A GLIMPSE OF THE FUTURE?

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It's Friday evening at the Emergency Department – the ED – in the city centre, and things are getting busy. At the heart of the hive are a dozen comfortable cubicles surrounding the nerve centre, a place to which ED staff return repeatedly throughout the evening, updating notes, putting up new names or removing the names of patients who have been discharged or admitted to the main hospital.

And each of them glances from time to time at the wall-mounted display showing a set of predictions. Unlike the ubiquitous satnav predicting arrival time, this system keeps estimating how long the patients will be in the Department tonight. Back in the noughties, before such systems were popular, a wait of more than four hours meant the ED had breached the metrics. Now, the display goes amber as soon as the average predicted stay exceeds 90 minutes, and red highlights identify patients who are heading for the two hour mark. Later this evening it will go amber again, and the Consultant in charge will spend five minutes running three pre-set scenarios through the model, including the option of redirecting some of the anticipated demand, before choosing how best to manage the crisis that will not happen tonight. It has been six months since any patient stayed for more than 2½ hours.

Smooth throughput needs to be blockage-free, so tonight patients will not wait for a bed. As each arrived, a sophisticated software system was already sifting through records and GP-generated predictions, capturing the provisional diagnoses of the consultant-led front-of-Department team and feeding this information into the model that drove the prediction-display on the wall. But the system also uses this knowledge to signal forward to the wards, and, sometimes, to other care services, about the likely admissions and discharges over the next few hours. These systems cannot say exactly who will be admitted tonight, but they have become uncannily good at getting the averages right.

The GP-generated predictions have also been a great success. Two hours ago, every feeder practice submitted its estimate of how many people in its catchment were likely to pitch up as emergency admissions every day for the next nine days. To begin with, these estimates had been haphazard, but it had not taken long for the main risks to be pinned down – the weather forecast (especially cold snaps), the demographics (the very young and the very elderly are higher users of services), diseases such as diabetes (with its associated morbidity), and risk factors such as alcohol consumption (with its link to violence) – and now EDs have been planning with confidence for a decade. Together with a few sports injuries and other accidents, there was now a robust map of what the evening might look like. Again, there were always exceptions, but now there was more resource left over to manage those carefully.

In fact, everywhere you look this Friday evening, predictors buried deep in the system are gathering data and signalling silently to other parts of the system. Seemingly magically, resources have been ready when needed – 98.7% of the time, according to the display on the wall this evening. Wards are estimating the length of patient stays to the hour, and scheduling transport services, alerting social services and managers of intermediate care to emerging demand, and texting friends and relatives with updates on when to expect people home.

Two decades ago, people had been really worried about the European Working Time Directive and the loss of resource it represented as Junior Doctors and others had to cut their on-call hours. Today, in 2030, the NHS delivers more and better care than ever before, and the number of staff has stabilised well below 2010 levels. As well as cutting costs dramatically, the NHS has more well-paid jobs and three-quarters of the workforce now choose their working hours through an on-line negotiating service.

Will it take until 2030 to deliver such a service? Well, by 2030, care will have to look very different – we simply will not have the staff to manage burgeoning demand. Most of the indicators are that we are travelling in the direction of using data intelligently to predict and manage demand – the key question is how fast? Can we bring the clock forward and have most of this in place before 2020?

The answer is that almost all the technology needed has already been developed in some form and has been used successfully somewhere. Figure 1, for instance, came from a simulation performed in our group by Dr Julie Eatock. It shows admissions to an urban ED (blue) averaged over 4 weeks. In red is the likelihood of breaching the 4-hour limit – until recently a national standard – estimated as each new patient arrives. Such a model, if implemented in real time, would give staff up to 4 hours to avoid breaching.

Increasingly, doctors, nurses and healthcare managers are turning to models and simulations to get a handle on care management. Stockport PCT noted a rise in GP referrals to hospital after the introduction of the new 'free choice' system for patients. Scenario Generator, a modelling package, was used to trace and analyse the routes – or pathways – patients were choosing and the management team found a way to ensure that 97% of patients received an appointment within 28 days and

that nobody waited for more than 37 (mashnet.info/case study/stockport-pct-%e2%80%93-understanding-demand capacity-and-waiting-times/).

Meanwhile, Dr Julie Hankin, a Consultant Psychiatrist and Clinical Director for service improvement, writes, "Mental health is affected by education, the criminal justice system, by employment and a host of other factors. If one can build these variables into models of mental health care, then one can performance-manage outcomes and not simply simulate service delivery. More practically, in the short term, modelling allows you to look across health and social services and see the impact of different commitments at various points in the patient pathway. It can really help us to optimise the positioning of resources and see, in advance, the knock-on effects of the changes we want to make. This is not a pipe dream. Lots of businesses use modelling very effectively. There is no reason why we cannot make it work for mental health services" (http://www.cumberland-initiative.org/2012/02/21/planning-mental-health-services-using-simulation-and-modelling/).

While not yet connected to patient notes, great strides are being taken to risk-stratify patients, especially those with long-term conditions, such as diabetes or physical impairment.
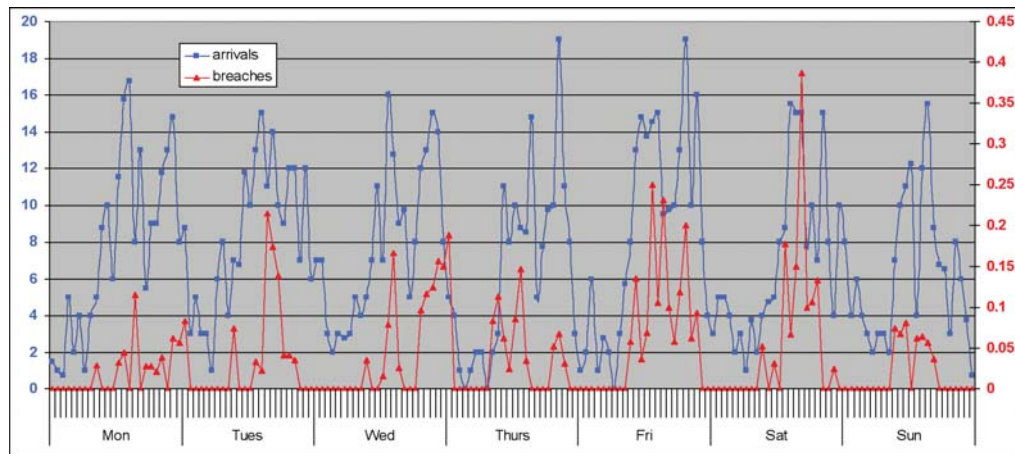

Figure 1 Simulation of arrivals and breaches at an ED

The SHIP cluster (http://hampshire.nhs.uk/component/content/article/60-corporate/780-ship-pct-cluster-takes-shape) will need to commission nearly £3 billion of care each year. To do this, it has brought together a range of tools from sources as diverse as the Johns Hopkins Bloomberg School of Public Health, McKesson and Experian, to predict and then procure the care that is needed.

Figure 2 shows a control room in Tan Tock Seng Hospital, Singapore, a concept that is starting to catch on in large hospital Trusts here. The big question is, what are the knowledge systems that will manage the flows behind the displays?

These examples establish a direction and there is a new generation of doctors coming through who will re-wire their world. What is needed now to help them is a systematic push to integrate this together and apply it across the nation. This will mean drawing our knowledge companies into healthcare in a new way. In a sense, the Connecting for Health debacle may unfortunately have inoculated the NHS against the information disease. Everyone has had just enough of IT-driven change to build up the antibodies. But what if we caught the 'knowledge' disease in the NHS big time?

Of course, it is not just about scaling up. We know that adding extra lanes to our motorways rarely eases congestion and often makes it worse. The reason is that the motorway is only a part of a complex social system of people and work and families and school and home and football and weddings, and funerals and shopping, and … the list is endless. Changing one part of that system changes the choices we have and we adjust our behaviour accordingly. Often the net effect is to take things back to where they were, sometimes to make things worse. In the past half century, we have come to understand quite a lot about systems and the perplexing responses we get to the changes we implement. Jay Forrester, a seminal thinker in this field, pointed out that when things become very complex, you must either try to

hold all the variables in your mind – a mental model – or you need to find a computational way to manage the problems. Models and computer simulation are a way of managing the complexity when our ability to foresee all the unintended consequences runs out.

Other sectors have used these methods to great advantage. We now make better cars more profitably – and more of them – than ever before. The grocery giants have shown what can be done by detailed analysis of their supply chains – fresher food, more choice, and, of course, a vastly more profitable sector.

The Cumberland Initiative (www.cumberland-initiative.org) is an attempt by a group of research academics with strong healthcare credentials, working with clinicians and knowledge companies, to bring this vision into reality. We understand that the vision is almost too great to be taken seriously. We also know that, in time, the system will get there on its own.

So what is it worth to bring the future a decade closer? And what is the biggest barrier to this level of change? Well, it is us. As Henry Ford is reported to have said "Whether you think that you can, or that you can't, you are usually right."

Figure 2 Photograph provided by Professor Sally Brailsford, Southampton University