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Modelling in turbulent times: why the NHS needs models more than ever

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Operational Research and the NHS

- The National Health Service and the modelling discipline of Operational Research were both born in the UK in the 1940's
- NHS founded in 1948: "Services should be comprehensive and free of charge and should promote good health as well as treating sickness and disease"
- OR originated in World War 2: models used in the campaign against U-boats and to plan optimal convoy size
- The UK OR Society and the NHS held a joint Colloquium on hospital appointment systems as far back as 1962

THE OR SOCIETY

NHS

The UK National Health Service

- To provide healthcare on the basis of need not on ability to pay – "free at the point of service"
- Initial estimates of costs in 1948 were "greatly underestimated" – *plus ça change*!!

	1949/50	2007/08
Inpatient episodes	3 million	14 million
Hospital consultants	5,000	35,000
Annual expenditure	£447 million	£114 billion

** Geoff Royston, 2009. *One hundred years of Operational Research in Health – UK 1948 to 2048.* JORS Special Issue "Milestones in OR", 60:S169-S179

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Why I am proud of the NHS

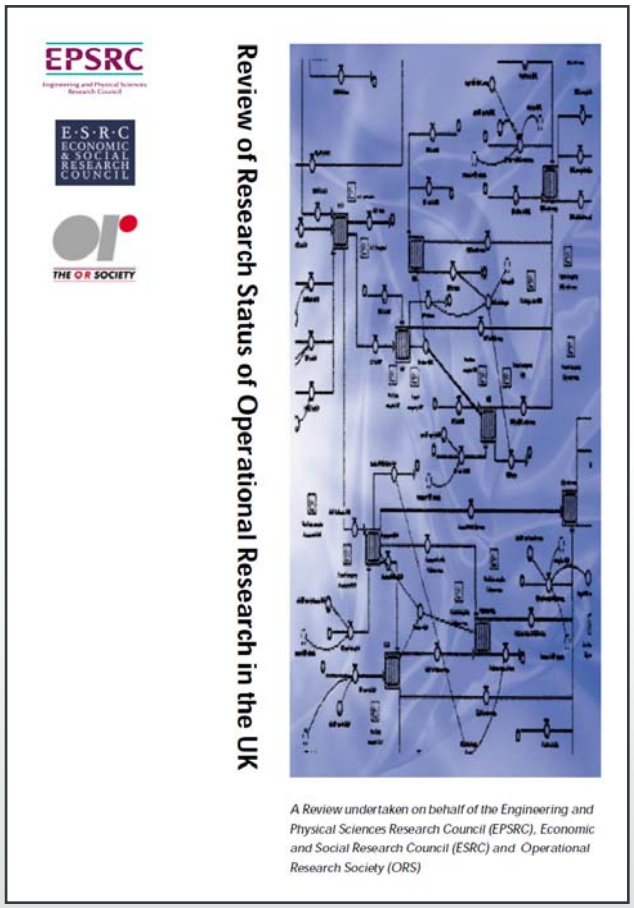
The NHS will provide a universal service for all based on clinical need, not ability to pay.

Healthcare is a basic human right. Unlike private systems, the NHS will not exclude people because of their health status or ability to pay

http://www.nhs.uk/aboutnhs/CorePrinciples/Pages/NHSCorePrinciples.aspx

The UK picture

- EPSRC/ESRC Review of UK OR Research in 2004 identified health OR as one of the UK's strengths
- Massive academic literature: Ovid search in 2007 found 176,320 hits, expanding at the rate of 30 papers per day
- Review papers (1976 to 2007) all report lack of implementation: simulation is not used as routinely in healthcare as in other industries



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For example.....

"… we were unable to reach any conclusions on the value of modelling in health care because the evidence of implementation was so scant."

Fone D, Hollinghurst S, Temple M et al. Systematic review of the use and value of computer simulation modelling in population health and health care delivery. J Publ Health Med 2003; 25: 325-335.

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So what's going on?

- Pockets of success: high-level policy models, advising Government departments, WHO etc; UK Department of Health models
- Some modelling is being done by consultancies, including the "big 5"
- Otherwise, a highly fragmented picture of one-off pseudo-consultancy academic projects carried out with a local hospital/PCT
- Simul8 Corp.'s Scenario Generator – an interesting experiment (more later)

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Why is modelling needed in "tough economic times"?

- Models aren't a luxury – they are a necessity
- Allow cheap, risk-free exploration of alternative policies and scenarios: avoid costly mistakes
- Models don't need to be hugely complicated to be useful and give insights
- You don't need to be a mathematical genius to build one!

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Example 1: Bagust et al (BMJ, 1999)

- A (fairly) simple Excel spreadsheet model which showed the impact of variability in arrivals and LoS
- Considers emergency admissions only: pool of 200 beds available, with mean daily admission rate 24.7 (plus a seasonal and day of week effect)
- Performance measures:
  - the proportion of emergency arrivals who cannot be accommodated owing to a lack of available beds
  - the proportion of days in a year when at least one such patient cannot be accommodated (termed a crisis day)

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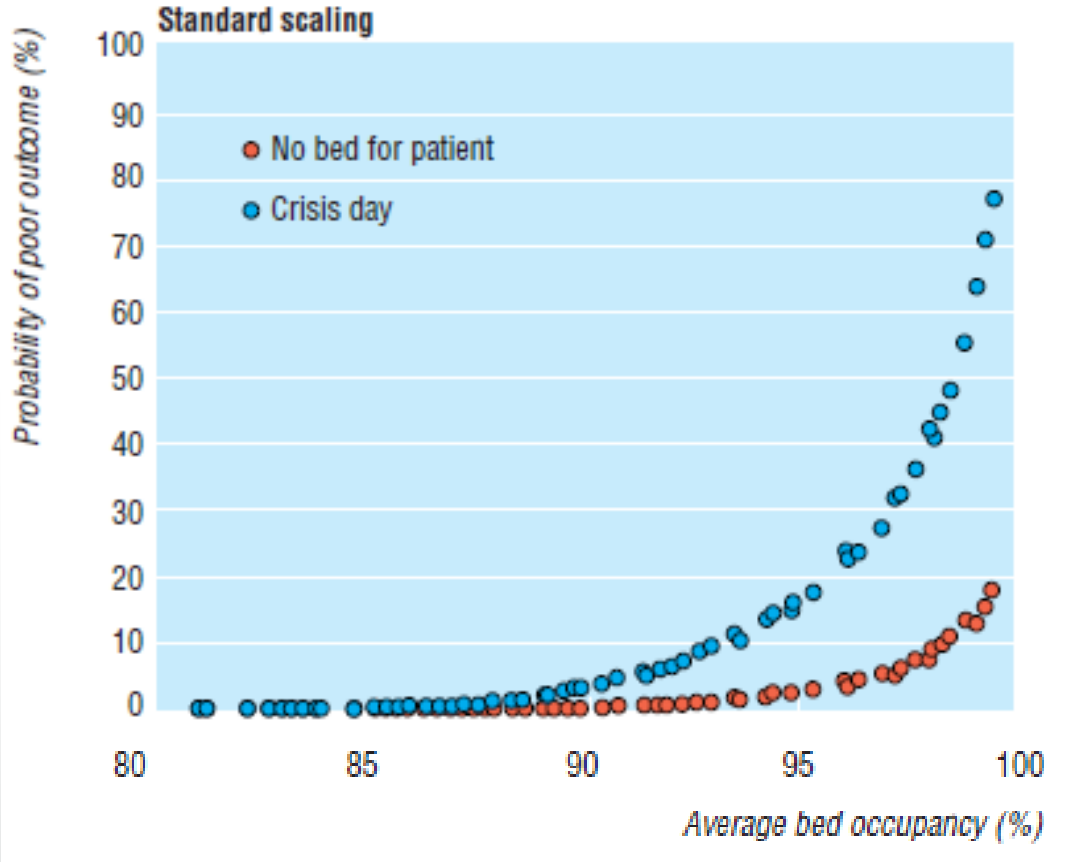
Results



Bagust, Place & Posnett (1999) Dynamics of bed use in accommodating emergency admissions: stochastic simulation model. BMJ 1999; 319:155-159

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Key message from this model

"Risks are minimal so long as the mean bed occupancy remains below about 85%. Above this level the risks become substantial (at 85%, a hospital can expect to be short of beds for admissions on four days in a year), and above a mean bed occupancy of 90% the system is regularly subject to bed crises".

(Bagust et al, p 156)

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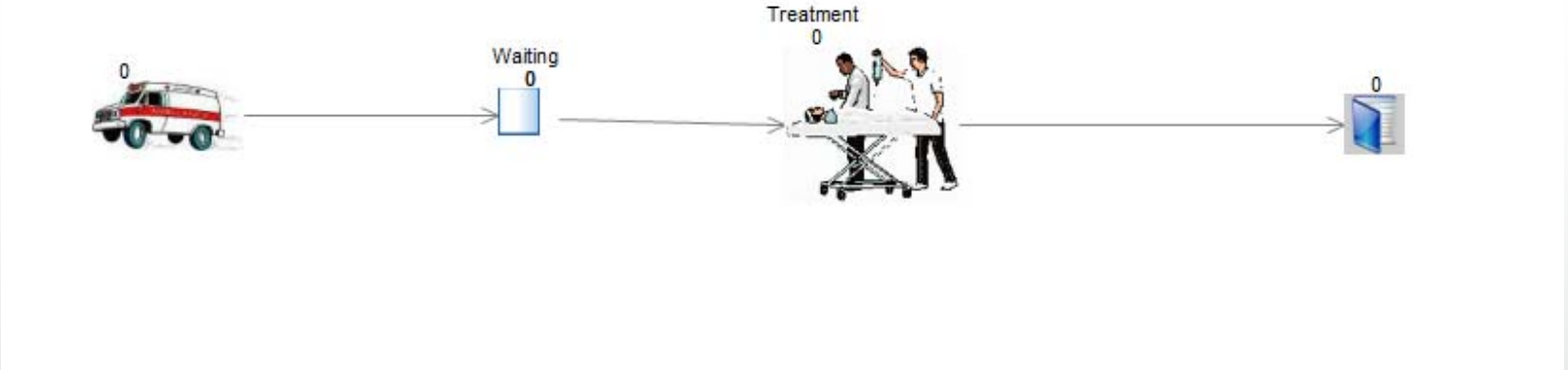
Example 2: simple insights from a VERY simple A&E model



(quick demo to show the impact of variability on the 4 hour A&E target)

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The impact of variability

Average arrival rate	Average treatment time	Number of staff	Average % inside 4 hours	95% CI (certainty level)
Fixed, 5	Fixed, 120	17	82.6	-
Fixed, 5	Fixed, 120	18	94.7	-
Fixed, 5	Fixed, 120	19	100	-
Random, 5	Fixed, 120	19	96.5	(90, 100)
Random, 5	Fixed, 120	20	98.2	(98. 100)
Random, 5	Normal(120,30)	20	97.3	(91, 100)
Random, 5	Normal(120,30)	21	99.2	(97, 100)
Random, 5	Normal(120,30)	22	100	-

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Scenario Generator

- A Simul8 product developed in partnership with the NHS Institute for Innovation and Improvement
- Finalist in the 2010 BT e-health awards competition for 'Healthcare IT product innovation'
- A "cut-down" version of Simul8, with inbuilt demographic and epidemiological data, for patient pathway planning & modelling
- Offered free of charge for one year licence (plus two days training) to all PCT's in 2008-09
- Claire Cordeaux, a Simul8 employee with an NHS background, was appointed to manage the project and provide the training

ehi 2010 AWARDS
In association with BT
FINALIST

S:G scenario generator

SIMUL8 CORPORATION

NHS Institute for Innovation and Improvement

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The Scenario Generator Evaluation project

- Study done by MASHnet, March – June 2010
- Research questions
  - Who is using Scenario Generator and what for?
  - Who is not using it, and why not?
  - What pre-existing skills did users have, and what additional training did they require?
  - What needs to be done to improve uptake and enhance usability, of Scenario Generator in particular and of modelling and simulation in general?
- Not a quantitative analysis or questionnaire-based survey – the Institute wanted an in-depth, qualitative study
- We did 28 semi-structured interviews across the user "maturity spectrum"

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Our user classification

- **Group 1:** people who were interested in using Scenario Generator but who, for a variety of reasons, had not got round to using it yet (27 invited, 9 interviewed)
- **Group 2:** people who had used it in the past, but had decided not to take it any further (22 invited, 6 interviewed)
- **Group 3:** "active users", people who Claire knew were either currently using S:G or had already used it successfully and achieved a benefit (22 invited, 13 interviewed)

	Group 1 Not started N = 9		Group 2 Given up N = 6		Group 3 Active users N = 13	
	+	–	+	–	+	–
Perceived usefulness						
Advantages & ROI	4	4	0	5	17	5
Ease of use	1	8	0	11	11	7
Security	0	0	0	0	0	0
Perceived fit						
Fit with intended tasks & goals	14	2	2	4	20	2
Compatibility with existing work practices	6	8	1	6	16	2
Perceived existing skill base	4	6	2	4	3	9
Organizational features						
Innovation culture	4	4	1	4	5	2
Risk culture	1	2	0	0	1	1
Size & structure	1	0	0	0	2	0
Environmental						
Regulation	9	1	5	1	17	0
Competitive pressures	2	0	0	0	2	0
Network effects	1	0	0	0	2	2
Supplier efforts						
Demand analysis	0	0	0	0	0	0
Deployment strategy	0	1	1	0	0	1
Pricing	6	2	3	3	9	0
Support	5	1	1	1	21	3
Internal						
Organisational support	5	5	2	3	17	3
Training access	2	6	1	4	16	4
Internal support for use	3	3	0	3	8	2
Personal characteristics						
Experience with product	6	3	7	0	12	0
Personal values	1	0	0	0	6	0
Other profile factors	4	1	0	0	4	2
Perceived usefulness						
Advantages over current practices	8	0	2	12	15	1
Ease of adoption	0	8	0	6	9	4
Identification of causal benefit link	2	3	0	1	4	0
Social usage						
Network effects	6	1	0	0	11	0
Usage by colleagues	1	1	1	4	3	3
Experience with innovation						
Attitude based on other innovations	8	0	4	4	7	3
Initial experience with S:G	0	1	0	3	13	0
Information from trusted sources	1	0	2	1	3	0

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Summary of all 28 interviews

Green = predominantly "+"

Amber = equivocal

Red = predominantly "–"

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Overall summary

- *"perceived current skill base"* was negative in all three groups: clearly skilled analysts are rare creatures!
- *"impact of regulation"* and *"experience with product"* were positive in all three groups; the latter was encouraging, as even Group 2 had positive things to say about S:G itself
- Otherwise broadly what we would have expected: for Group 1 the jury is out, Group 2 tend to be more negative and Group 3 are positive all round
- It was clear that Group 1 were not deliberate "non-users" – most of simply had not got round to starting with S:G yet, for a whole range of valid reasons
- Amazing diversity in respondents, across almost every factor

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Recommendations to users (i)

- Be brave! Don't be frightened of having a go. Just play with it and don't lose heart. Some of our best success stories came from people with no previous experience of modelling
- Don't necessarily feel you have to give it to the most technical person to use. Look for someone who is a good networker and who is able to communicate enthusiasm. It could be an analyst, or a strategic planner, or someone in public health: it doesn't really matter, as long as all these job roles are represented in the modelling team
- Make best use of the training sessions: ensure the right people are there; have a person with good chairing skills lead the meeting and keep discussions focused.

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Recommendations to users (ii)

- Senior management buy-in is key; use success story examples from other places to sell modelling to your boss, or use the visual aspects to explain the benefits of modelling
- Start simple and add in complexity only when you have to. Stay focused on why you are doing the modelling; this will help you achieve the benefits
- If you decide to start off by getting external consultants to do the modelling for you, make sure you are engaged with this process; make sure somebody understands the model(s), can explain them to other people, and can take over "ownership" and modify the model(s) afterwards
- Try to ensure that the knowledge of any specific model is not limited to one single person. This makes your organization very vulnerable if this person changes job role or leaves

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Lessons for modelling in general

- Have a go! – don't be afraid, and don't feel you have to be an IT or mathematical expert. Many of today's tools are designed for the lay user
- Start small – small, simple models can be the most useful
- Networking is valuable – share experiences
- Enhance your skills and make yourself a valuable resource
- Never stop trying to get buy-in from senior management
- Help is on hand! (http://mashnet.info/)

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Questions?