

The potential for operational research

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ABSTRACT

Operational research embodies a wide range of techniques that can improve the way we plan and organise health services. So, why have these tools not been more widely adopted in the NHS? To answer this we need to understand the key structural barriers to implementation, only then can we address the key issues and begin to realise this untapped potential.

The growing challenge within the NHS to get the most from its considerable, but always limited, resources has stimulated interest in a host of managerial approaches aimed at enhancing service performance. Process improvement frameworks such as Lean Thinking, Six Sigma, and Theory of Constraints (Young et al, 2004), as well as more generic modelling tools such as System Dynamics (Royston et al, 1999) and Discrete Event Simulation (Eldabi et al, 2007), have been advocated to increase efficiency in the health services. All these approaches use modelling to represent operational processes, to promote understanding and assist system redesign, and all can be considered to fall within the general field of operational research.

Modelling approaches have a long and proven track record in many areas of the service and manufacturing industries (Young, 2005). No leading chemical producer, car manufacturer or call centre manager would dream of establishing new operations or making great changes to existing processes without running a computer simulation to test differing system configurations and minimise the risks associated with full implementation.

Modelling is increasingly recognised as a valuable complement to experiment in some biomedical areas (Royston, 1999). These approaches, however, are not routine in the management of health care. Despite chief executives, operations managers, clinicians

and others seeking tools to improve service organisation (and considerable research interest), use of modelling and especially the dissemination of modelling products and the application of modelling results in health care, is still patchy.

This is illustrated by the findings of an extensive review of modelling in public health which concludes that (Fone et al, 2003):

‘Despite the increasing numbers of quality papers published in medical or health services research journals we were unable to reach any conclusion on the value of modelling in health care because the evidence of implementation was so scant.’

Although there is some history of applying operational research in healthcare management (Boldy, 1981; Luck et al, 1971; Pierskalla and Brailer, 1994), there is an ‘implementation gap’ in ensuring that the products of researchers/developers are useful to, and used by, health service managers and in ensuring effective dissemination of solutions between organisations. This article aims to diagnose the problems leading to that gap, and to prescribe some remedies.

Diagnosing problems

The UK Network for Modelling and Simulation in Healthcare (MASHnet) is an initiative which brings together disparate communities

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in the health service, research and commercial sectors to improve the implementation of healthcare modelling. MASHnet has hosted a series of workshops to engage professionals, which have focused firstly on developing a shared understanding of the factors inhibiting implementation, and secondly in outlining recommendations to overcome the obstacles. From these the following core issues have emerged.

Cultural divisions

There is a separation of professional cultures between the community engaged with research and development in healthcare modelling and those who manage and deliver care. This manifests at many levels and is often revealed in language and expectations. NHS managers, for example, tend to think of a modelling project as a modestly priced activity delivering outputs within months (if not weeks) and focused on the specific needs of their institution. Academic researchers, in contrast, commonly regard a meaningful project as more widely focused, requiring several years to complete and costing hundreds of thousands of pounds. While healthcare managers have difficulty in specifying organisational issues in the abstracted generic terms suited to research needs, researchers can struggle to translate theoretical outputs into terms relevant to practitioners in the service.

Skewed incentives

Appropriate incentives to promote uptake of modelling solutions in health services are essential for successful implementation. Currently these drivers are far from obvious. In fact, some evidence exists that incentives might inhibit the adoption of modelling solutions in health care. Rae et al (2007) report the effects of a mismanaged response to an effective

model of geriatric ward capacity management. Improved performance and innovation needs to be rewarded, not penalised. If the response to efficiency gains is to withdraw resources, then a reluctance to embrace beneficial solutions is unsurprising.

In the academic research community, professional incentives largely derive from the Research Assessment Exercise (details at: www.rae.ac.uk). The main drivers are to publish in academically respected journals with little or no direct recognition for seeing the research prototypes through to completion, or on evidence of a provable contribution to health service delivery.

Unnecessary complexity

Simple, accessible and well presented solutions are almost invariably more effective than complex and opaque models in health care (Proudlove et al, 2007). The role of models for visualisation, understanding, and as a basis for shared dialogue is also important (Eldabi et al, 2002). The natural tendency of academics to delight in complexities needs to be managed if useful end-products are to be delivered. The complexity of a solution should reflect the demands of the modelled scenario, but also the needs of decision-makers. Complex scenarios can often be decomposed into more manageable chunks and presented in accessible ways. Attention to the ways in which models are presented to the user, for example through the use of interactive colour graphics and animation, can also be crucial in determining eventual value.

Costly bespoke tailoring

The NHS is an intrinsically complex, disparate and ever-changing organisation. The lack of standard ways of working is expressed at any one time across the service (e.g. different

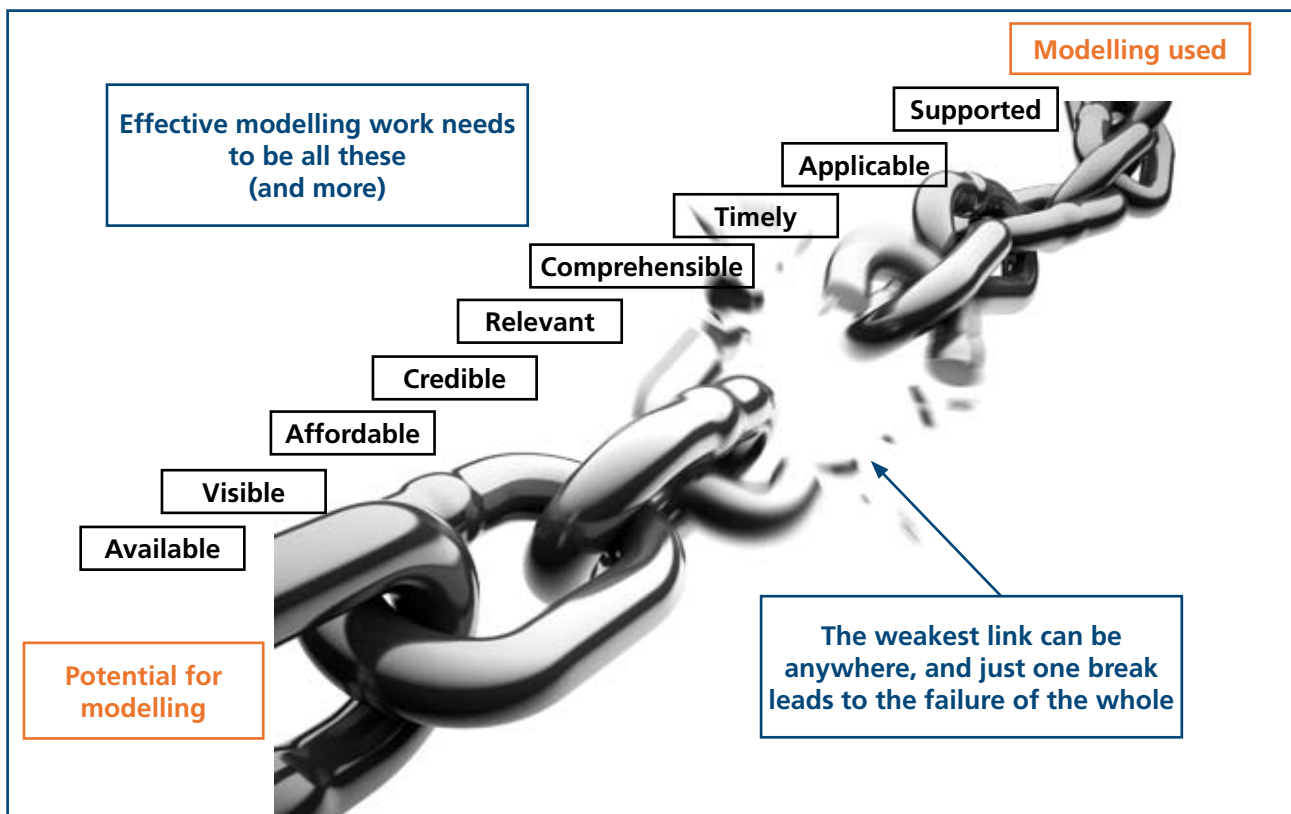


Figure 1. The modelling implementation chain—where is the weakest link?

modes of operation between hospitals) and also over time within organisations due to constant process change and evolution (e.g. new Government initiatives, service targets, new technologies). This diversity makes generalised modelling solutions highly challenging and many initiatives end up as bespoke solutions relevant only to one specific institution and one specific time.

For the cost–benefit equation for modelling in the NHS to be favourable, modelling solutions need to be generic. The overheads entailed in one-off solutions are unlikely, for example, to entice commercial software developers to make the significant investments required.

Likewise, economies of scale to individual healthcare organisations can only be delivered if solutions are relevant to a range of users. Precedents exist in other areas for generalised modelling solutions which retain flexibility, relevance and ease of use, and this is the approach required in health care (Pitt, 1998).

Insufficient management recognition

Operations managers, when asked about the lack of use of modelling methods in their organisations, have pointed to the lack understanding and support from senior levels.

This can impact on other crucial elements required for good modelling, such as the priorities driving routine data collection. In hospital trusts the support of chief executives is paramount to enable uptake.

This support relies on an appreciation of the potential benefits. Promotion of operational models is paramount to overcome the vicious cycle whereby recognition is limited by a lack of good exemplars, while development of good exemplars is thwarted by lack of recognition.

NHS staff themselves typically lack the time to report and promote the modelling tools that they have used successfully. Researchers typically publish in academic journals that remain impenetrable and unread by potential health service users.

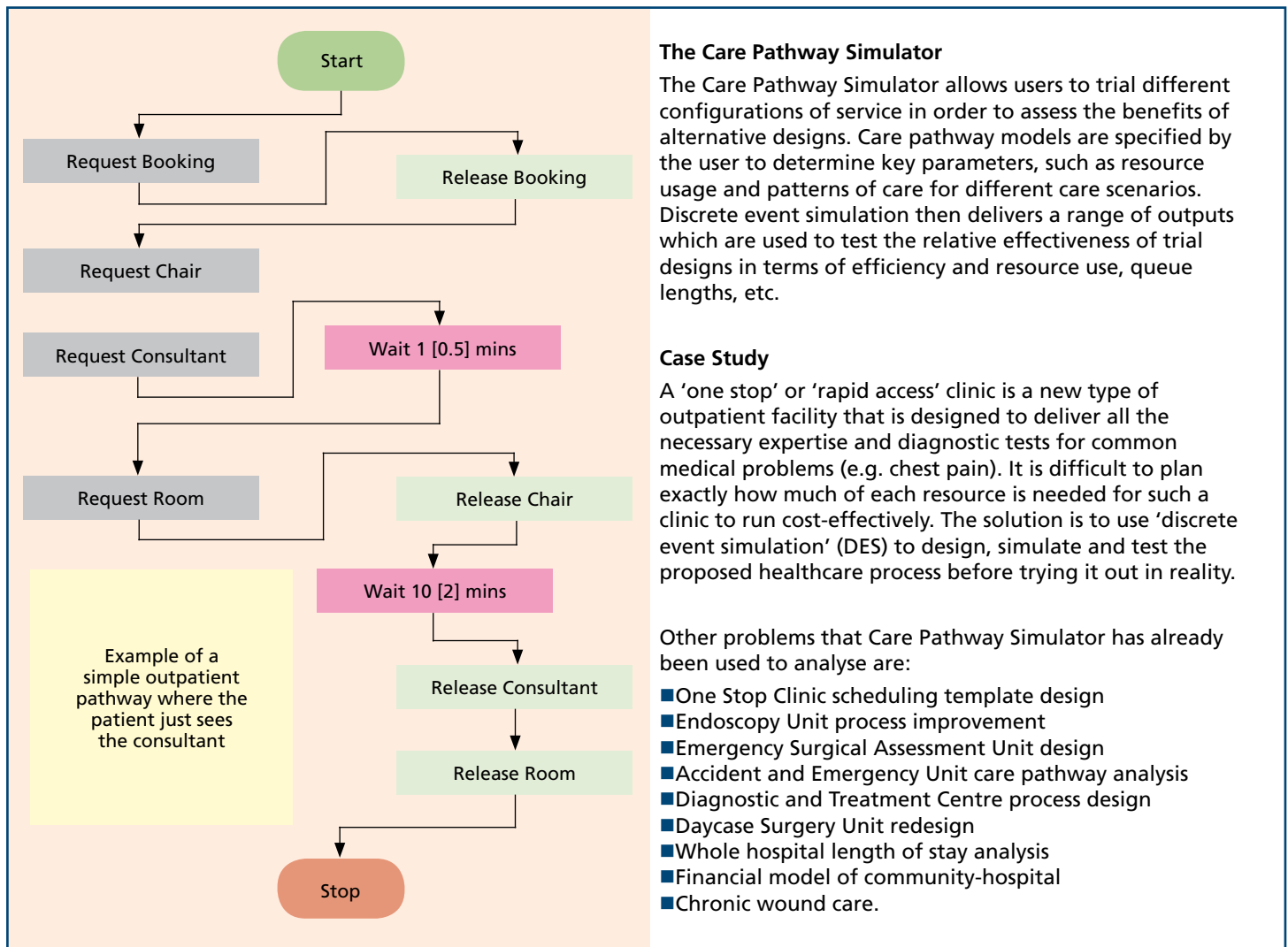


Figure 2. The Care Pathway Simulator and an example of the patient pathway model used

Where is the weakest link?

The obstacles described (and others) generate a large gap to bridge between model development and service application. There is a long chain of necessary conditions for success (*Figure 1*). Weakness in any link can lead to failure of the entire chain. To counter this, a far more integrated approach is needed to manage delivery from research hypothesis to useful health management application.

Prescribing remedies

Some of the problems outlined point directly to solutions. However, structural steps also need to underpin these solutions and bring modelling and management in health care closer together.

Inter-organisational networking and dialogue

Perhaps the strongest single need is for a more comprehensive approach to operational research in health care. There are many obvious steps to create a shared basis for dialogue and greater inter-organisational activity:

- More embedded researchers working in-situ in healthcare organisations
- Research incentives allied to delivery of working technologies rather than academic publications
- A greater emphasis on research which embraces the whole chain of conditions (human/social as well as technological)
- A bridging organisation to network across different institutions to guide

implementation, avoid duplication through dissemination, and translate the key needs of service users into research specifications.

This could also be instrumental in translating generic approaches into bespoke solutions, responding to the training needs of health staff, and in championing successful solutions across the NHS, especially to senior management.

Structures to support the evidence base for service delivery in healthcare

The increased emphasis in the NHS for evidence-based management offers a real opportunity for operational research in health care. As in the case of competing clinical interventions, alternative configurations of healthcare delivery need to be assessed using evidence-based methods.

Modelling offers a real alternative to experimental and 'suck-it-and-see' approaches (Royston, 1999). It can be central to the development of new configurations of care and useful in overcoming inertia and risk-averse behaviour (*Figure 2*). Particularly important is the contribution that simulation can make in situations where the long-term benefits of service redesign are masked by short-term dis-benefits. In these circumstances, stepwise approaches such as the 'Plan-Do-Study-Act' (PDSA) cycle typically fail (Young, 2005).

The National Institute for Health and Clinical Excellence (NICE) now recognises economic modelling as central to its evidence-based methodology in health technology assessment (HTA) (NICE, 2008). This provides an instructive contrast to the relative neglect of modelling in the area of health service organisation and delivery. The difference here is that NICE creates the fertile context in which HTA modelling can thrive. There is, as yet, no equivalent body in the field of health service delivery and organisation,

although there should be scope for the NHS Service Delivery and Organisation (SDO) research programme to do more to stimulate and support modelling work.

A framework for promotion and case studies dissemination

The need to raise the profile of healthcare modelling within the NHS is a key finding from the MASHnet workshops. Crucially, the most important vehicle for this is not research publications, but working examples delivering real benefits. Greater publicity of working examples, which demonstrate the benefits from modelling and simulation is paramount to win hearts and minds. Here, there is great potential for inter-organisation exchange, learning from best practice, and shared knowledge to create a virtuous cycle of development within the service.

Within MASHnet currently, efforts are being made to establish a listing of successful operational research projects which have delivered real benefits to organisations at the ground level of health care. These projects remain largely unpublished and opaque to the wider audience within the NHS.

Conclusions

Modelling and simulation methods have much to offer health care. While there have been valuable instances of applying this technology in the NHS, they are far from mainstream and the potential benefits remain unrealised to a large degree. Insight into the underlying causes reveals a host of inhibiting factors. A more comprehensive approach is required to integrate the disparate elements and oversee the complete process from research hypothesis to service-level implementation.

While innovation is best fostered at the base level of service delivery, a coherent national

framework is needed to cultivate links, promote best practice and ensure dissemination between the different elements of the NHS, research and industry. There is a clear opportunity for a step change in the level and success of technology transfer between operational research and health care.

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KEY POINTS

- The potential benefits of operational research methods in health care are great but largely unrealised
- The host of inhibiting factors that underlie this failure of realisation need to be understood in order to be overcome
- A comprehensive approach is needed to integrate the disparate communities and oversee the process of conversion of research into implementation
- While innovation is best fostered at the base level of service delivery, a national framework could foster links, promote best practice and ensure effective dissemination
- There is a clear opportunity for a step change in the level and success of technology transfer between operational research and health care