant fashion, column C. The problem of measurement arises because the events are randomly distributed.[2]).

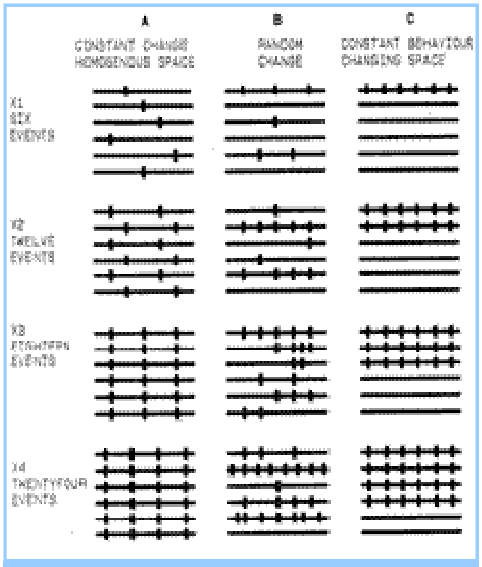


Figure 1: Hexagrams showing three reasons why turnover could have increased in geriatric medicine from one event per year to four events per year.

In six line models it is unclear whether admissions increased because length of stay shortened in the available beds, or because of increasing activity, i.e. increasing skill, or whether admission increased because the space within changed.

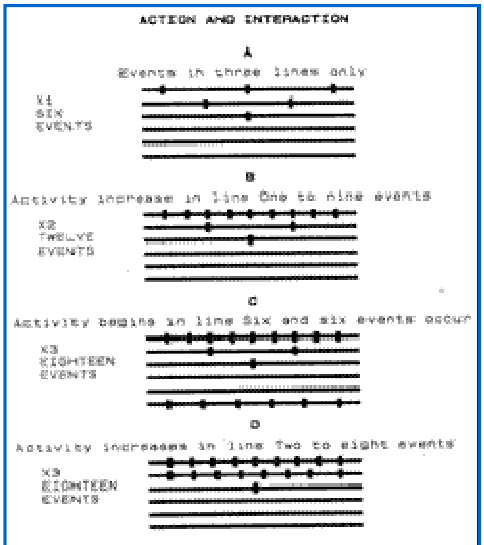


Figure 2: Six line models showing why increasing events could begin in one ward only, and how a rate limiting factor could explain why change was introduced into other wards.

Behavioural change (Figure 1)

Column C shows, theoretically, a constant form of behaviour could be operating within the allocated space. If so, increased admission numbers would then reflect change of use of long stay beds to admission beds. Alternatively increasing skill in coping with the problems of an aged population reduced the demand for long stay beds.[3] Whether the latter is not untrue, depends upon whether action in the acute wards interacts with the duration of life in long stay wards.

Action and interaction (Figure 2)

Consider a six line model with three events in the first line, two events in the second line, one event in the third line and no events in lines four, five and six. Overall six events occur. Then increase the number of events in the model to twelve by placing the six extra events in the first line. As figure 2 shows, this can be done without altering the other lines. If change occurs in the other lines there must be some form of interconnection between the lines.

However, if the number of events increase to eighteen, as in mod-

els C and D, then it may not be possible to introduce them all into the first line, simply because of lack of space. So, to accommodate the extra events they have to be placed in other lines. Where they are placed is simply a matter of choice. They could have all been placed in the sixth line as in model C, which would imply that a distant long stay ward changed its function. Practically, it is more likely that a ward close to the original ward would change its function instead (Model D).

Hypothesis

If a rate limiting factor, a specialty specific service time, equivalent perhaps to a Diagnostic Related Group, operated in geriatric medicine, then this would explain why admissions increased as long stay beds were turned into acute beds[4] and decreased when acute beds were converted into long stay.[5]

In six line models events can be placed anywhere in a line and there is no reason why change in one line should in any way interact with other lines. However, in hospital wards and departments interaction may occur. Better treatment might reduce the demand for long term care; nursing staff move between wards; doctors, therapists and social workers are responsible for patient care in more than one ward etc. Interaction may or may not be occurring. Examined from without, without visiting the wards, one will have little understanding of what is happening within.

Policy issues (Figure 3)

Nine possible strategies for change in bed allocation and use to meet the needs of an ageing population are shown in Figure 3. The boxes represent the long-term strategy.

With the passage of time the overall bed allocation can remain the same, increase, or decrease. And within these changes, the number of beds for long stay care (the black portion) remains the same in models 1, 2, and 3, increases in models 4, 5 and 6 and decreases in models 7, 8, 9.

Moving between State A and State B, increasing the overall number of beds increases the space available for admissions, only, if the increased numbers of beds are designated as acute (model 3). Admission numbers would increase in models 3, 7 and 9 because the space designated for acute admissions increases, and decrease in models 2, 4 and 5 because the designated acute space decreases.

Overall the best outcome is model 9 and the worst is model 5. Which, believe it or not, is the current UK policy.

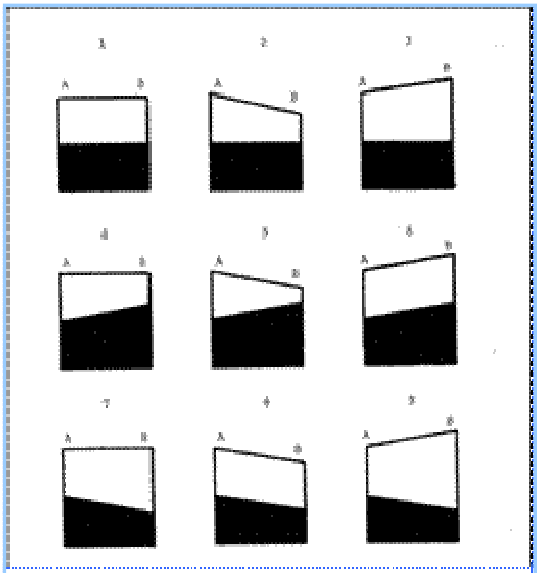


Figure 3. Nine patterns showing the outcome of decisions which influence the balance of acute and long stay beds when state A s transformed to state B. Assuming constant behaviour then admission numbers will increase in 3,7 and 9, decrease in 2, 4 and 5, and stay the same in 1, 6 and 8.

Model making

In developing a behavioural theory of flow I was influenced greatly by the work of PD Ouspensky a Russian mathematician philosopher. He made me realise that the solution to measuring and modelling clinical care systems lies in new physics. In the next article I will explore the thinking which led us develop a theoretical basis for the creation of models based on bed census data.

> 'Everything we know, everything we recognise as existing, lies on the line of the fourth dimension; the line of the fourth dimension is the historical time of our section of existence. This is the only time we fill, the only time we recognise'.[2]

This is the time we see on ward rounds. This is the time that defines inpatients into clinically meaning time related categories of dying, acute, recovering, 'bed-blocking' etc. And this is the time that we will never find if we use black-box (econometric models) fail to introduce different methods of measuring and modelling health and social care systems.

1. Wilhelm RT. *I Ching, or Book of Changes*. 3 ed. London: Routledge Kegan Paul, 1984.
2. Ouspensky PD. *A new model of the universe*. Third Edition 1938 ed. London: Routledge & Kegan Paul Ltd, 1931.
3. Avery-Jones F. Length of stay in hospital. *Lancet* 1964;i:321-332.
4. Arnold J, Exton-Smith AN. The geriatric department and the community: value of hospital treatment in the aged. *Lancet* 1962;ii:551-553.
5. Millard PH. Throughput in a department of geriatric medicine: a problem of time, space and behaviour. *Health Trends* 1992;24:20-24.

From the Journals

Observation units: clinical benefit, increased cost?

Develops a model using economic principles of stock options, opportunity costs, and net present value to capture the value generated by observation units: i.e. separate admission units for chest pain, asthma etc. Estimates that the average value of a single admission in dollars is 40% higher than expected. Nevertheless, the positive clinical benefit may justify the cost. The Appendix describes the method used.

Baugh, CW and JS Bohan (2008) Estimating observation unit profitability with options modeling. *Acad Emerg Med* 15 (5):445-52.

Predicting bed occupancy

Develops a model which predicts bed occupancy in real time. Uses statistical data at the patient level, from a mid-size American community hospital. Second generation model described. Discusses results of piloting previous model. Tests model using two years data.

Littig, S J and MW Isken (2007) Short term hospital occupancy prediction. *Health Care Manag Sci* 10(1):47-66.

Planning for emergencies

National policy in USA for emergency preparedness calls for hospitals to accommodate 500 new patients per millions. Peak hospital capacity was defined as the 95th percentile. Data analysed for 1996 to 2002. Occupancy averaged 60% of the peak for children and 82% for adults. After 9/11 a discretionary modification of admissions and discharges resulted in 11% reduction for children and adults. Concludes that standards of hospital care for children need to be expanded.

Kanter, RK and JR Moran (2007) Hospital emergency surge capacity: an empiric New York statewide study. *Ann Emerg Med* 50(3):314-9.

Emergency overcrowding - why's and wherefore's

Structured literature review. From 4,271 abstracts and 188 full texts 93 article met inclusion criteria. 33 studied causes, 27 effects and 40 solutions. Results indicate the complex, multifaceted characteristics of inpatient crowding, with different input, process and output factors. Clearly one size does not fit all. Provides a useful background and fruitful field for modelling research.

Hoot, NR and D Aronsky (2008) Systematic review of emergency department crowding: causes, effects, and solutions. *Ann Emerg Med* 52(2):126-36.

and ...

Hoot, NR, LJ LeBlanc, et al. (2008) Forecasting emergency department crowding: a discrete event simulation. *Ann Emerg Med* 52(2):116-25.

Hoot, NR, C Zhou, et al. (2007) Measuring and forecasting emergency department crowding in real time. *Ann Emerg Med* 49(6):747-55.

McCarthy, ML, SL Zeger, et al. (2008) The challenge of predicting demand for emergency department services. *Acad Emerg Med* 15(4):337-46.

Improving emergency efficiency - sting in the tale

Describes a practical project that streamlined the admission of emergency patients. Structurally, the medical admission unit became part of A&E, and short-stay medical, surgical and paediatric wards were relocated. Practically, medical notes were redesigned and the first attending doctor clerked the patient. Three months comparative data, before and after, showed that emergency admissions decreased by 16.3% (medical) and 3.9% (surgical). Median length of stay for emergency medical patients decreased from 7 to 5 days. However, length of stay of admitted patients and medical outliers (bed-borrowing) increased, and the improved efficiency in processing emergency patients disadvantaged the hospital financially.

Boyle, AA, SM Robinson, et al. (2008) Integrated hospital emergency care improves efficiency. *Emerg Med J* 25(2):78-82.

Optimising flow in new hospitals

In planning a new hospital, services, such as centralised medical imaging generate a lot of back and forth patient flow. This increases lead times of care and puts patients at risk. Information for proximity ranking of different units of the hospital enabled the planning team to decide where units should be cited. Medical imaging is ubiquitous and optimal placement is essential to achieve simple high velocity flow.

Karvonen, S, H Korvenranta, et al. (2007) Production flow analysis: a tool for designing a lean hospital. *World Hosp Health Serv* 43(1):28-31.

Nosokinetics News

Bi-monthly Newsletter of the UK Nosokinetics Group

Bits and pieces

Health expenditure Australia 2006-07 Australian Institute of Health and Welfare Report

Examines expenditure on health goods and services in Australia for 1996-97 to 2006-07. Australia spent over $94.0 billion on health in 2006-07, $7.3 billion (8.4%) more than in 2005-06. Report presents expenditure estimates: at the aggregate level; as a proportion of gross domestic product (GDP); on a per person basis; by state and territory; by comparison with selected OECD and Asia-Pacific countries; and by source of funding (Australian Government, other governments and the non-government sector). This report will be helpful to anyone interested in studying, analysing and comparing estimates of health expenditure in Australia.

AIHW catalogue number **HWE 42**. Available from CanPrint for **$32.00** (1300 889 873).

For media release see http://www.aihw.gov.au/mediacentre/2008/mr20080926.cfm
For report see http://www.aihw.gov.au/publications/index.cfm/title/10659

Merger of USA data bases on aging

The National Center for Health Statistics is pleased to announce the forthcoming merger of the Trends in Health and Aging (THA, http://www.cdc.gov/nchs/agingact.htm) and Health Data for All Ages (HDAA, http://www.cdc.gov/nchs/health_data_for_all_ages.htm) web-sites. The new web-site, Health Data Interactive (HDI), will incorporate information on aging as well as on the health of children and younger adults. During a transitional period, the THA and HDAA sites will remain operational but not updated. After that, please direct questions on HDI to hdi@cdc.gov. Other questions on aging-related data can be sent to yag9@cdc.gov. You can learn more about NCHS data and the HDI web-site at the NCHS Data Users Conference in Washington DC, August 11-13 (http://www.cdc.gov/nchs/events/duc2008/08duc_postcard.htm).

EURO XXIII

23rd European Conference on Operational Research
Bonn, Germany, July 5-8, 2009

Submission for abstracts starts: October 2008
Deadline for abstract submission: March 1, 2009

CALL FOR PAPERS http://www.euro-2009.de/

Last words: Springer Book Chapter Deadline

Authors of accepted papers please send their contribution to Sally by October 24th, in the Springer Style. Time is passing and we need to get as many as possible completed to ensure we meet the December deadline.

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

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