BIG DATA IN HEALTHCARE: HOPE OR HY? A White Paper by Carol J McCall, with a Foreword by Sir Liam Donaldson.
TABLE OF CONTENTS

FOREWORD ............................................................... 02

Overview ............................................................... 05
What is Big Data? .................................................... 05 - 06
From Burden to Bonanza .......................................... 07 - 08
Data Science Goes Mainstream ............................... 09
Big Data in Big Business .......................................... 10
Big Data in Healthcare ............................................ 11 - 12
The 21st Century Learning Organisation .................. 13
An NHS Performance Revolution ......................... 13 - 14
Unleashing the Power of Observation .................... 15
About the author ..................................................... 16
The opportunity to bring together health data with sources of information from many unrelated areas opens new doors.

“I have completely transformed the way I look after my patients.” This was just one of the responses from a group of frontline nurses that I chatted to over a cup of tea during a visit to Croydon University Hospital. Another told me: “If my patient gets sicker, I spot it straightaway. I can react before the problem gets worse. I can almost feel when I’m saving a life.”

I had watched as this team of nurses had reviewed, on a computer screen, the vital signs of all the patients under their care. They focused on the changes over time, identifying people who were not getting better as they should or were getting worse. They made comparisons and quickly identified the patients who were most at risk. I saw how animated they became. They admitted that they weren’t the sorts of people who had used data before in their clinical work. They didn’t need any statistical training or even have to be interested in numbers. The beauty of the data they were looking at was that it gave them clinical insight. It prompted them to take action to protect their patients. It told a story that made sense to them as nurses. The power of those data was almost palpable. That day I realized that whilst the quality of NHS tea hadn’t improved since I last drank some, there was no doubt that I was witnessing a transformation in the quality of care for acutely ill patients.

Each patient’s vital signs were being collected, automatically analysed and displayed by a system called VitalPAC. Nurses input the data into their mobile devices. From all the hospitals that are using VitalPAC, a database of more than 100 million sets of data has been assembled. When I think of Big Data, the theme of this White Paper, I see VitalPAC as an excellent example of the benefits that this revolution makes possible.

If I were to pile, on a table, 30 sets of hospital case notes, each containing (along with much other paper filed away), a set of charts with manual recordings of the patients’ vital signs on different days and at different times, I am confident of three things. Firstly, that no one involved in day-to-day clinical care would have the time or inclination to look through the records to try to see a pattern in the quality of care being delivered. Secondly, such a pattern would be very difficult to discern, even if it was present. Thirdly, some essential data would be missing. On the last of these, there is a telling point about human fallibility. Amongst the regular observations recorded on patients—the vital signs—is the frequency at which they breathe in and out (the respiratory rate). Changes in this measure can be a strong indication that a patient’s condition is worsening. Yet, in traditional nursing observations, this vital sign is often missed out. Crucially, it takes time to do and nurses are almost always operating under extreme time pressures. Automated monitoring of vital signs involves the device obliging the nurse, for example, to take and record a respiratory rate. It will not allow her or him to move on to the next item until a plausible reading has been entered, so it cannot be missed out due to pressure of time. Also a wildly high or low reading will prompt an “are you sure?” check, reducing another source of error that could harm the patient.

About the same time that I visited Croydon University Hospital, I was undertaking research to examine the causes of patient safety-related deaths in NHS hospitals in England. I analysed 2000 individual reports made by NHS staff because they perceived that the patient’s death was associated with unsafe care. I found that an entire third of these deaths involved mismanagement of those acutely-ill patients whose condition was deteriorating. The precise underlying circumstances varied but many involved failure to take necessary observations, missing out observations and not noticing or acting on worsening of vital signs.
The research was subsequently published in a major medical journal. The results shocked me, especially as I had read each individual incident report, each one describing a human tragedy. This state of affairs emphasised once again what other high-risk industries have known and acted upon for decades: when systems or procedures are at risk from human errors or failings, then safeguards need to be designed in to provide protection. Health care worldwide has not learned this lesson and, as a result, it is not as safe as its patients and their families should expect. Too many people are dying unnecessarily, not because of their illnesses but because of the way their care is organized and delivered.

New opportunities to improve the quality and safety of care are just one of the health aspects of Big Data highlighted in this White Paper. Every health system in the world is struggling to cope with the increased burden of chronic diseases like diabetes, cancer, heart disease and stroke. Too many years are spent incapacitated and suffering with the consequences of poor health. Every health minister in the world would like to prevent, or at least postpone the onset, of these diseases. One of the keys to doing this is to gain a greater understanding of people’s behaviour and the factors that influence it. Research has already told us a great deal about this but the opportunity to bring together health data with sources of information from many unrelated areas opens new doors. It may take us closer to the means to shape the behaviour patterns of whole populations towards the ultimate goal of enabling tens of millions of people to achieve a better state of health and sustain it for most of their life.

“DJ” Patil, the first Chief Data Scientist appointed by the United States Government, described President Obama as “the most data-driven President we’ve had.” It is significant that world leaders see the Big Data revolution as so important that they are not leaving it to computer scientists to take forward. Since Patil started his job, at the request of the President, he has made 130,000 government datasets available to the public. It is also significant that the first area being addressed is health and healthcare. The initiative will seek to harness genomic and personal health information: “An innovative approach to disease prevention and treatment that takes into account individual differences in people’s genes, environments, and lifestyles.” In the United Kingdom, the first strides into this exciting area have been faltering as the public and some groups of healthcare professionals have become alarmed about data privacy. This is a very legitimate area of concern and it is vital that the most robust safeguards possible are built in. The Government has not done a good job of communicating and explaining to the public the ways in which data can be a force for good in their lives. There is a risk that the traditional British strengths of invention and innovation will be held back whilst other countries march forward.

Through this White Paper, The Learning Clinic is signaling its intention to move the debate on Big Data (particularly in the field of health and healthcare), on from a diffuse exploration of the subject to practical ideas and action that will benefit the patient and the citizen. It is nothing less than a new frontier in the human endeavour.

SIR LIAM DONALDSON
Chief Medical Officer for England (1998-2010).

References
OVERVIEW

The National Health Service is facing fundamental reform of the way it delivers care. NHS England’s Five Year Forward View (FYFV) is seeking to disrupt nearly every major aspect of how care is organized, delivered, and experienced, shaking up both relationships within the health service and between its organizations and other public services, the community and its users. These changes are driven by a recognition that the UK needs to deliver better care in better settings, both to achieve the outcomes its citizens deserve and to meet the funding gap driven by population change and the availability of new drugs and technology which can help achieve those outcomes.

Alongside this reform is another seemingly unstoppable force, dubbed ‘Big Data’, which is sweeping across industries and fueling radical changes in how companies operate, compete and thrive. If we are to believe the hype, it transforms everything it touches.

As these forces collide, can NHS leaders leverage the latter to address the former? How might Big Data fit into the FYFV? This White Paper sheds new light on Big Data, what it is and why it’s different, and examines the possibility for harnessing it to transform healthcare.

We conclude that in order to improve, the NHS – like any organisation – needs to learn. In order to learn, it needs to measure its current performance. The emergence of Big Data in healthcare offers an opportunity to measure, learn and improve on an unprecedented scale.

WHAT IS BIG DATA?

Big Data is not simply lots of data: companies in retail, telecommunications, and other data-centric industries have had large datasets for a long time. As their ability to generate and gather information continues to grow, these will get even bigger, but in a scalable way. That is, such traditional datasets are still amenable to ordinary processing, and are only being asked easy questions. They form a static, well-behaved input. They are still not Big Data.

But past a certain point, a change of quantity becomes a change of quality. Processing issues start to loom large when the datasets become too large (terabytes or even exabytes*), when they change too rapidly, and when manipulating the data in standard relational databases is just too slow.

To add clarity, the consultancy Gartner coined the now often-quoted “three Vs” to characterise what makes big data different: volume, velocity and variety. Data in sufficient volume brings the most immediate challenge to conventional IT structures, with its demands for scalable storage and distributed approaches to processing. Managing data’s velocity means handling the increased rate at which data flows into (and through) an organisation, its rate of change, the integration with data that comes at different speeds, and dealing with bursts of activities rather than predictable, steady tempos.

*Quantities such as these become increasingly difficult to grasp in any sort of useful way. To help add context, an exabyte is roughly the equivalent of 5 quadrillion 200-page books (which would form a 140,000,000 mile high stack), or 275 billion MP3 songs (which would require roughly 28,000 uninterrupted lifetimes to consume).
Big Data’s most interesting (and most challenging) aspect is its variety. Data sources can now include social network chatter, web server logs, traffic flow sensors, satellite imagery, broadcast audio streams, banking transactions, music, web page content, scans of documents, GPS trails, telemetry from automobiles, financial market data and medical records. These various sources, with their differing structures and flow rates, far outstrip traditional processing capabilities, and have thrust data curation and governance into critical roles.

So, just how much “data” is there? A rough estimate of the generation of measurements and other sorts of recorded facts gives about five exabytes from the birth of civilization to 2003. By 2013 we were creating that much data per day. And the pace is rising exponentially.

This is in large part because the Internet of Things (IoT), when in place, will see sensors added to virtually everything. Today’s IoT landscape has roughly 2 billion Things (the vast majority of which are smartphones) but by 2020, experts say this will skyrocket to 26 billion. They see the biggest growth coming from automobiles, health monitoring devices and home management systems, each generating vast quantities of data.

Lest our terminology lag our reality, there’s even a discussion underway on what to call Big Data’s soon-to-be-largest quantities. Today, the yottabyte, (which is 1,000 zetabytes or 1 million exabytes) is our largest measure, and currently the end of the scale. What comes next? Ninabyte and brontobyte have been proposed, but another leading candidate is hellabyte."
But data has only ever been as good as the intelligence we can glean from it. As Steve Lohr said in 2011, “if ‘big data’ is to be more than a marketing term, it has to be the raw material for making smarter decisions, faster”.

It would seem that, depending on our needs (finding the efficacy of a drug, or forecasting the weather), greater quantities and varieties of relevant data should help us, but analyzing Big Data brings its own unique challenges. If there is no good way to process the available river of facts that have different volumes and degrees of trustworthiness, then Big Data is no more than burdensome: it presents obstacles that simply cannot be overcome using traditional analytic techniques.

The inherent limits of rules-based approaches (where programs must pre-specify each if-then-else sequence) become fatal in a data-driven world. Almost always simple and incapable of learning, they are powerless to perform better than the rules underlying them, and improve only if experts come armed with better rules.
In a Big Data world, classic statistics is also reaching its limits. Such analyses begin with a specific hypothesis (i.e. an explicit statement of how certain variables combine to explain an observation or outcome) which is then statistically tested to confirm whether the data supports it. Such methods are adequate when the number of variables is small, because there is a manageable limit to the number of ways variables can be combined to explain the data. But when the number of variables gets big, the number of such possible combinations explodes astronomically. It becomes literally impossible to formulate and examine each one by hand.

To overcome these barriers, companies have turned to ‘Big Data Analytics’, a term used to describe a variety of artificial intelligence (AI) and machine learning approaches. Fundamentally different from their analytic predecessors, they harness three powerful trends and, according to Kevin Kelly, have finally unleashed AI on the world through their combination of:

- **Cheap parallel computation** – Thinking is an inherently parallel process, and building learning algorithms requires many different processes to take place simultaneously. Until recently, the typical processor could only ping one thing at a time.

- **Big Data** – Part of the AI breakthrough lies in being able to find useful patterns in the avalanche of data collected, where our entire digital universe has become the teacher making AI smart.

- **Better algorithms** – Machine learning was invented in the 1950s, but a resurgence in the last decade has helped computer scientists learn to tame the astronomically high number of relationships involved.

Rather than being swamped by data, AI exploits its volume and diversity, learning directly and at-scale from it. Problems that seemed unassailable a few years ago are now being solved, with companies reporting startling gains, particularly with a branch of AI called ‘deep learning’. Skype has Star Trek-like instant translation capabilities, Google is building self-driving cars, robot dogs now walk very much like their living counterparts, and promising molecules for new drugs are quickly identified.

According to Yann LeCun, a computer scientist at New York University, there have been “a number of stunning new results with deep-learning methods. The kind of jump we are seeing in the accuracy of these systems is very rare indeed”.

For over half a century, researchers have predicted that AI was right around the corner, yet until a few years ago, it seemed as stuck in the future as ever. But the synergies of processing power and programs that can learn to be better programs are finally able to take this “blooming, buzzing confusion” of inputs and make sense of it, whether it’s to read hastily scrawled handwriting (just like a human), or pick out the actual efficacies of a drug from millions of incomplete and inconsistent clinical records (something no human could ever do).

> “If ‘big data’ is to be more than a marketing term, it has to be the raw material for making smarter decisions, faster.”
> Steve Lohr
Riding the coat-tails of these sweeping advances in AI is another revolution, one that has been dubbed “the last mile of analytics”\(^9\). Bridging the “last mile” involves creating data-driven software (DDS) that delivers sophisticated machine learning using data in the cloud (its natural home) without having to be a data scientist.

> Ten years ago, data science was sitting in the math department; it was part of academia. Today, you see data science applications [across] multiple industry verticals. In the next 5 to 10 years, data science will disrupt every industry, resulting in better efficiency, huge new revenue streams, new products and services, and new business models. We’re seeing a very rapid evolution.\(^{10}\)

While Big Data analytics companies aren’t new, the mission of one of these ‘young’ analytic companies captures it well: “We are bringing machine learning to everyone, helping people make the leap from the theoretical to the practical quickly”\(^{11}\). They want to bridge the gap between hardcore data science and practical applications.

This evolution shouldn’t come as a surprise; the path from infrastructure to applications is a familiar one:

> This is a pattern that occurs with practically every new and disruptive technology. Think back to the early days of the Internet. Most of the innovation was focused on infrastructure. There were small groups of sophisticated people doing very cool things, but most people couldn’t really take advantage of the technology. Fast forward in time and the technology has matured to the point where any company can use it as a business tool. The Internet began as a science project, and now we have Facebook and OpenTable.\(^{12}\)

Experts agree the growth will be furious. They divide the big data ecosystem into below-the-line technologies (data infrastructures, platforms and security services) and above-the-line technologies (industry-specific DDS, data-as-a-product, and data tools), and project the fastest growth will come above-the-line, calling it “up for grabs...with hundreds of billions of dollars at stake.”

This will be a boon to business everywhere, since one of the often-cited barriers to exploiting big data analytics has been the shortage of data scientists. In an ironic twist, by making AI available to the masses, data science may actually end up automating itself out of “the sexiest job of the 21st century.”

At this point, we can only conclude that the notion of Big Data isn’t actually about data, nor is it about any particular technology or algorithmic technique. Instead, Big Data is a term that captures a megatrend, one that seems to be the unavoidable consequence of the co-evolution of data, science and technology. After all, and as Kevin Kelly would say, “it’s what technology wants”\(^{13}\).
Big Data is enabling companies to learn faster and more deeply than ever before, whether it is to make business decisions (what to charge, what to offer) faster or more cheaply, find better ways to serve customers, or design and deliver new products and services. It is revolutionizing business as it sweeps across several industries:

**Manufacturing**: General Electric is putting sensors in gas turbines, jet engines, MRIs and anything it calls “things that spin” to determine when the machines will need to be serviced. The sensors from one gas turbine alone create more data per day than Twitter does in a week. GE makes 50% of its income from services for these devices and has transformed their entire services business as a result.

**Retail**: Macy’s Inc. adjusts pricing in near-real time for 73 million items, based on demand and inventory.

**Oil**: Royal Dutch Shell is developing the ‘data-driven oil field’. In surveys of possible fields, they are moving from collecting a few thousand readings to more than a million, so geologists can make more accurate recommendations about where to drill.

**Agriculture**: John Deere, Monsanto, and Pioneer equipment allows farmers to collect planting and yield data and produce detailed prescriptions for how to increase yields. And, since farmers often use a jumble of different equipment (not a single manufacturer), the Open Ag Data Alliance created open APIs for different systems to communicate automatically through secure cloud services.

**Fast Food**: This $700 billion global industry is using everything from real-time data analysis and inventory-tracking sensors to gamified training programs and dashboards that track sales and labour costs. They are even exploiting cameras trained on drive-through lanes to adjust their digital menu boards. When lines are longer, menus feature products that can be served up quickly; when they are shorter, menus feature items that take longer to prepare.

What about healthcare? Can healthcare organisations learn and change with the adroitness of other industries, or is healthcare too different? Does it need something else?
While healthcare is often described as lagging behind its industry siblings in terms of technology maturity and adoption, experts are no less bullish on Big Data’s potential impact. This is partly because healthcare is fast becoming a Big Data industry with a data explosion that makes analytics an absolute requirement. In fact, the projected growth of healthcare analytics is nothing short of staggering. According to research from Markets and Markets, the global healthcare analytics market is predicted to grow 27% per year, from $5.8 billion in 2015 to $18.7 billion in 2020.

With the race for raw material creating a gold rush of sorts, the generation of and access to data is increasing exponentially, from Electronic Health Records to social platforms, health insurance claim records, environmental factors and genomic markers. And the current rush is just the beginning; experts say that a significant portion will be driven by the IoT, which seems made for healthcare:

“Millions of smart sensors and devices connected through the internet to provide up-to-the-second data on everything from a patient’s heart rate to how many pills they’ve taken that day to the ambient temperature of their hospital room, can provide the type of detailed, actionable, ongoing management that most providers can only dream about.”

How many nurses are needed on an acute hospital ward to ensure that patients receive all the care that they need, and are kept safe? As hospitals treat an increasingly dependent and complex case mix of patients, the demands on nurses have increased accordingly. Some countries have adopted fixed ratios (eight or ten patients per nurse) but this is an arbitrary figure based on average workloads. Many hospitals perform daily or shift-based reviews of staffing versus patient needs, but the picture changes much more frequently than this given the rapid throughput of patients.

The Francis report on care quality at the Mid Staffordshire NHS Foundation Trust in early 2013 was a watershed for the NHS. Published in response to concerns about high mortality rates and poor governance, the report recommended that hospitals adopt more systematic and responsive approaches to determining nurse staffing levels.

The Learning Clinic exploited its huge database of clinical data to build a “ward busyness” model. The model uses selected data linked to the timeliness of observations, patient acuity and other features of ward activity to determine whether it is possible to predict when a ward’s workload is becoming unsustainable. In such instances, the model allows hospital managers to deploy extra nurses to such wards and ensure that staff are being used as effectively as possible, ensuring safer care and better outcomes for patients.

References

BIG DATA IN HEALTHCARE

How Big Data and its feeder technologies improve diagnostic accuracy and speed

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<tr>
<th>Improvement</th>
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<td>Improved on cardiology diagnoses</td>
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<td>Reduced on Norovirus Outbreaks</td>
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Ahead of the IoT tsunami, Big Data Analytics is already showing its value. The following are but a few examples of how healthcare institutions are using Big Data and its feeder technologies to improve diagnostic accuracy and speed, ignite health engagement, drive efficiencies in care operations, enhance treatments, and dramatically reduce the spread of infectious disease:

**Cardiology diagnostic accuracy**22: AI technologies use 10,000 attributes collected from 90 metrics in six different locations of the heart to pinpoint disease states more quickly and accurately and improve the accuracy of cardiology diagnoses by 17%.

**Predicting onset of psychosis**23: A proof-of-concept exploration leveraged Natural Language Processing (NLP) and, using a novel combination of semantic coherence and syntactic assessments as predictors of psychosis transition, was able to predict the onset of psychosis in high-risk youths with 100% accuracy.

**Speeding cancer treatment**24: Baylor College of Medicine is using Big Data to speed cancer diagnoses and treatments. Using ‘electronic triggers’ from Electronic Health Record data to flag and follow up with patients with abnormal findings from an initial screening or evaluation, they have nearly halved diagnostic times for colorectal cancer patients.

**Targeting Metabolic Syndrome**25: Aetna is using Big Data to expand their health services offerings and tailor them to provide highly personalised guidance. In a partnership with GNS Healthcare and Newtopia, Aetna can accurately predict who will develop Metabolic Syndrome within the next year, including which risk factors will be the biggest contributors, and is using this to target and personalise interventions to promote behaviour change.

**Diabetes management**26: Managing diabetes effectively is like having a part-time job and many diabetics don’t check their blood glucose as often as they should. Google wants to change this. With their newly-patented contact lens that continuously measures the blood glucose of diabetics through the tears it touches, they are now partnered with Sanofi and Joslin Diabetes Center to revolutionise the way that people interact with their diabetes care.

**Reducing Norovirus Outbreaks**27: The Learning Clinic, in partnership with the Portsmouth Hospitals NHS Trust built an electronic system to identify and highlight cases of norovirus so that infection control staff could intervene earlier. The VitalPAC system exploits the vast amount of data being captured in real time by ward nurses on every ward, recording routine and other clinical information. The system interrogates the data and identifies patterns of symptoms that might predict a case of norovirus. The system automatically notifies the Infection Control Team accordingly so that they can intervene earlier and prevent spread. This might include isolating patients in side-rooms, more rigorous hygiene measures and intensive cleaning of all affected areas.

Between 2009-10, when the initiative began, and 2013-2014, the number of norovirus outbreaks at PHT fell by 91%, from 21 to just one. The number of patients affected by norovirus-like symptoms fell by 92%, the number of affected staff fell by 81% and the days of disruption in the hospital as a result of the virus fell by 88%.

The number of reported outbreaks also fell across the Wessex region and across England as a whole, but by a far lower percentage (15% in Wessex and 28% across England). Nationally, norovirus outbreaks affect 13,000 patients and 3,400 staff every year, leading to 8,900 days of ward closure and the loss of more than 15,500 bed-days. They cost the NHS £41.5 million a year, suggesting savings across the whole system of £38 million per year if every hospital achieved the same result as Portsmouth.

These are but a few examples of how Big Data, broadly conceived, is beginning to transform healthcare, and it has only just started. What these companies have in common is that they are moving quickly and learning to think differently about how to solve problems. And, as technology cycles shorten and experimentation costs drop, they use ‘agile’ techniques to iterate quickly as they learn what matters most.

**References**

Continuous improvement requires a commitment to learning. Whether it’s solving a problem, introducing a product, or re-engineering a process, they all require seeing the world in a new light and acting accordingly. In the absence of learning, organisations (or individuals) simply repeat old practices.

Harvard professor and expert David Garvin defines a learning organisation as one that is “skilled in creating, acquiring, interpreting, transferring and retaining knowledge, and at purposefully modifying its behaviour to reflect new information and insights.” He calls this a surprisingly stringent test because companies may be skilled at acquiring knowledge, but many are notably less effective at applying it to their own activities or translating it into new ways of behaving. The key to success is mastery of the details and a “command of the levers that shape behaviour,” by such means as collecting intelligence from outside sources (e.g. via interviews and observation), accumulating data through targeted actions, and experimentation.

Big Data is creating a renaissance of the learning organisation. This is because, in many industries, beating the competition by improving existing business models is no longer enough. To survive and grow, companies are having to deal with ever-increasing threats by continually innovating, and see it as their only way to create a true, sustained advantage. New approaches to innovation are emphasizing experimentation over elaborate planning, feedback over intuition, and iterative design over drawn-out development, with everything designed to produce knowledge quickly about what works and what doesn’t.

Much of this is being driven by the power of feedback loops, which are a profoundly effective tool for changing behaviour, whether we’re talking about corporations taking a lean approach to innovation, or about individuals changing their behaviours.

Feedback is more than just information. It is the control of a system by reinserting into it the results of its performance. In other words, information about a performance gap is only considered feedback when it is used to help close the gap. If it is simply recorded, or is too deeply coded to lead to action (e.g. a summary grade given by a teacher to a student), it is not properly feedback.

Feedback loops are how we learn. They are entering a renaissance, using emerging technologies that make data more available and feedback more rapid. By creating quicker cycles of learning and improvement, they have become a powerful technique for fostering change in individuals and organisations.

AN NHS PERFORMANCE REVOLUTION

In the UK, the NHS is facing some of the most far-reaching changes ever to the way care is delivered. If the Five Year Forward View is successful, by its end almost every major aspect of how care is organised, delivered, and experienced will have changed.

If all goes to plan, the NHS will deliver unprecedented innovations that change how organisations engage with one another and align virtually every aspect of care with its impact on people’s health. But the NHS is also facing unprecedented challenges that threaten long-established practices and rewrite much of today’s underlying business model.
The net result will be a massive reshaping of the NHS and its key segments. Entire parts of its delivery chain may be unseated or change in importance, and there will be new opportunities for players whose innovations bring more compelling benefits. Across the board, NHS leaders are having to aggressively adapt or risk long-term sustainability.

Among the changes that need to occur, one of the most important is for the NHS to become a learning organisation. The importance of this to the success of reform was highlighted by Don Berwick, who said:

“The most important single change in the NHS would be for it to become, more than ever before, a system devoted to continual learning and improvement of patient care, top to bottom, end to end. The NHS should become a learning organisation, its leaders should create and support the capability for learning and therefore change, at scale, within the NHS.”

The NHS is poised to undergo a ‘performance revolution’, akin to what James Surowiecki described in Better All the Time. Surowiecki has an important message for entities where becoming a learning organisation is a new competency: their first goal should be to get better at getting better.

He describes professional sport having undergone such a performance revolution in a “technological and analytical arms race” that now produces the best athletes in the world. But, he says, that wasn’t always the case. Years ago, playing professional sports was about staying in shape and learning to play with your teammates, not about mastering skills. Today, “technology has provided a flood of data about what’s happening on the field and teams are smarter about using Moneyball-style analytics to improve tactics and strategy. Efforts that would have seemed unimaginably sophisticated and obsessive are now simply what it takes to stay in the game.”

He also describes a revolution in education (a situation more similar to healthcare), where systems perform exceptionally well by taking seriously the factors they do control.

“Countries that perform exceptionally well all take teacher training extremely seriously. They’ve even developed a vocabulary to describe successful teaching tactics. This method – with its systematic approach to learning, its emphasis on preparation, and its relentless focus on small details and the need for constant feedback – is much like the way athletes train today.”

As the NHS begins its own performance revolution and as we embrace the tools and processes that accelerate our ability to learn, our first goal will be to ‘get better at getting better’.
Getting better begins with measurement.

Rapid improvement in any field requires measuring results. Indeed, rigorous measurement of value (outcomes and costs) is perhaps the single most important step in improving healthcare. Wherever we see systematic measurement of results, we see those results improve.

While the measurement of healthcare’s quality and safety is evolving in response to reform, much of healthcare still remains poorly measured or unmeasured. Such measures as do exist are the more easily-captured or less controversial, being either process measures that describe compliance with practice guidelines, or traditional clinical indicators. Both fall well short of measuring actual outcomes. This is sometimes called the “streetlight effect”, because we shine measurement’s light on data that is easy to see rather than on data that would be the most meaningful. But, while this may be useful in the short-term, it is untenable as a long-term strategy. If we fail to capture the outcomes that matter, not only does “value” remain largely unmeasured, we lose our most powerful lever for learning and improvement, and fly blind in deciding how to improve health and redesign care.

To transform healthcare, we need the right measures, and our most important ones will come from data we don’t have yet. But we now possess the means to create data that can characterize each person’s health, capture the outcomes we seek to promote, measure people’s motivations, behaviours and experiences, and the sustainability of their health and functional status. As crucially, we can create measures that describe the treatments and services themselves, so we can learn which ones are capable of achieving the outcomes we want.

Beyond any specific use, healthcare’s deluge of data will create a paradigm shift. Like all such shifts, it won’t happen overnight, but for organisations ready to embrace it, it will open new landscapes and expose opportunities that were uncommon or even unheard of before. This is the lesson from an older era, as Bill Gates pointed out, on the importance of measurement:

“We can learn a lot about improving the 21st-century world from an icon of the industrial era: the steam engine. Harnessing steam power required many innovations, [but among] the most important were new ways to measure energy output [and] a micrometer that could gauge tiny distances. Such measuring tools allowed inventors to see if their incremental design changes led to [improvements]. There’s a larger lesson here: Without feedback from precise measurement, invention is “doomed to be rare and erratic.” With it, invention becomes “commonplace.””

Healthcare need no longer “avoid the risks that are the hardest to measure.” With new data to drive measurement, and feedback loops’ powerful analytics to reduce the time needed to learn, healthcare’s attitude toward “observation” will shift. By ceasing to be a burden, its power can be exploited. We can catalyze our capacity to learn, unleash our creativity and use this to transform healthcare.

UNLEASHING THE POWER OF OBSERVATION

Early Warning Score (EWS) systems use combinations of vital signs such as blood pressure and temperature to predict whether a patient’s condition is likely to deteriorate. The EWS is typically calculated by assigning scores from 1 to 3 to each vital sign, depending on its value. The individual scores are summed to produce the total EWS which drives the clinical response. Higher scores predict that a patient is more ill and therefore require a faster review by more senior staff.

Historically in the UK, a large number of modified Early Warning Scores (EWS) had been developed on an ad-hoc basis by interested clinicians. Most used a similar set of vital signs but none had been validated properly against a large enough dataset to ensure that the sickest patients were being correctly identified. But doing so had been incredibly difficult because vital signs are typically recorded on paper charts, are often incomplete and frequently illegible.

The Learning Clinic developed its VitalPAC system to enable the electronic capture of vital signs, at the bedside, on handheld iPod touches and similar devices. Not only does the system ensure that nurses record a full set of data every time, the system also improves compliance with the frequency of observations. The resultant database, (more than 100 million sets of data by 2015), enabled researchers to link the data to patient outcomes and build a much more powerful EWS to predict deterioration.

The resultant model was adopted by the UK Royal College of Physicians as the National Early Warning Score (NEWS) which was subsequently rolled out across all UK hospitals.

References
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