

Simulating the Impact of Change: Implementing Best Practice in Stroke Care

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ABSTRACT:

This article presents the experience of healthcare decision-makers who used simulation to better understand the impact of adopting best practice in stroke care, as outlined in the National Stroke Strategy. It describes the process of developing a simulation model and how stakeholders were involved in testing the key questions, which they needed to answer in order to adopt a new commissioning strategy for stroke care. It outlines what simulation is and discusses how it can be used to support evidenced-based decision-making.

KEY WORDS: Stroke, Simulation, Care Pathway, Evidence-Based Decision-Making

KEY MESSAGES:

- Understanding the impact of adopting evidence-based practice and any potential financial risk is crucial to decision-making
- Simulation can help decision-makers to test impacts and solutions in a risk-free environment

WHY THIS MATTERS TO ME:

Working in health strategy in the NHS, it became clear that health planners and decision-makers needed a modeling tool to support strategy development. This was the start of the development of a simulation tool, Scenario Generator, with the NHS Institute for Innovation and Improvement and SIMUL8 Corporation.. It cannot provide the whole answer, but we strongly believe that routine use of modelling and simulation in the health service will improve decision-making, and is a vital part of the tool-kit when good decisions to improve efficiency and reduce spend are the order of the day.

INTRODUCTION

Understanding the impact of system change in the health service has always been a challenging task. Whether reconfiguration of hospital services, patient choice, population growth or new commissioning pathways, it is often hard to visualise where resources are needed to meet demand, and whether future plans are sustainable and affordable.

As finance is increasingly constrained and the need for efficiency becomes even more acute, many of the solutions to the provision of health services are being tested in primary care and community services, and will be led by GP commissioners.

So how do health systems assess whether proposed solutions will work and what resources are needed?

SIMULATION

Simulation is a technique which allows users to create a computer-based model of a system or process. "Models" are very simply cut down versions of the real thing. Simulation can help make decisions and communicate their effects. It allows the comparison of different sets of scenarios so that the decision-maker can formulate judgements after considering all possible angles. Simulation software shows the flow of work, one event at a time, graphically through a system and all its key interactions with organisations and resources including financial implications. The graphics can be animated and the results produced in hardcopy for analysis and examination.

Simulation and modelling techniques have been gaining traction in the health service over the last few years¹. Used in the manufacturing sector initially, improved computer performance and software has meant that simulation is now easier to use, faster, and more accessible to other sectors. In healthcare, simulation has been used for operational questions such as models of A&E departments, patient scheduling and capacity management, but a systematic review² also shows simulation being used in hospital scheduling, infection and communicable disease modelling, health economics and screening. Whether in back office functions or looking at changes in pathways of care, wherever there is a flow of activity, simulation techniques can be applied.

In 2006, the NHS Institute for Innovation and Improvement collaborated with SIMUL8 Corporation to develop a whole health system simulation tool for use by Primary Care Trusts (PCTs) to model the impact of change in a whole health system. Following extensive field testing the resulting tool, Scenario Generator, was released in October 2008. Licenses are now held by over 130 PCTs in the UK and some Health Boards in Scotland.

THE STROKE MODEL

South Central Strategic Health Authority's (SHA) work with the South East Public Health Observatory (SEPHO) on stroke is a good

example of how using simulation has helped PCTs to understand the impact of implementing best practice as described in the National Stroke Strategy³. Working with clinicians and managers, a model was built using SIMUL8's Scenario Generator tool to answer the questions:

Question 1: What is the demand on stroke services if we get more referrals into urgent treatment?

Question 2: Can we afford specialist rehabilitation in the community for stroke patients if we implement early supported discharge?

Question 3: What are the outcomes for patients?

BUILDING THE MODEL

The first thing the team had to do was to produce a stroke pathway model that was truly relevant to the local context. The stroke pathway model is a simplified flow of patients from initial event to diagnosis, through start of treatment to general rehabilitation. The full model reflects simplified current practice, including the possibility of thrombolysis provision, neurosurgery for haemorrhagic stroke and TIA surgical interventions. It also includes several rehabilitation options: specialist stroke unit rehabilitation, non-specialist stroke unit and other intermediate care, and an option for early supported discharge.

The Map of Medicine (MOM) was helpful to give an initial impression of what the model would look like, but the local context was different in many ways from the MoM generic model. A lead stroke clinician and the stroke lead of the Cardiovascular Network in South Central provided local information on pathway flow as well as modelling sources on prevalence of conditions, and the team looked at the model from different perspectives.

Although the baseline model was designed as a generic pathway, one PCT in South Central requested specific support to investigate the marginal cost of the introduction of an early supported discharge (ESD) unit into the local district general hospital. SEPHO adapted the model to represent the intervention, validating against recorded Hospital Episode Statistics (HES), local datasets and clinician feedback.

ESTIMATED NUMBERS OF SUSPECTED EVENTS

The expected numbers of suspected cerebrovascular events that feed the model were created by manipulating the percentage incidence of stroke and *transient ischaemic attack* (TIA) for the PCT population, using the Royal College of General Practitioners Annual Prevalence Survey (3). Scenario Generator comes pre-populated with this data, which can be changed to reflect the local position. The South Central model adjusted the expected disease incidence inputs derived from the Oxford Vascular Study (OXVASC) study to account for non-cerebrovascular referrals for all suspected events. This figure was increased to account for an additional 10% of patients who die immediately from the disease before entering the health service.

ASSESSMENT AND TREATMENT

First the team considered what happens to a patient with a suspected event. They recognised that a patient enters the system in one of three ways – 1) Via GP, 2) Via Ambulance, 3) Via A&E. They drew this onto the SIMUL8 software and attached expected numbers of patients to enter through each route using evidence from the National Stroke Strategy.

As they did this they recognised that some patients die without getting as far as any of these routes and this forced them to consider this group that had previously escaped their attention (Figure One).

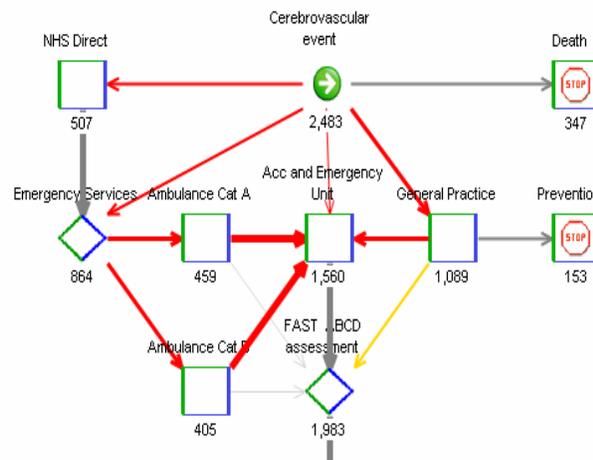


Figure 1: Entry to the Care Pathway (sample results for one PCT)

Next they considered what happens to the patients that enter the system. The model assumed that GPs would increase referrals to secondary care to 80%. Initial assessment using tools such as FAST (Face, Arm, Speech, Time) is expected to be carried out in A&E (or medical assessment unit equivalent) rather than by the GP or ambulance service.

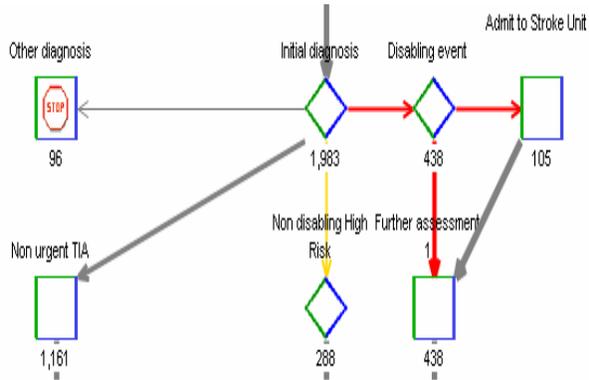


Figure 2: Secondary Care Assessment (sample results for one PCT)

Figure 2 shows the flow of activity into secondary care and how it is assessed. This was translated into the three pathways of care:

- Disabling event (assumes all inpatient care)
- High risk non-disabling events (assumes possible inpatient and/or outpatient/day case care)
- Non-urgent referrals/TIA pathway (assumes all outpatient care)

Quite quickly, the team built a complex diagram of what happens in all parts of the system, allowing them to debate every aspect (see Figure Three). They added the cost of each step to reveal the whole system cost of care. To produce the final pathway various iterations were developed, each refining the pathway to help to answer the evolving questions of the South Central PCTs.

RESULTS

The team then used the model to test their initial questions. Both the intervention and baseline models for the PCT were run several times to model variability in the system. Averages of these runs were used to show outcomes.

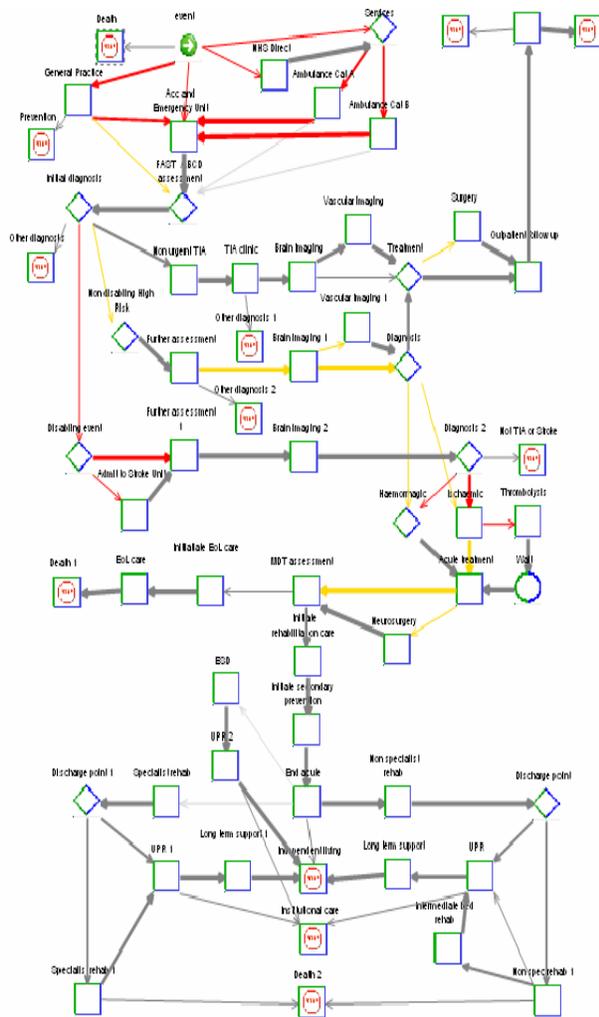
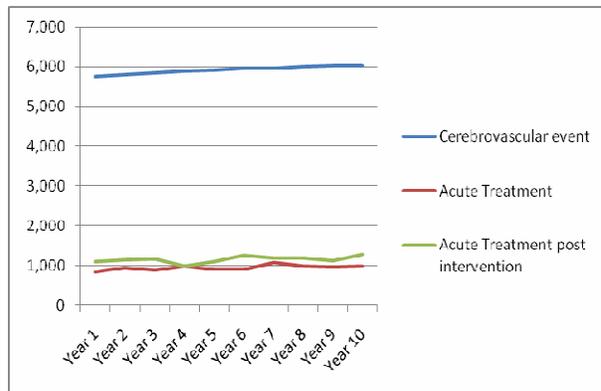


Figure 3: Full Model of Stroke Care Pathway

Question 1 : What is the demand on stroke services if we get more referrals into urgent treatment?

The team used population projections and expected prevalence to predict the expected number of strokes in the next 10 years. They ran the scenario with these different starting conditions to observe the changes in Acute Treatment, and tested what would happen if GPs increased referrals of stroke and TIA to secondary care by 35%.

They found that stroke prevalence was expected to increase over the period and with the increase in referrals to secondary care, there would be an increase in the volume of acute treatment required. (See Figure 4)



This represented an additional cost of £3.5m over the 10 years, factoring in inflation.

Figure 4 : 10 year results for stroke and acute treatment

Question 2: Can we afford specialist rehabilitation in the community for stroke patients if we implement early supported discharge?

Whilst the increased referrals to secondary care would increase hospital activity and costs by around 30%, changing the rehabilitation programme and bringing in early supported discharge, decreased costs by between 20% and 30%. Taking these two factors into account, the overall cost impact of the intervention in a one year period was a small reduction of just over £3000. This does not take into account the costs of expected institutionalisation, often borne by social care or by families.

Question 3 : What are the outcomes for patients?

As a result of changing post-discharge services, the intervention model demonstrates that there would be a 12% reduction in people needing institutional care and a 6% increase in people living independently (Table 1).

	Baseline	Intervention	Percentage change
Expected institutionalisation	117	103	-12%
Increasing in people living independently	742	698	+6%

Table 1. Average outcomes from implementation of Early Supported Discharge and Specialist Stroke rehabilitation

The scenario results showed that despite the additional demand on the pathway from more

referrals to secondary care in the initial stages, with decreased lengths of stay in hospital, specialist rehabilitation is affordable and the patient outcomes are significant. The health system in question was able to make a very coherent business case from these findings and persuaded the PCT to commission community specialist rehabilitation and early supported discharge services as a result.

DISCUSSION

It is worth reiterating that the process of model development in South Central was evolutionary and the model went through several versions as results enabled the PCT to identify the key questions which needed to be modelled in order to enable them to make a commissioning decision. In the end it was the patient outcome and cost implication questions which emerged as the factors in enabling a decision to be made.

One of the important advantages of the software cited by users was that it forced them to consider all potential patients rather than the ones they are treating. It does this by simulating all events individually and ensuring that each event is accounted for. This makes sure that planners consider the whole system rather than the discrete services within it.

The model has now been used by a number of PCTs across England and it is always redrawn and amended to reflect local contexts and concerns. For one PCT it was the impact of secondary prevention which was the most important issue, for another it was the impact of wider prevention strategies over time and whether the planned new stroke unit would still need to be as active in 5 and 10 years. Local government too has been interested in extending the pathway to consider impact on social care services.

South Central did not use the constraints feature in the software. This would have enabled them to simulate the impact of constraining demand by the availability of stroke beds, to discover where bottlenecks are occurring within the system and how to manage them. This feature was, however, used by another health system who also added a clinical drive time constraint to better understand how local hospitals would be able to meet demand when local populations were growing as a result of

housing development. They tested different hospital configuration scenarios to understand whether there was sufficient volume of activity to enable a safe service in selected hospitals *and* whether clinical drive times would be met.

Problems with this approach can occur if stakeholders are not sufficiently involved in the model development process to “own” the way the system works. Often proxy data has to be used to generate the flows of activity because precise data is not available, or would take too long to collect.

The model can never be exactly like real life and making sure that stakeholders understand and accept the potential limitations of a model and the assumptions used, is essential if decision-makers are to be confident in the results. In fact, PCTs often find that the process of building the model is as illuminating as the end result.

Simulation is never the only technique to be used to inform decision-making. It does not, for example, deal with the local political context for a decision. It can, however, help stakeholders to visualise and view the issues from a more objective standpoint, to understand how a whole system interacts and the impacts of change. As such, it provides a good evidence base for some of the structural and process changes required to bring about good patient outcomes.

In this case, simulation and modelling provided the PCTs with compelling evidence to demonstrate that the financial risk of recommissioning the stroke pathway was negligible and showed the huge benefits of the new pathway for patients. The evidence was a significant factor in enabling the adoption of best practice in stroke care.

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