Megatrends
Healthcare

The speed and scale of the changes affecting both business and society demand new thinking and new solutions. At Fujitsu, we are addressing these challenges in a responsible and sustainable way by exploiting new and emerging technology.

Contents

Headlines

- Data is the lifeblood of healthcare - with better information, we can treat more patients and improve everybody's quality of life.
- Smart sensors are delivering a rush of valuable data which we need to gather, analyse and act on.
- Medical research is making healthcare more personal - we must be ready to respond to changing demands.
- Security need not be a headache if we work together openly and effectively.

Healthcare for tomorrow

As we experience an increasing demand on healthcare resources from an ever-growing population and ageing society, technology is even more important as it promises great advances in personalised care, increased effectiveness and lower costs. Where are the biggest benefits going to arise? And what obstacles should decision makers watch out for?

Ultimately it's all about the data – acquiring, securing, understanding and acting on the huge quantities of disparate data being generated by both research and health applications. For once, it's no exaggeration to say that IT can change our lives radically for the better. To ensure we all reap the rewards, we need to work together.

In this paper, author Andrew Harding, Chief Architect for Fujitsu's managed infrastructure services and Fujitsu Distinguished Engineer, introduces the major themes in healthcare technology today – from closing information gaps to personalised care and security assurance.

Knowledge for life

Good healthcare is founded on knowledge and skill. Progress in medicine continues to deliver impressive new therapies, while research into the human genome is extending our understanding of health and suggesting new approaches to personalised healthcare.

But in the day-to-day business of health, there are serious information gaps which threaten the wellbeing of us all – and which add substantially to the costs of maintaining our healthcare system. For example, every year in the UK some 62,000 people die because their blood pressure is not properly controlled[1]. While detection rates are improving, challenges remain, including misdiagnosis.

"The possibilities for improving healthcare with new technology are exciting – and in our grasp today"

Ignorance is dangerous. So is an inability to act promptly and appropriately to known situations. Take diabetes: in 2012 the number of adults around the world aged between 20 and 79 estimated to be living with diabetes was 382m. That figure is expected to reach 592m by 2035[2]. The complications resulting from unmanaged diabetes include blindness, stroke, kidney disease and heart disease. That's a lot of unnecessary suffering as well as a high social cost.

Information and communications technology has a vital role to play in fixing these deficiencies. However, IT has an even bigger role to play in the management of healthcare by helping to cure, care and prevent.

Sensors – big data driving big benefits

Technology is making inroads into healthcare through a proliferation of intelligent, connected devices. In particular, sensors are being used to track key health metrics and feed these data streams into the cloud for analysis or action.

The Internet of Things promises connected sensors to monitor every conceivable health metric. Many devices have been developed and released – such as tiny, wearable accelerometers that measure movement

Data is the lifeblood of healthcare and can change our lives radically for the **better**

and orientation – while others such as wearable blood glucose sensors are in the advanced stages of development. Already small, easily wearable and wireless blood pressure monitors can collect blood pressure data and send it to central servers over the internet in real time. The resulting data can be analysed with no perceptible delay and if necessary an action message can be sent to the wearer or their doctor.

A caring environment

These personal sensors can provide vital data, but so too can sensors in the patient's environment. As people get older and live for longer, the number of years in which people need care is increasing.

One of the ways in which we can respond is to fit homes with ambient sensors monitoring the elderly and frail for abnormal movement patterns associated with a fall or other injury.
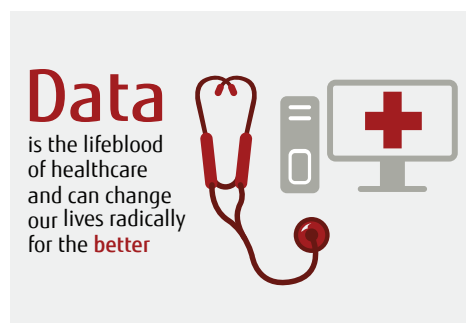

3.8 million older people live alone in the UK

1 He F, MacGregor G. Cost of poor blood pressure control in the UK : 62 000 unnecessary deaths per year. Journal of Human Hypertension 2003; 17: 455-457 (www.nature.com/jhh/) via http://www.bloodpressureuk.org/microsites/kyn/Home/Media/Factsandfigures

2 Diabetes UK. Diabetes Facts and Stats, Diabetes UK 2014. Online. Available from http://www.diabetes.org.uk/Documents/About%20Us/Statistics/Diabetes-key-stats-guidelines-April2014.pdf

Every year some 3.4m people in the UK over 65 suffer a serious fall[3] so the detection of anomalous movement, based on the analysis of large amounts of baseline data in the cloud, will be almost instantaneous for clinical purposes.

This means that not only will carers will be able to respond faster and to more falls, but the healthcare community will also learn more about the environmental factors affecting falls. Fujitsu is helping with the KIDUKU Research Project in Ireland, an initiative to provide health monitoring services and assisted independent living for senior citizens and patients who live in smart houses.

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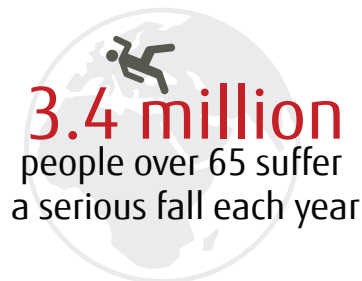
Dealing with the health data explosion

The mobile phone you carry today is likely to contain an accelerometer and gyroscope – which are used, for example, in step counter apps. The resulting data can be used to track fitness and compare activity with friends in real time. Such health apps are a major driver of smartwatches from Apple and its competitors.

However, making sense of this growing but highly diverse sector raises its own problems. One challenge is that different sensor types sample at different rates. For example, a GPS sensor may only sample its location every few seconds, whereas an electroencephalography device may sample several hundred times a second. As a result any effort to aggregate data with these different resolutions needs to deal with different numbers of samples for different sensors over the same time period[4]. A further challenge is the establishment of standards for the format of data stored. The data is only useful if it can be accessed, interpreted correctly and acted upon with confidence.

The possibilities offered by massive sets of health data from large population samples across global geographies are almost limitless. How we structure and analyse the data is vital to unlocking the potential. At Fujitsu we are using Hadoop distributed computing technology to manage large, diverse health data sets – but the development of data standards across healthcare will help everyone make sense of data faster.

3 http://www.ageuk.org.uk/Documents/EN-B/Campaigns/Stop_falling_report_web.pdf

4 Guo, L. et al. Wiki-Health: A Big Data Platform for Health Sensor Data Management. Imperial College London. Online. Available from http://www.doc.ic.ac.uk/~yl4709/papers/WikiHealth-A-Big-Data-Platform-for-Health-Sensor-Data-Management.pdf

5 http://unlockinglifescode.org/timeline?tid=4

6 Genomics England. Understanding genomics: The 100,000 Genomes Project. Genomics England 2015. Available from http://www.genomicsengland.co.uk/the-100000-genomes-project/understanding-genomics/

7 http://www.genomicsengland.co.uk/first-patients-diagnosed-through-the-100000-genomes-project/

8 Cancer Genomics: What Does It Mean for You? The Cancer Genome Atlas. National Institutes of Health 2010; 10-7556. Online. Available from http://cancergenome.nih.gov/PublishedContent/Files/pdfs/1.1.0_CancerGenomics_TCGA-Genomics-Brochure-508.pdf

9 OECD (2013), ICTs and the Health Sector: Towards Smarter Health and Wellness Models, OECD Publishing. http://dx.doi.org/10.1787/9789264202863-en

Genomics – living data we can act on

In 2003, fifty years after the discovery of the structure of DNA by James Watson and Francis Crick, the Human Genome Project announced its successful completion. The entire human genome had been mapped and sequenced. The project had only been in existence for little more than a decade and yet its achievements have been likened to that of landing a man on the moon[5].

In the years since 2003 the cost of sequencing an individual genome has plummeted. The very first genome took thirteen years to be sequenced at a cost of £2bn. Today the same sequencing can be performed in two days and costs around £1,000[6].

These cost and time reductions together mean that a highly valuable database of human genetic information is becoming a reality. The days of massive, undifferentiated programmes of medicine development worth billions of dollars and spanning decades are long gone. Today, more focused developments of treatments for single patients are becoming possible, costing far less and with much greater efficacy.

The 100,000 Genomes Project has identified a patient with a long history of high blood pressure leading to kidney failure, connected this with the patient's family history, and pinpointed a gene responsible for the condition. This patient is now being treated with exactly the right medicine – and his family is also being tested and treated[7].

"Data is the lifeblood of healthcare - we can treat more patients and improve quality of life"

Cancer patients can look forward to medicines tailored to their specific tumour through the analysis of their genetic material, leading to more effective treatments and reduced secondary tissue damage[8]. Tamoxifen hormone therapy for breast cancer routinely relies on a test for an enzyme identified through genomic research[9]. This means the therapy is targeted at patients whose genetic makeup indicates their suitability.

Technology transfer – healthcare borrowing from business

We've focused here on the major sources of IT benefits in healthcare, namely big data and genomics. But IT is also making major contributions in areas where advances in other sectors can be copied. For example, experience from logistics and business process management can be imported to make health systems run more efficiently and effectively. Using Fujitsu's RunMyProcess technology, healthcare workflow in Spain is being improved radically.

In addition, Robotic Process Automation (RPA) can emulate human execution of repetitive processes with existing applications saving time and costs and more importantly enabling healthcare professionals to treat patients instead of needing to engage in IT processes.

Technology developed to enable data visualisation or extend the range of possible user interfaces can also find vital roles in healthcare. At Fujitsu we've developed haptic feedback technology which helps patients rehabilitate after nerve surgery. We are also collaborating with the University of Tokyo to use the Fujitsu K supercomputer to model virtual hearts so accurately that a surgical procedure using the patient's actual data can be rehearsed fully prior to undertaking the real operation.

Meanwhile 3D printing technology is set to revolutionise joint replacement therapies, and even organ replacements. Not only does this mean more personalised solutions for patients, with the benefits of closer adaptation, better function and reduced recovery time, it also signals a radical change in the surgical supply chain. With clinics able to fabricate parts at the time and place of need, fewer resources will be tied up in generic stock.

Our partners and competitors are busy innovating as well. Healthcare is becoming more responsive, more intelligent. Technology is enabling professionals to do what they do best and optimise scarce resources while helping citizens to lead healthier and more productive lifestyles.

Security – keeping our data safe and sound

The advances in healthcare described here rely on large amounts of detailed personal data being collected, transmitted and stored in central locations. This raises obvious concerns about patient privacy and data security.

Data could be intercepted as it is streamed from a sensor over a wireless network. Hackers could gain access through firewalls and other defence mechanisms to steal data from databases in the cloud. And although a key part of the adoption of the new healthcare paradigm is personal access to one's own medical data via a Personal Health Record (PHR), this opens another point of access for criminal elements .

The consequences of unauthorised access to medical data demand that we take all possible measures to protect it. These measures may include the adoption of personal banking-style authentication controls for access to a PHR, the removal of personally identifiable data from publicly available databases and the segmentation of data to allow specific groups of healthcare professionals to access only the data they need to perform their roles.

"A secure solution is required to protect our personal data"

Fujitsu's PalmSecure technology uses unique palm vein patterns to provide highly secure authentication for access to medicines and sensitive medical data. This is just one of the innovations needed to integrate effective security with day-to-day healthcare activity.

Conclusion: Better health together

Healthcare has a great deal to benefit from IT. Technology offers a key means of extending medical knowledge, intervening in patients' treatments, improving outcomes, extending services and reducing costs. Advances in sensor technology, the application of massive, cheap computing power to huge amounts of data and the amazing possibilities offered by genomic research all combine to create an attractive proposition for government, patients and IT providers. At the same time the mass collection of disparate, personal data presents practical and ethical issues which must be solved through the active collaboration of all the parties involved.

We may also see premature or misjudged applications which fail to offer long-term value. Decision makers need to prioritise high-value needs and outcomes – and ensure they are exploiting the technology for real business ends, rather than reacting to a vendor agenda. This reinforces the importance of close cooperation between government, industry and patient groups. Healthcare belongs to us all – we must build its future together.

Three things you can do today – to make tomorrow healthier

- Understand where new technologies are impacting patients' lives and your business processes.
- Make a plan for taking advantage of the growing mass of healthcare data.
- Get involved in industry initiatives to standardise data, ensure security and drive collaborative innovation.

Fujitsu would be delighted to discuss the megatrend implications for your organisation. Please contact the author Andrew.Harding@uk.fujitsu.com

About megatrends

This paper is one in a series of megatrends papers written by Fujitsu to help inform organisations of the current and future trends impacting business and society. Highlighting how human centric innovation is responding to these global challenges, they aim to enable you to consider how you can contribute to a more prosperous and sustainable world.

Other papers tackle the challenges and opportunities of an ageing population, urban migration, population growth, energy demand, and the Internet of Things.