

Content

Page 1	Metaphysics: What do we know and how do we know it? Peter Millard
Page 2	Skype for the NK Community. Mark Mackay
Page 3	News from the Groups: HSCMG, University of Westminster. Thierry Chausailet
Page 4-6	Management Accounting and Patient Length of Stay Analysis? Mackay & Rae
Page 7	Intelligent patient management: More from Springer book

**Metaphysics: What do We Know and How do We Know It?**

Looking up, as one does, Metaphysics, in the 1911 Encyclopaedia Britannica, I came across the following comment:

'We must go forward from Aristotle to Bacon and modern science, and even pass through the anarchy of modern metaphysics in the hope that in the future we may discover as complete answer as possible to these two questions:

1. *What is the world of things we know? And*
2. *How do we know it?'*

Metaphysics from Wikipedia (http://en.wikipedia.org/wiki/Metaphysics#cite_note-2, accessed 4 Sep 2009)

'...Someone who studies metaphysics would be called either a metaphysician or a metaphysicist. ... "meta" ... meaning "beyond" or "after" and ... "physical" referring to those works on matter by Aristotle in antiquity.' ... Ontology is the investigation into what types of things there are in the world and what relation these things bear to one another. The metaphysician also attempts to clarify the notions by which people understand the world, including existence, objecthood, property, space, time, causality and possibility.

Before (*Bacon*) ... scientific questions were addressed as a part of metaphysics known as "natural philosophy".... (After Bacon) The scientific method however, made natural philosophy an empirical and experimental activity, ... and by the end of the eighteenth century it had begun to be called "science" in order to distinguish it from philosophy. Thereafter, metaphysics became the philosophical enquiry of a non-empirical character into the nature of existence.'

What's this all about? You may well ask

What is the world of things we know? Sick and well people. Living and dying. Moving through time and space in everlasting now. Yet in the world as we see it the physical, mental, spiritual and social attributes of every person is different. Though there is a start, birth and an ending death, the pathway in between varies for each and every one of us. So what then do we have in common? Time.

Clearly, it's all a matter of time. Everyone, and everything we see is present at a moment in time. How we interpret what we see depends on the point of view of where we stand, the direction in which we look and our previous knowledge of events. There is no certainty. Just everlasting now.

Time past, time present, time future. Seconds, minutes, hours, months, years, decades ... everything we see is moving with us in time. The white butterfly, fluttering around our garden now, searching for a mate, has a life span of fourteen days in that form. The statue for 40 years at least. How then can we measure this? Only with snapshots in time—spring, summer, autumn, winter everything changes. We can't go backwards, only forwards.

How we know it?

For me that's the Nosokinetics agenda. Forty years on from the original observation of problems with the use of computer generated average length of stay of discharged patients, thanks to the contributions of many people living and dead, we now have new theories, new methods and prototype tools which could and will transform the way that health and social care services are measured and planned.

Where to next?

Education, education, educations. But where and how? and who?

Answers, suggestions, propositions welcome pmillard@tiscali.co.uk

PS. Mark has one suggestion overleaf.

Skype for the NK Community by Mark Mackay

Proposition

That we establish a list of NK community members who are willing to join up or list their existing Skype contact on the NK website and perhaps periodically in the NK Newsletter.

Why?

To facilitate more direct contact between those interested in patient flow and modelling issues.

Background

While email is fine for traversing the barriers presented by geography and time zones, there are occasions when a face-to-face meeting would be better. As a community we are dispersed across the world and thus the opportunities for such meetings are rare. An in-between step is the phone. Existing landline calls, however, are expensive or require the purchase of time limited phone cards (I don't know about your experience with them, but I find they expire before I use the full value of the card – thus increasing the costs of the calls).

Voice over Internet Protocol (or VoIP) is a recent arrival (yes it's been around for a few years now) technology that enables telephone conversations to occur over the internet. Skype is a VoIP provider and calls between Skype users to other Skype users are free (currently). The software is free to download and all that is required is a microphone (most computers have speakers now and many indeed have microphones built in as well). What's more, teleconferencing – where you see the person – can also occur if a camera is connected (these are now very cheap) and documents can be shared. Thus, VoIP is a means of getting a step nearer to the face-to-face meeting, particularly when used as a teleconference device.

Another feature of VoIP is the conference call facility – many people can be a party to a single call (though video can't occur).

Example

Gary Harrison and I had a need to talk and there was a third party involved. Email was no longer sufficient for our purpose. The current time difference between where Gary lives in the USA and where I live in Australia is 13.5 hours. Setting up a conference call at work was not an option that was easily doable – but using Skype was. Gary was able to speak with us (a colleague of mine) in the morning (his time) while I was at home and my colleague was at his home (fairly late at night). We had a couple of initial stumbles in getting the conference call started - new computers, novice Skype users, but in a few minutes we were up and away. We achieved a lot more in one Skype call than in a whole host of emails.

There are other features in Skype that should be useful to the NK community – e.g., you can set it up so that contacts know when you're on-line. Note – unwanted callers can be blocked too!

What's needed?

Skype (www.skype.com), some low cost (or no cost) hardware (the microphone and speakers as a minimum) AND for the community to have a contact list of members willing to chat via Skype. Note – it works for PC and Mac users.

So let's broaden our use of this network – let's talk!

Mark Mackay

PS – Thanks to Gary for agreeing to try Skype out and also for including his Skype contact in this article.

Let's Talk: Here's a start to the new Skype list	
Name	Skype Contact
Mark Mackay	Mmbm2009
Gary Harrison	Gary.W.Harrison
Peter Millard	(needs computer change!)

Improving Health Care Planning Through Informatics by Prof Thierry Chausalet

HSCMG - The Health and Social Care Modelling Group - is an interdisciplinary group, with expertise in health-care, operational research and statistics, and one of the main research groups in the School of Informatics at the University of Westminster. HSCMG works in close collaboration with organisations involved in health and social care. The group has extensive research experience in the application of data mining techniques and the development of decision support techniques and tools in health and social care. Its work is widely published in the statistics, operational research, and medical informatics literature.

Main interests and activities include:

- Multi-phase models of patient flows and length of stay
- Data-driven modelling and data mining in healthcare: in particular using routinely collected data (e.g. Hospital Episode Statistics) to derive useful decision models
- Performance modelling and monitoring in health care
- Application of stochastic and queuing network models, discrete event simulation, decision and risk analysis in health care systems
- Wide areas of applications: from A&E and intensive care units to health and social care services for older people

Group members at HSCMG include 2 professors, Thierry Chausalet (Group Leader) and Peter Millard (visiting professor), with 2 senior academics, a visiting research fellow, 2 research associates, 4 PhD students and a further 3 PhD students to start in September 2009.

Current and recent projects include:

- I. *Developing* an adverse event reporting and risk assessment system, developing a clinical monitoring system, and building a computer simulation based toolkit to enable rapid development of models of healthcare processes, funded by the Department of Trade and Industry.
- II. *Forecasting* length of stay and committed cost in long-term care for elderly people, funded by the Engineering and Physical Sciences Research Council (EPSRC) and the Department of Health.
- III. *Modelling* readmission and patient pathways, and models for capacity planning in neonatal care.
- IV. *Data driven solutions*. Latterly, HSCMG has worked more closely with health services managers and analysts, particular in Primary Care Trusts to develop data driven solutions to address issues such as:
 - Mining patient profiles and cohort of users of a portfolio of services
 - Determining demand and capacity for a polyclinic
 - Forecasting demand and length of stay in NHS continuing care
 - Analysing and monitoring demand for back pain services

Methods A great deal of the research undertaken by HSCMG involves mining, analysing, and modelling acute activity dataset (inpatient care, outpatient care, Accident & Emergency, mental health, community services). Many analyses make use of the national hospital episodes statistics (HES) dataset, which is a database of over 80 million records (1997-2004) containing anonymous personal, medical and administrative details of all patients admitted to, and treated in, NHS hospitals in England; most analyses are conducted using R and SAS.

Educational HSCMG is also involved in various initiatives to promote and teach modelling approaches to improve health services delivery and organisation such as MASHnet, the UK network on healthcare modelling and simulation funded by the EPSRC and the Teaching Operational Research for Commissioning in Health (TORCH) project funded by the NHS Institute for Innovation and Improvement. It delivers various short courses and master classes on topics such as service modelling and predictive modelling.

External relations HSCMG members hold various key roles in societies such as the Operational Research Society, the British Geriatrics Society, and the Royal Society of Medicine. They are also found in various journal editorial boards and peer review panels of national and international funding bodies (e.g. EPSRC, NIHR, EC Framework Programme), as well as conference organising and programme committees.

Forthcoming conference involvement (see last page)

Further details contact: Prof Thierry Chausalet chausst@westminster.ac.uk

What does Management Accounting have to Offer in Patient Length of Stay Analysis? by Mark Mackay and Brendon Rae

A changing pattern of Length of Stay

The average length of stay (ALOS) is an often used measure in the health care sector. Past articles in this newsletter have described the problems of using the average length of stay as a measure that can be used to analyse bed problems. Essentially, it is a poor measure, but nevertheless it is widely used.

In this article, we look at a changing pattern of average length of stay. This measure is used because it exists, not because it's a good measure of stay.

I'm (Rae) a clinician in Internal Medicine, concerned not only with my patients and striving to provide them with the care they need to get an optimal outcome, but also with, among other things, looking at why "bed problems" are occurring. The graph in Figure 1 illustrates the trend in the average length of stay over the period of July 1998 to May 2009.

While there is some variation in the length of stay, which in part can be attributed to seasonal changes, there is an overall pattern of increase in the average length of stay over the period of the analysis.

The initial question that was posed was "why is there a rise in the average length of stay". The response to this question was "This may be a complex question".

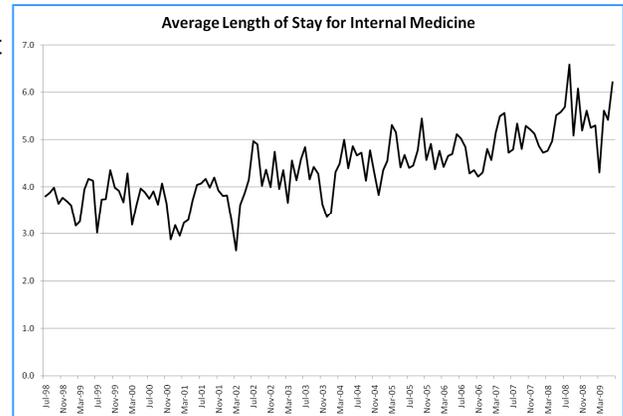


Figure 1: General Medicine: Monthly Average Length of Stay: July 1998 to May 2009. Dunedin Hospital NZ

Intra hospital transfers

A proportion of elderly patients were transferred to an inpatient rehabilitation service, and it was observed that it was becoming increasingly more difficult to secure transfer to that service. It was believed that one of the factors driving the increased hospital length of stay was the lack of ability to transfer patients, and the subsequent need to provide sub-acute rehabilitation for these patients in an acute clinical area.

Table 1: 1998 - 2009 Changing pattern of inpatient usage in down-stream rehabilitation service

Measure\Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
ALOS-Acute	18.6	14.4	17	13.1	11.8	10.6	11.8	14.1	9.8	12.7	13.5	12.1
ALOS-non Acute	17.7	16.6	16.9	15.1	14	14.9	15	15.9	16.2	16.9	16.8	17.7
Patients-Acute	27	24	23	20	24	33	42	29	32	186	209	75
Patients-non Acute	589	1,003	1,016	1,132	1,195	1,111	967	910	843	705	574	237
Total ALOS	17.8	16.6	16.9	15.1	14	14.7	14.9	15.8	15.9	16	15.9	16.3
Total Patients	616	1,027	1,039	1,152	1,219	1,144	1,009	939	875	891	783	312
% Acute	4.4%	2.3%	2.2%	1.7%	2.0%	2.9%	4.2%	3.1%	3.7%	20.9%	26.7%	24.0%

Table 1 gives details of patient admission numbers and the average length of stay stratified into acute and non acute categories in the down-stream rehabilitation service.

While it is evident that total admissions peaked in the 2002 year, it is also evident that a significant increases in acute admissions occurred more recently in 2007 as shown in Figure 2.

It is this more recent change in admission type and how this may provide some explanation of the change in average length of stay in the up-stream provider service to which we now turn our attention. While additional investigation was undertaken to provide information about a range of sources that contribute to the change in the average length of stay, we look at how another field, usually more associated with the misuse of the average length of stay measure, can contribute to extracting some additional information for very little effort.

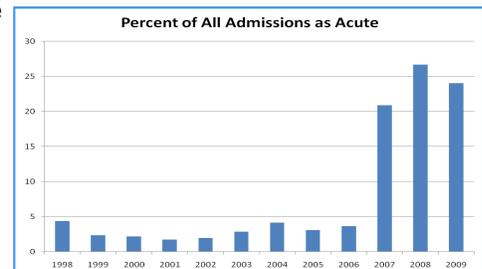


Figure 2: Acute admissions to down-stream service

Management or cost accounting and the analysis of variance

Often the extent of involvement of the accountant in the hospital setting relates to how patient stay has altered as it is seen as being linked to costs and also revenue, particularly where case-mix funding systems are used. Clinicians, and some times others, are then asked to provide suitable explanations for the noted changes.

According to Horngren and Foster (1987),

cost accounting [or management accounting] provides data for three major purposes (1) planning and controlling routine operations; (2) nonroutine decision, policy making, and long-range planning; and (3) inventory valuation and income determination.

Management accounting, unlike financial accounting, has as one of its foci, the task of providing understanding about outcomes – albeit usually related to dollars.

As someone trained as an accountant and having worked as one in a past life, I (Mackay) have formed the view that management accounting is often taught as though it should be applied in the factory setting and the analysis approaches taught should only be linked to dollars, production units or market-share variation. However, the techniques are relatively straightforward and can be applied more widely – even in the hospital setting!

Variance analysis in the management or cost accounting world centres around considering what has occurred and how it relates to a budget. In analysing bed issues, as illustrated by the changes in the data previously tabulated and illustrated, we substitute the budget with a prior year's activity.

Analysis is often limited to the following approach:

Year	Previous Year	Current Year	Variance (can be expressed as a percentage)
Average length of stay	$ALOS_t$	$ALOS_{t+1}$	$ALOS_{t+1} - ALOS_t$
Number of patients	$Patients_t$	$Patients_{t+1}$	$Patients_{t+1} - Patients_t$
total beddays	$ALOS_t \times Patients_t$ = $Beddays_t$	$ALOS_{t+1} \times Patients_{t+1}$ = $Beddays_{t+1}$	$Beddays_{t+1} - Beddays_t$

However, management accounting techniques facilitate the examination of the individual and combined contributions of changes in the average length of stay and patient numbers to the change in total bed-days. Such analysis is constructed using the following approach:

Year	Previous Year	Current Year
Average length of stay	$ALOS_t$	$ALOS_{t+1}$
Number of patients	$Patients_t$	$Patients_{t+1}$
total beddays	$ALOS_t \times Patients_t = Beddays_t$	$ALOS_{t+1} \times Patients_{t+1} = Beddays_{t+1}$
explained by:		
change in patient numbers (ALOS constant)	$ALOS_t \times (Patients_{t+1} - Patients_t)$	expressed as % of $Beddays_{t+1}$
change in ALOS (patient numbers constant)	$(ALOS_{t+1} - ALOS_t) \times Patients_t$	expressed as % of $Beddays_{t+1}$
change in patients and ALOS	$(ALOS_{t+1} - ALOS_t) \times (Patients_{t+1} - Patients_t)$	expressed as % of $Beddays_{t+1}$
sum of changes reconciles to	$Beddays_{t+1}$	

The application to the problem

Simple analysis of the ALOS and patient numbers, as is often done remotely by those in management roles or in bureaucracies, would suggest that there has been little change in these figures, as indicated in table 2 overleaf.

From table 2 (overleaf) the change in total bed-days is primarily explained by the increase in the ALOS – at the overall level. While analysis could stop here, the real value comes in repeating the analysis for acute and non-acute patients as shown in tables 3 and 4.

From table 3 the large increase in total bed-day use by acute patients in 2007 compared to 2006, is largely explained by the increase in ALOS (64%).

And table 4 shows that the slight decline in non acute bed-days in 2007 compared to 2006 can be explained by a decrease in patient numbers. Had the patient numbers not declined, the increase in ALOS would have seen total non acute bed-days increase substantially.

Discussion

The illustrated method is not meant to support the use of the average length of stay as a good measure. Rather it illustrates the application of a technique borrowed from the management or cost accounting field and applied to the issue of bed problems using an existing ubiquitous measure.

The technique is simple and quickly applied, and may enable the better understanding of the interaction of length of stay and patient numbers when analysing bed management issues. While it won't provide a complete understanding of the issues, it should help facilitate identification of questions that warrant further investigation.

Reference

Hornigren CT and Foster G (1987) *Cost Accounting – a managerial emphasis*. Sixth Ed. Prentice-Hall International Editions, Englewood Cliffs, New Jersey (USA).

Brendon Rae is an Internal Medicine Consultant at the Otago District Health Board, Dunedin, New Zealand

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<i>Table 2: Overall All patients</i>	2006	2007	%
ALOS	15.9	16	1%
Patients	875	891	2%
total bed-days	13912.5	14256	2%
Explained by:			
increase in patient numbers (ALOS constant)		254.4	2%
increase in ALOS (patient numbers constant)		14000	98%
growth in patients and increase in ALOS		1.6	0%
Reconciled to 2007 bed-days		14256	100%

<i>Table 3: Acute patients only</i>	2006	2007	%
ALOS	9.8	12.7	30%
Patients	32	186	481%
total bed-days	313.6	2362.2	653%
Explained by:			
increase in patient numbers (ALOS constant)		1509.2	64%
increase in ALOS (patient numbers constant)		406.4	17%
growth in patients and increase in ALOS		446.6	19%
Reconciled to 2007 bed-days		2362.2	100%

<i>Table 4: Non acute patients only</i>	2006	2007	%
ALOS	16.2	16.9	4%
Patients	843	705	-16%
total bed-days	13656.6	11914.5	-13%
Explained by:			
decrease in patient numbers (ALOS constant)		-2235.6	-19%
increase in ALOS (patient numbers constant)		14246.7	120%
decline in patients and increase in ALOS		-96.6	-1%
Reconciled to 2007 bed-days		11914.5	100%

Intelligent Patient Management

Editors Sally McClean et, Peter Millard, Elia El-Darzi, Chris Nugent. Volume 189 In *Studies in Computational Intelligence*, Editor-in-Chief Prof J Kazprzyk. 2009 Springer-Verlag Berlin Heidelberg. ISBN 978-3-642-00178-9

Part III: Intelligent Clinical Support (cont)

Optimal Scheduling Using Length-of-Stay Data for Diverse Routine Procedures. Christine S.M. Currie, Lanting Lu. SCI 189, pp. 193-205.

Tackles the problem of scheduling routine operations, and admission days. Case study from a network of UK private hospitals. Illustrates methods of grouping data. Extension to emergency decisions planned.

The Impact of Induction Room on Operating Theatre Performances. Said Kharraja, Pascal Albert, Sondes Chaabane. SCI 189, pp. 207-220.

Explores the impact of a separate induction room for anaesthesia prior to surgery. In contrast with anaesthesia in the operating room. Random and real data used. Experimental results favour the use of induction rooms. Data from French hospitals.

How Stochasticity and Emergencies Disrupt the Surgical Schedule. Jean-Sébastien Tancrez, Benoît Roland, Jean-Philippe Cordier, Fouad Riane. SCI 189, pp. 221-239.

The goal of the research is to rationalise the planned operation theatre spare capacity, usually 15%. By developing a tactical strategic decision level. The analytical process takes account of stochasticity as well as the disruptions due to emergency cases. Indices emergency disruption rate, probability of other time and average time. Belgian hospital data.

Using Markov Systems to Plan Stroke Services. Sally McClean, Lalit Garg, Maria Barton, Ken Fullerton, Peter Millard. SCI 189, pp. 241-256.

Develops a methodology for costing unified stroke services. Extends previous work which attached costs to duration in states for a non-homogenous Markov system. Based on results for spend down in three different organisational in patient management. Arbitrary costs used, future work aims to use the model with real time data. Northern Ireland data.

Part IV: Smart Homes

iCOPE: Intelligent Context-Aware Patient Management Systems for Elderly with Cognitive and Functional Impairment. Victor Foo Siang Fook, et al., SCI 189, pp.259-278.

Research aims to develop tools which recognise anomalous behaviour in clinical settings. Continence management, agitation, medication etc. Aim to improve patients' overall condition.

Semantic Smart Homes: Towards Knowledge Rich Assisted Living Environments. Liming Chen, Chris Nugent, Maurice Mulvenna, Dewar Finlay, Xin Hong. SCI 189, pp. 279-296.

Presents a conceptual system architecture. Focuses on the methodology, content generation and management. Illustrating the metaphor with a number of use scenarios.

Profile Management for Dynamic Groups. Josef Hallberg, Mia Backlund-Norberg, Kåre Synnes. Chris Nugent. SCI 189, pp. 297-313.

Develops a new concept, which makes creation, management and usage for communication in social networks. Presents Home-Com, a model for profile management In dynamic groups.

Uncertain Information Management for ADL Monitoring in Smart Homes. Xin Hong, Chris Nugent, Weiru Liu, Jianbing Ma, Sally McClean, Bryan Scotney, Maurice Mulvenna. SCI 189, pp. 315-332.

Research deploys the Dempster-Shafer theory of evidence to represent and reason within sensor data. Presents a general frame work for sensor information fusion and knowledge revision / merging especially for monitoring activities of daily living.

Future Conference Involvement (cont from page 3)

WHCM2010, IEEE Workshop on Health Care Management, 18-20 February 2010, Venice, Italy. *Call is now open.* <http://www.deei.units.it/WHCM2010/index.html>

IMA HEALTH 2010, the 6th IMA International Conference on Quantitative Modelling in Management of Health-care, 29-31 March 2010, London, UK. *Call is now open.* http://www.ima.org.uk/Conferences/health2010/call_for_papers.html

We invite researchers in all relevant problem domains and methodologies to submit abstracts of 300-500 words online at <http://online.ima.org.uk/> or to Amy Marsh at Amy.Marsh@ima.org.uk by **20 December 2009**.

Case studies and methodological papers are both welcome. Authors of accepted abstracts will be notified by the end of January 2010.

Authors should indicate whether they wish to make an oral or a poster presentation. Poster presentations are particularly welcome as they stimulate discussion and feedback.

We are also planning a special poster presentation session for PhD students to show their work in progress. Selected papers presented at the conference (whether orally or as a poster) will be published in the Springer journal **Health Care Management Science** or the **IMA Journal of Management Mathematics**.

Last Words

The anniversary of the start of the Second World War brings back memories. First Canadian troops, then Americans in the park and my older brother and his friend having two live mortar bombs and 100 live bullets under the fig tree in the garden. Which prompted my father to say to compose:

"Horace Burley, in a crater, found a Mills Bomb detonator. Blue flash, boy ash. St. Peter at the Pearly Gates said Horace Burley, your fifty years too early."

Thinking of times past and times present, I realise that the creation of a three monthly newsletter is not the best way to move forward our cause. Indeed things happen and things forgotten. Hence, on my middle son's advice I propose to change to a monthly news letter sending out what comes in.

Each month I get from the RSM library a selection of references—which this time are lying in the depth of my computer. Those and news of conferences which come in will enable me to create and move on. Giving plenty of time for golf—happy days. Thanks for your support and encouragement.

Its not a forest fire—but we are getting there.

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>

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