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**Nosokinetics**  
HEALTH & SOCIAL CARE MODELLING

## Where too next? Science base completed: Now for the Art

The mathematical science base is complete. The interactions within and between health and social care services are clear. Failure to provide appropriate, knowledge based, clinical and social services to meet the genuine needs of sick and dependent citizens causes bed crises.

The weakness of econometric, cause and effect, models, is the assumption that human beings act rationally. Just like the machines in the industrial revolution, pull the levers and low and behold change happens. Similarly, in an adversarial society, politicians plan in sound bites, with their eye on the next election. Blame the outgoing party. Think of a good slogan, and, metaphorically, throw the baby out with the bathwater.

How easy it would be to solve the problems of modern hospitals by only admitting people worthy of admission. Interesting cases, with single organ failure, challenging diagnosis, and supportive families. Better still if the 'grot', the 'old crumble' and the 'bed-blocker' never came in. Blaming others for their presence. Creating a world of delusion. While secretly wishing they were at St. Elsewhere's.

Have you ever arrived at a friend's house and known, without being told, that all was not right. Or been to a residential home, and felt that you would not like to be there. Or worse still, seen a consultant physician or surgeon and the team walk past a 'bed-blocker' without even recognising that they are there.

Old and vulnerable, in need of love and belonging, how would you feel, if the first time the care manager came to assess your needs, you were asked "Where would you like to die?" Be careful what you say. In the UK, seemingly, the answer 'At Home' is legally binding, whereas 'In hospital' is not.

Will the science base be used for good or ill? Like elephants passing in the night sky, here today, gone to morrow, we cannot be indifferent to what happens next? Our life on the planet, a hundred years at most, is a pebble on the beach compared with eternity.

History teaches: without love and belonging, the art of medicine, is easily corrupted. Moving forward the choice is clear. Either we plan to make the equation  $Ac=Lv$  become  $Ac-Rd=Lv$  or we don't, i.e., either we create a knowledge based interface service between the acute hospital demand for long stay institutional care and its provision, or we don't.

In this newsletter we go back to the 1970's to seek long forgotten post-war dreams of a better world. Putting love and belonging at the centre of every plan.



West Cameroon 1962.  
Elephants passing in the sky

## Therapeutic Optimism: The Missing Ingredient of Evidence Based Medicine

Disease presents differently in sick and dependent people. The classic 'I am sick help me' contract between patient and doctor rarely applies. Rather a third party is involved. Usually a relative, but neighbours, friends or colleagues (the latter in the case of bed blocking) may be involved. Hence the contract becomes "He / She is a problem do something": falling, incontinent, confusion, wandering, bed-blocking, and the role of the doctor changes, in the words of Dr Trevor Howell, a pioneer of geriatric medicine as 'Searching for diamonds in dustbins'. Based on a 1974 conference presentation

**Back to the Future.** When Dr. Trevor Howell invited me to address you today my behaviour could be predicted. As the event was distant I would feel honoured and accept, as the appointed day came closer I would become more and more concerned and today I stand before you wondering why I accepted at all. Dr. Howell's motivation in inviting me is unknown, what he prophesied to the organising committee that I would say is unknown; but if he is correct they should not be surprised for his prophecy is more likely to be accurate simply because it was made.

**Prophecy causes its own fulfilment** In hypnosis (Moll 1898) subjects behaved as they believed they were expected to behave. Also in athletics (Jastrow 1900) entertainment of the notion of a possible failure to reach the mark lessens the intensity of one's efforts and prevents the accomplishment of one's best. He did not say whose expectations were involved.

**The placebo effect** In medical field, at the very least, staff prophecies or expectancies can affect their prescription of patient improvement; and very likely staff prophecies can also effect the patient's actual improvement. Hence, the wisdom of the old physician who "Treats as many patients as possible with new drugs whilst they still have power to heal."

**Education** More disadvantaged children, rather than middle class children fail at school. Why do they fail? By definition they come from lower socio-economic groups where low income is associated with values that are different to the culture of the pre-dominantly middle class school.

**Prophecy fulfilled** Rosenthal and Jacobson (1968) reported to their teachers that 20% of the children in a US school were showing unusual potential for intellectual growth as assessed by a new test. The test was a standard I.Q. test and the names of the children were chosen at random. Eight months later these unusual or "magic" children showed significantly greater gains in I.Q. than did the remaining children. Supporting the concept that the lower class child is punished for what he / she is.

**Cause and effect** Differential funding. Rose (1956) concluded if the State spent less than one-fifth as much on the education of its disadvantaged youth, inferiority of scholastic achievement may well have become a reality. Are there not here some similarities with medical provision for the elderly?

**Analogy to Health care.** If the medical and remedial professions expect old people to fail and they too expect to fail, could this not stop them from trying? If in addition, we provide them with inadequate services and often ignore them, the poverty of their achievement will have become a reality. We can justify our failure by quantifying their advanced years, poor housing, bad eyesight, incontinence, deafness, loneliness and dementia. Creating artificial scores of their mental state, social isolation, social contacts, mobility and continence and then from these we can measure their failure. Are we not, however, using the values of a historic medical scientific culture to measure another culture?

**Prophecy** Diagnosis focuses on what patients cannot do. Enablement focuses on what they can do. If, it is not untrue that people behave in the way they are expected to behave, then we too should be looking at the teachers and not at the taught. The person looking from the outside at a group of old people can prophecy that they will not do well, that their incontinence will be irremediable, that their minds will be muddled and that their age is against them. They are, however, only passers-by whilst we remain.

As health care workers, we cannot be allowed the casual prophecies of the passer-by for our prophecies will be fulfilled. A pessimistic prognosis if supported by the staff, relatives and patient carries a formidable force which if it is a prediction of death is usually accurate, especially if nothing is done to prevent it.

**Bed-blocking** The prophecy that this patient is irremediable and needs to be looked after in a long-term hospital bed or nursing home is best made, we are informed, either in another physician's bed or on a domiciliary visit, when both the medical and social factors can be taken in to account. If the prophecy is one of the eventual need for long-term care the patient or client is put on a non-priority waiting list for a long-term bed.

(Continued over leaf)

**Therapeutic optimism** What would happen if we all decided, whatever our eyes showed us, we would make sure that we always started discussing the medical care of old people with an optimistic prophecy? You will all by now have said to yourselves that this is impossible and will have thought of an individual case to prove your point of view. You may say that it is no longer defensible to make generalizations about old people as if they were all the same and that old people are individuals with individual diseases, and that some of them are poor and some of them are dirty and some of them are not wanted by anybody. I agree but my generalization was not about the patients it was about ourselves.

**Examining ourselves** If we are to examine ourselves let us start by considering the theme of today's symposium "Living dangerously in old age". All of us have run many risks in coming here today. We could have been involved in a road traffic accident, which we would have avoided by staying at home but this in itself is highly dangerous for most accidents occur in the home! Why then is living any more dangerous in old age than it is in middle-age? I drive (sic 1974) a sports car; my mother doesn't drive but walks everywhere. Not only is she in no danger of killing herself in a car but she is probably age for age much fitter than I am. Should not then this symposium have been entitled "Living"?

**Living in old age** Old people in England cannot accurately be described as usually disabled from illness, economically destitute or psychologically alienated. On the contrary, most older people in urban industrial societies are reasonably competent in meeting their needs, socially as well as personally. And it is no longer profitable or indeed defensible to make generalizations about the aged as if they constituted a single category.

**Planning.** What sort of medical and social service should we plan? Clearly, it must be optimistic as pessimists always fail. Given adequate supporting medical staff, enthusiastic nurses, and rehabilitative staff a considerable amount can be achieved. In the London Borough of Merton we have developed a policy of mixed sex nursing which we believe improves the standard of care in that all procedures, both medical and nursing, must be carried out in strict privacy and that when patients are out of bed they must be adequately dressed. All methods of restricting mobility throughout the unit have been removed. There are few cot-sides and no special geriatric chairs.

**Active optimistic target programming** A high degree of personal independence is encouraged. All patients are told how they can help themselves to get better and achieve the goal of returning to their own home. We accept, however, that for some patients, especially those who are dying, that a different pattern of nursing care is needed. We are attempting to develop an optimistic philosophy of care with which everyone must agree. Within a situation such as this, that involves many personalities, the ultimate outcome in each ward is dependent on the staff in that ward.

**Interlocking sub systems** The role of each part of the department is dependent upon what each part of the unit comes to fulfil which as I have said is dependent upon the personnel involved. Whether a ward becomes a rehabilitation centre is not therefore solely dependent upon the facilities provided but upon the attitudes of the staff. I believe that in Merton we can now say that an active optimistic service can be given to elderly people to enable them to live at home so long as the hospital and the local authority work together towards a common goal.

**Prophecy success** Professionals can no longer be allowed the casual prophecies of the passer-by. Old people in the main are not sociably isolated, not lonely, not incontinent, not depressed and not demented and that if they are there are many things that we can do to make them better and to enable them to live in their own home. We should, however, remember that it is not solely a matter of dressing them, walking them and treating them with the right drugs. Nor of prescribing meals-on-wheels, home helps, district nurses and day centres as the panacea of all ills, but it is all to do with how we behave towards them.

A quotation from George Bernard Shaw's PYGMALION is the best summary of what I have been trying to say: "You see, really and truly, apart from the things anyone can pick up (the dressing and the proper way of speaking and so on) the difference between a lady and a flower girl is not how she behaves, but how she's treated. I shall always be a flower girl to Professor Higgins, because he always treats me as a flower girl, and always will; but I know I can be a lady to you, because you always treat me as a lady, and always will."

Pygmalion in the Classroom (1968), Rosenthal R. Jacobson L. Renhart and Winston Inc.

*Waiting list behaviour and the consequences for NHS targets*

Bowers, J. (2010). *Journal of the Operational Research Society* 61(2): 246-255.

Scotland Simulation. Data, orthopaedics. Clinical priorities, trump first in first out. In the short or medium term waiting list distributions are approximately constant.

*Health network mergers and hospital re-planning*

Güneş, E. D. and H. Yaman (2010). *Journal of the Operational Research Society* 61(2): 275-284.

Turkish hospital networks. Government 2005 merged Ministry of Health and Social Securities hospitals. Model an assessment tool considering the outcome of changes.

*Modelling the size and skill-mix of hospital nursing teams*

Harper, P., N. Powell, et al. (2010). *Journal of the Operational Research Society* 61: 768-779.

UK Optimization of a hospital capacity simulation tool, PROMPT, suggests cost benefit of increasing permanently employed nurses. Model permits study of changing size and skill-mix as a consequence of changes in patient volumes, patient case-mix, numbers of beds and length of stay.

See also *Ward nursing quality and grade-mix. Report of paired-ward experiments undertaken in the North Western Region*. Bagust, A., R. Slack, et al. (1992). University of York, York Health Economics Consortium. Describes benefits in efficiency and outcome of employing fewer all trained nursing staff, rather than more staff auxiliaries.

*A system dynamics-based simulation study for managing clinical governance and pathways in a hospital*

Maliapen, M. and B. C. Dangerfield (2010). *Journal of the Operational Research Society* 61(2): 255-265.

Australian data. DRG case mix data. Classification into useful pathways, enables executive and clinician to test various scenarios. reducing length of stay, costs and resource utilisation.

*Why modelling and model use matter*

Pidd, M. (2010). *Journal of the Operational Research Society* 61: 14-24.

Develops a theory of model use based on four categories. decision automation, routine decision support, investigation and improvement, and generating insights for debate. Concludes a theory of model use would be of value to academics, who could prioritise their work, and to practitioners, who could place their own work in a broader landscape.

*First, do no harm? A framework for evaluating new versus reprocessed medical devices*

Sloan, T. (2010). *Journal of the Operational Research Society* 61(2): 191-202.

Reprocessing single use devices. Economy points one way, patient safety another. Markov decision framework used.

*Impact of adjustment measures on reducing outpatient waiting time in a community hospital: application of a computer simulation*

Chen, B. L., E. D. Li, et al. (2010). *Chin Med J (Engl)* 123(5): 574-580.

China. Adoption of an appointment system and flexible management of doctor scheduling may be effective way to achieve decreased waiting time.

*An integrated queuing and multi-objective bed allocation model with application to a hospital in China*

Beullens, P., D. Jones, et al. (2009). *Journal of the Operational Research Society* 60: 330-338.

The model is based on queuing theory and goal programming. Taking account of targets and objectives related to customer service and profits



*Estimating parameters of proportional hazards model based on expert knowledge and statistical data*

Zuashkiani, A., D. Banjevic, et al. (2009). Journal of the Operational Research Society 60: 1621-1636.

Canada: Collaboration with the steel and mining industries inspired this research. The main purpose was the need to make maintenance decisions on condition monitoring variables. For me the terms - imminent risk of failure, catastrophic potential, loss, injury, failure potential and probability - resonated with the use of DRG - one size fits all - nature of current hospital funding initiatives. Treating the pathway, forgetting the individual.

Generally, hazard models require large data sets. However, Bayesian methods allow expert knowledge and collected data to be used. Medically, every clinician can recall things that went wrong. Similarly, as in the mining and steel industry, in health and social care experts overestimate the risk. Witness Generally, hazard models require large data sets. However, Bayesian methods allow expert knowledge and collected data to be used. Medically, every clinician can recall things that went wrong. Similarly, as in the mining and steel industry, in health and social care experts overestimate the risk. Witness the worldwide pandemic about bird flu.

Hazard models need large data sets, however black swans do occur.

*Editorial: Belgian care programme for older patients*

Baeyens, J. P. (2010). J Nutr Health Aging 14(6): 474-475.

Belgium. Impact of Royal intervention in decision making which led to all hospitals in Belgium having departments of geriatric medicine. A role model to follow?

*A discrete event simulation model to evaluate operational performance of a colonoscopy suite*

Berg, B., B. Denton, et al. (2010). Med Decis Making 30(3): 380-387.

USA. Procedure room turnaround time has a significant influence on patient throughput, procedure room utilization, and endoscopist utilization for varying ratios between 1:1 and 2:1

*A predictive model for the early identification of patients at risk for a prolonged intensive care unit length of stay*

Kramer, A. A. and J. E. Zimmerman (2010). BMC medical informatics and decision making 10: 27.

USA Models using day one and day five data accurately predict likely stay. The longer you are in, the longer you stay; in on day five, likely to stay 5 more days

*Predicting hospital admission and returns to the emergency department for elderly patients*

LaMantia, M. A., T. F. Platts-Mills, et al. (2010). Acad Emerg Med 17(3): 252-259.

USA Data ED visits patients aged 75 and over. 65% possibility admission. Regression model based on five degrees of difficulty predicted need for admission. However, as with other studies, the model failed to accurately predict ED return.

*Modeling the length of the care episode after hip fracture: does the type of fracture matter?*

Sund, R., J. Riihimaki, et al. (2009). Scand J Surg 98(3): 169-174.

Finland. One size does not fit all. National guidance suggest similar rehabilitation. However, intracapsular fractures had simple unimodal LOS. Whereas extra capsular fractures had a bimodal distribution.

*Tactical and operational decisions for operating room planning: efficiency and welfare implications*

Testi, A. and E. Tanfani (2009). Health Care Manag Sci 12(4): 363-373.

Italy. Surgery. Model introduces a societal / clinical 'welfare loss' concept in scheduling operation theatre time. Outcome health improving and life enhancing (operations on time) and health worsening (clinical deterioration due to cancelled operations ).

*Bayesian Analysis of Nosocomial Infection Risk and Length of Stay in a Department of General and Digestive Surgery*

Saez-Castillo, A. J., M. J. Olmo-Jimenez, et al. (2010). Value Health.

Spain. Data: 1039 surgical patients. LOS of stay, the existence of a preoperative stay and obesity were found the main risk factors for a nosocomial infection. Hospital acquired infection increases LOS by a factor of 2.87

*A model for understanding the impacts of demand and capacity on waiting time to enter a congested recovery room*

Schoenmeyr, T., P. F. Dunn, et al. (2009). Anesthesiology 110(6): 1293-1304.

USA. Post operative recovery. Queuing model. Small changes big differences. 60% benefit of 10% increase in beds

*Forecasting models of emergency department crowding*

Schweigler, L. M., J. S. Desmond, et al. (2009). Acad Emerg Med 16(4): 301-308.

USA. Retrospective data. ARIMA and AIC models. Occupancy at 4 and 12 hours in advance predicts overcrowding.

*Using simulation to determine the need for ICU beds for surgery patients*

Troy, P. M. and L. Rosenberg (2009). Surgery 146(4): 608-617; discussion 617-620.

Canada: Monte Carlo simulation. Demonstrates need to take into account actual and functional ICU capacity. Facilitates discussion of pros and cons of implementing management and expert proposal.

*A model to prioritize access to elective surgery on the basis of clinical urgency and waiting time*

Valente, R., A. Testi, et al. (2009). BMC Health Serv Res 9: 1.

Italy. 2001, the Italian Ministry of Health funded the Surgical Waiting List Info System (SWALIS). Reports 2005 validation of use. More patients treated in time. Providing patients and users useful tools to manage waiting lists and to schedule hospital admissions with ease and efficiency.

*Models as instruments for optimizing hospital processes: a systematic review*

van Sambeek, J. R., F. A. Cornelissen, et al. (2010). Int J Health Care Qual Assur 23(4): 356-377.

Holland. Review 68 articles reviewed. 31 simulation, 10 descriptive, 27 analytical. Few models validated. Insufficient MeSH headings and key words.

*Disequilibrium between admitted and discharged hospitalized patients affects emergency department length of stay*

Vermeulen, M. J., J. G. Ray, et al. (2009). Ann Emerg Med 54(6): 794-804.

Canada; Across hospitals, the daily mean (SD) 50th percentile ED length of stay averaged 218 (51) minutes. As the inpatient admission-discharge ratio increased or decreased, next-day ED length of stay changed accordingly.

*A systematic review of models for forecasting the number of emergency department visits*

Wargon, M., B. Guidet, et al. (2009). Emerg Med J 26(6): 395-399.

France: Most models linear regression or time series. Mathematical predictions have a low rate of error. However, *prediction* of daily visits should be used carefully, as does not allow day-to-day adjustments of staff.

*Health care costs in the last week of life: associations with end-of-life conversations*

Zhang, B., A. A. Wright, et al. (2009). Arch Intern Med 169(5): 480-488.

USA; Linear models: 603 cancer patients who report End-of-Life decisions (31%) cost significantly less in their final week of life, and have better quality of death.

Stop Press HIGH HOSPITAL OCCUPANCY LEVELS ARE MAKING US SICK

**EMBARGOED Till SUNDAY, 5 SEPTEMBER 2010 Medical Journal of Australia**

High bed occupancy and emergency department (ED) overcrowding are bad for patients, staff and the system itself, according to an editorial in the *Medical Journal of Australia*. In the editorial, Dr Sally McCarthy, Director of Emergency Medicine at the Emergency Department, Prince of Wales Hospital, Sydney, discusses hospital occupancy levels and ED overcrowding. Dr McCarthy said that reducing the number of hospital beds, and increasing occupancy above 85 per cent in the name of operational efficiency, has clearly had a negative effect, as the demand for hospital beds in Australia exceeds supply. "The root cause of the problem will remain unless hospital capacity is addressed in an integrated approach at both national and state levels,"

Dr McCarthy said. In an accompanying article in the *MJA*, Dr Andrew Keegan, Adjunct Associate Professor at the Sydney Medical School, University of Sydney, said that high bed occupancy rates have been shown to be associated with greater risks of hospital-associated infection and to have a negative impact on staff health. "Clinical observational data have suggested that bed occupancies above 85 per cent could adversely affect safe, effective hospital function," Dr Keegan said. "There is an urgent need to develop meaningful outcome measures of patient care that could replace the process measures currently in use."

In a second accompanying article in the *MJA*, Dr Rodney Jones, Statistical Advisor at Healthcare Analysis and Forecasting, Camberley, Surrey, UK, said that occupancy and hospital size are linked and, therefore, hospital size is important when examining occupancy levels. "Current methods used to calculate the required size of hospitals are underestimating the true capacity needed for operational efficiency," Dr Jones said. "Trends in occupied bed-days, rather than admissions and length of stay, give better estimates of future bed requirements."

Dr McCarthy said that failure to acknowledge the causes and consequences of high bed occupancy is seen in well-publicised health system responses to incidents that have occurred in overcrowded EDs. "The solutions proposed in response to these incidents so far have not included fixing the underlying reason for the patient being stuck in the waiting room – lack of hospital capacity."

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**Nosokinetics News is the newsletter of  
the UK Nosokinetics Group**

Nosokinetics is the science / subject of measuring and modelling 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 mak-

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