

Spotlight

MEDICAL TECHNOLOGY: THE DATA WILL SEE YOU NOW

Matt Hancock / Sarah Wilkinson / Chris Green



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Miracles for a lucky few



This year, Louise Brown from Bristol turned 40. Brown was the first “test-tube baby” to be conceived by IVF, a medical technology pioneered in Britain in the 1960s and 70s. More than eight million people have now been born thanks to IVF. In 2015, a major study of census data from Israel and the US found that women who have access to IVF were more likely to get married later in life and to complete further and postgraduate education. The researchers concluded that IVF constituted “a form of insurance against later-life infertility”, and that its availability meant that “women who wanted to pursue a career were able to do so”. This career flexibility is important to businesses also; Facebook, Apple and others offer to pay for egg freezing to give female employees more choice in planning their careers. In her new autobiography, Michelle Obama has written that she was able to start a family in her mid-30s thanks to IVF.

The First Lady would not have had this opportunity had she been a working-class woman in one of 12 areas of England that now automatically refuse to provide IVF to women over 34. The campaign group Fertility Fairness revealed last month that 85 of the UK’s 195 clinical commissioning groups also refuse to fund IVF for women over 39. At around £5,000 per treatment cycle, a technology that promised, 40 years ago, to give women more time for their careers is being limited to those who have already found the money – and a partner – by a certain age.

While the Health Secretary has said this is “not acceptable”, he has been a member of successive governments that have slashed both the rate of spending growth for the NHS and cut social care spending by £7bn since 2010, which has put huge funding pressure on many services. It is also an unavoidable fact that the UK population is getting older, on average, and that older people cost more to treat. Medical technologies can help to create a fairer society and a better economy, but only if they are made available, and not only to those who can afford them.

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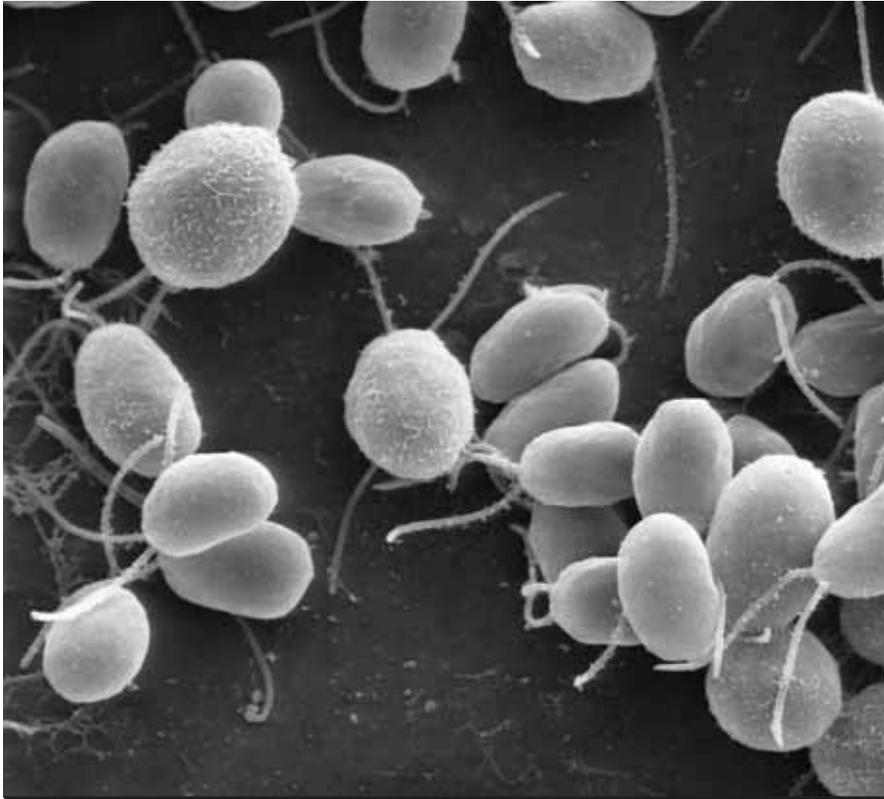
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Algae deliver drugs to individual cells

Will Dunn

Researchers in Germany have developed a technique to use microscopic algae to place drugs directly onto individual cells, which could allow some cancers to be treated more precisely and safely.

Metin Sitti and his colleagues in the Physical Intelligence Department at the Max Planck Institute for Intelligent Systems specialise in designing very small mobile robots – so small that they can use swimming bacteria to move around. While using bacteria carries a risk of infection, the single-celled green alga *Chlamydomonas reinhardtii* is

non-toxic and biodegradable. Sitti's team fitted the algae, which swim using whip-like tails, with microscopic beads made from a magnetic polymer. They were able to guide the algae, using a magnetic field.

Targeted drug delivery is significant to cancer treatment, which in many cases can damage healthy tissue. Last month, James Allison and Tasuku Honjo were jointly awarded the Nobel prize for medicine for their work on immuno-oncology, which uses the immune system to target diseased

VR therapy attracts investors

Rohan Banerjee

Oxford VR, a startup attached to the University of Oxford, has announced £3.2m in funding from investors, including Oxford Sciences Innovation, Force Over Mass, RT Capital and GT Healthcare Capital Partners. The company uses virtual reality technology to enhance exposure and immersion therapies and treatments for different psychological conditions.

Oxford VR's first product, a VR-based treatment for vertigo, was tested this year in a large randomised controlled trial, with the results published in *Lancet Psychiatry*. The treatment has been made available in selected NHS clinics. The latest round of investment, CEO Barnaby Perks said, would finance an ambitious "range" of product development. Although Oxford VR's first treatment is for a phobia, it is the company's intention to address a full range of psychological problems, including psychosis and social anxiety. Perks, who is formerly the founding CEO of Iso Digital Health, said: "Our focus is on developing clinically validated, cost-effective, user-centred treatments for clinical conditions with significant impact on patients, the health system and wider economy."

Clark launches AI healthcare centres

Augusta Riddy

The Business Secretary, Greg Clark, has launched five new technology centres that will develop artificial intelligence healthcare capabilities. They will be based in Leeds, Oxford, Coventry, Glasgow and London, and will receive £50m through the Industrial Strategy Challenge Fund. The centres will use

technology to diagnose conditions at an earlier stage, improve medical imaging, and use large-scale genomics to better understand conditions.

Clark said that the centres would “give people more options when it comes to their treatment and make reporting more efficient, freeing NHS staff to spend time on direct patient care”. Each centre will have a unique focus. The London Medical Imaging and Artificial Intelligence Centre will explore the role of AI in quicker diagnosis, whilst the Industrial Centre for AI Research in Digital Diagnostics in Glasgow will work with SMEs to solve healthcare challenges.



NHS app goes to Google Health

Will Dunn

The team behind Streams, an app created by Google-owned DeepMind using data from NHS patients, is being merged into the company’s new Google Health division. The Streams app was developed in partnership with the Royal Free Hospital in London to help identify at-risk patients. Last year, the Information Commissioner found that in the process, the Royal Free NHS Foundation Trust had illegally handed the medical data of 1.6m people to DeepMind. The company responded that “no NHS patient data will ever be connected to Google accounts

or used for any commercial purposes”.

Julia Powles, research fellow at New York University’s Information Law Institute, described the acquisition as “trust demolition”, while professor Iain Buchan, director of the Centre for Health Informatics at the University of Manchester, observed that trust was for companies such as Google “hard earned” and “easily lost”.

Coroner warns of robot “risk”

Rohan Banerjee

Following an inquest into the death of a patient who died during robotic heart surgery, a coroner has warned there “remains a risk of further deaths” should machines be rolled out too quickly and without proper training programmes.

Stephen Pettitt, 69, died after a valve replacement operation led by surgeon Sukumaran Nair at the Freeman Hospital in Newcastle in 2015. He was the first patient in the United Kingdom to undergo the procedure using a robot, and the coroner heard that Pettitt would have had a stronger chance of survival had he undergone a conventional operation.

The coroner, Karen Dilks, told the inquest that there was an “absence of any benchmark” for training on these machines. The inquest also heard that Mr Nair had declined an offer of one-to-one training on the device.

The Trust’s medical director, Dr Andy Welch, issued an apology and said it had “failed to ensure the standard of care that would be reasonably expected of us with a tragic outcome”. Welch has confirmed that the robotic heart programme at the Freeman Hospital was stopped after Mr Pettitt’s death and “significant changes” had been made.

Ms Dilks told the inquest that she would contact the Royal College of Surgeons and the Department of Health to ask them to consider whether national guidelines should be written for any future technology-aided surgery.



Amazon to sell diabetes products

Augusta Riddy

Online retail giant Amazon has partnered with health brand consultancy Arcadia to sell diabetes management devices.

Under the “Choice” brand, the company will sell blood glucose monitors and blood pressure monitors, which will be paired with apps that allow users to track the data. Bob Guest, CEO of Arcadia Group, said: “Consumers no longer need to drive to a store to stand in line and purchase their medical devices and supplies. Now, in the privacy of their home, consumers can review, compare and purchase the products of their choice.”

The move signals a foray into healthcare for the internet giant, which acquired the online pharmacy PillPack earlier this year. The sheer size of Amazon has caused apprehension within the healthcare market as observers wait to see what impact the company will have.

In certain areas of the UK, the *British Medical Journal* found that thousands of type 1 diabetes patients were not being offered the most up-to-date glucose monitoring devices, despite their being available on the NHS. There are now 4.6m people living with diabetes in the UK, and 12.3m are at increased risk of type 2, according to Diabetes UK.

A technological future for the NHS



The new Health Secretary, Matt Hancock, explains why he has made adopting innovation a priority for the NHS

The health tech revolution is coming. Imagine a future where your GP explains to you that a company specialising in artificial intelligence (AI) and a pharmaceutical company have collaborated to develop a new medication for your condition.

More significantly, this medication has become available much earlier thanks to research breakthroughs inspired by detailed – but fully anonymised – patient medical data such as yours. Through analysis of equally anonymised data from people with similar backgrounds and comparable medical histories, they have synthesised a drug to benefit your exact condition type.

Now here's the best bit: your doctor now programmes and applies a patch to your skin which will administer the bespoke formulation. From this point on, the wearable tech measures the drug's effectiveness, transmitting data back to your GP and the AI system, allowing them to alter the dosage in real-time via updates forwarded to the patch.

The use of data and technology in this way gives your GP more time for regular calls to check in on you and helps maintain the face-to-face relationship that is so cherished by patient and practitioner alike.

This kind of integrated, person-centred care epitomises the aims of my department's recently launched "vision for digital, data and technology in health and care". It also underpins why our amazing NHS must be at the forefront of efforts to bring this vision of the future into the present.

Why? Seven decades of a national healthcare system means seven decades of data accrued on tens of millions of people throughout the years – but only now have diagnostic technologies matured enough to truly exploit this information goldmine.

Harnessing this data provides extraordinary and unrivalled potential to improve our health system and the direct care of millions of people. In the realms of patient safety and integrated



Patient data is an information goldmine

healthcare I believe the benefits will be off the scale.

We have to get the IT infrastructure right first though – and it’s a major focus of our vision, alongside speeding the development and deployment of new technologies, encouraging innovation and increasing efforts to upskill and liberate the health and care workforce.

Good data management can bring these innovations about and at the same time strengthen cyber security and privacy. And it must.

When the insidious WannaCry malware attacked multiple computer systems worldwide last year it threatened to undermine efforts to strengthen all three. Of course action has been taken.

A sum of £60m has already been invested to improve local IT infrastructures, and a Windows 10 licensing agreement has been reached in order to give NHS colleagues the most up-to-date systems.

A further £150m will be invested over the next three years to improve cyber security, including development of a national monitoring and security operations centre. All this will be underpinned with new codes of conduct making sure technology providers and those commissioning and deploying their products never compromise the privacy of the patients they serve. The Data Protection Act I took through parliament during my time at DCMS was just the beginning.

Legislation and codes of conduct are important, of course, but not at the expense of innovations which can save and transform lives – and it’s exciting to see them popping up everywhere.

Moorfields Eye Hospital recently hit the headlines with its unveiling of an AI system which reviews patient scans, detecting and proposing treatment referrals for more than 50 distinct eye conditions with a speed and accuracy to rival its human peers.

And we’re not just talking about the development of health tech in traditional, clinical environments – this is also about health tech that goes home with you. For example,

diagnostic devices are now available to measure blood coagulation at home or in residential care. This amazing kit emails data to the hospital automatically, allowing medication and treatment plans to be altered as needed.

I want to make sure the NHS is at the forefront of innovations like these – innovations that use data in the right way to increase efficiencies, drive down costs and free time for improved doctor-patient interactions in the NHS.

Importantly, I believe it will also have a positive impact on workplace morale – especially if health and care professionals are given more time to support their own wellbeing, not just those receiving care.

But we need to come together as partners to achieve this. The tech vision will make the NHS more human, bespoke and better equipped to tackle disease and dysfunction in all its myriad forms. It’s a noble cause and one I am proud to champion – with the help of dedicated health and social care staff.

I want the vision to be a catalyst for creativity, innovation and collaboration. So, let’s get to grips with how we use technological innovation to deliver truly person-centred, integrated health and care, focusing as much on prevention and detection as treatment and ongoing support.

Let’s double down on advances in communications and analytics to liberate the workforce from laborious admin, and empower them to deliver the very best care without compromising their own health and wellbeing.

Let’s build faith and trust in how we collect, interpret and use patient data by creating safe, secure and reliable frameworks accessible to all those tasked with saving, prolonging and enhancing people’s lives.

Above all, let’s find the fastest, most effective ways to deploy cutting-edge technologies that deliver better outcomes for patients, the NHS and the social care sector.

I’m confident that with a task so exciting, urgent and bursting with potential, it won’t be hard to concentrate minds. Let’s get to work.

No one should have the stress of managing their own medical history, writes Sarah Wilkinson, chief executive at NHS Digital

Data can thrive in a better connected NHS



Annabelle, an energetic, determined and highly competent professional in her 40s, has terminal cancer. She is seeing multiple doctors across multiple care settings as she tries a wide range of interventions to extend her time with her family. In approximately half of the conversations with her doctors and carers she provides them with details of guidance and medication provided by her other doctors – information they can't access quickly and easily other than through her.

She has this information impeccably collated in folders she carries everywhere. She is always the first to identify and help resolve inconsistencies in guidance. She spends hours contacting medical secretaries and records departments to obtain details of test results and consultations and the letters, forms and faxes that document her incredibly difficult medical journey. Annabelle is a good friend and I watch as

this process adds daily to the exhaustion of her condition over the final few years of her life.

The NHS is a large, federated system, in which there are many providers. The system is designed such that specialist providers collaborate to create a set of services that, in aggregate, protect and restore health to whatever extent is possible. Annabelle's journey began with, and remained anchored to, her GP. She also saw doctors at two hospitals and another doctor privately. In her final months she was in a hospice and, for a few days, in a third hospital. Despite the fact that almost any complex medical journey is likely to require multiple parts of the NHS to work together, as the system has been digitised over recent decades the technology has not been designed to support these interconnections. It's a huge design flaw.

In recent years the problem has worsened. There has been increased digitisation, but in the years following



the failed National Programme for IT, as the centre rightly stepped away from the misguided ambition to provide large centralised national systems, and local providers made local technology choices, the critical function of national orchestration was lost.

We now have a hugely heterogeneous technology environment in the NHS. And whilst some providers have become true digital exemplars, others remain

The NHS needs digital infrastructure

reliant on paper. Some have rigorous quality, security and safety controls over data, algorithms and systems. Others do not. And, with disturbing consequences for Annabelle and so many others, systems don't talk to each other. Information does not move safely and efficiently between different parts of the system.

Making embedded and highly disparate systems interoperate is a genuinely complex problem. It's a bit like deciding to lay down a national rail network after allowing hundreds of individual train companies to design rolling stock of any dimension and specification. Everyone understands the importance of getting data from A to B in the system. Indeed, there have been multiple interoperability programmes underway across the system for many years as people have sought to address this issue, but the necessary programmes of work are so long and difficult and expensive that they often make slow progress, they often falter and some simply fail.

But 70 years of unstinting service has made the NHS a resilient creature. Across the system there are phenomenal people collaborating every day to solve seemingly intractable problems, and they are coming together with a renewed zeal to address interoperability. Our Secretary of State has provided the impassioned leadership necessary for an undertaking of this scale and has made clear his intent to provide sustained sponsorship and support. There isn't a technologist or clinician across the system who doesn't want to see progress on this.

Enthusiasm, passion and commitment are necessary but insufficient conditions for success. We also need a technically rigorous and carefully planned new approach to this work. One of our first challenges is to identify which inter-system connections are our highest priority. We're working through networks and partnerships to build consensus on this. We then need to define very clear measures of success that can be tracked over time. Technology

teams within provider organisations across the system will need to report rigorously on their capability and progress against more clearly defined technical targets.

Detailed design specification for new, standardised interfaces will need to be developed, with the specific circumstances and challenges of individual providers assessed in detail so that plans to migrate to new standards are sensible and achievable. The national critical infrastructure delivery teams within NHS Digital must set the pace.

Critically, deep technical expertise must be brought to bear. We need to bring our top technical talent together from across the country, augment them with the brightest and best external partners and deploy them at the coalface, alongside local technical teams, to design solutions for the multiple unique challenges that will arise within local system architectures, identifying and deploying reusable patterns.

The NHS's "Getting it Right First Time" (GIRFT) programme has been hugely successful in reducing the levels of unwarranted variations in clinical outcomes by measuring performance, identifying and communicating best practice, and taking deep expertise to the front line to provide guidance and partnership. In doing so they have made progress on a problem that seemed intractable for a long time. We are about to do the same with technical interoperability.

This will be a marathon, not a sprint. Persistence, tenacity and commitment over multiple years will be necessary, and very clear ongoing communication of progress will be critical to sustain the spirit and the ambition. In future years, patients will be able to rest confident in the knowledge that their records will move seamlessly between providers and their clinicians will have complete visibility of their journey through the system. Their care will be safer and more efficient as a result. And no patient will have to bear the anxiety of managing the communication of their medical records on top of the anxiety of illness.

Data is fueling the fourth industrial revolution in healthcare

Andrew Davies, director of market access at ABHI, discusses the role of digital information in creating a more bespoke and responsive health service

Advocating on behalf of the largest employer within life sciences, HealthTech, the Association of British HealthTech Industries (ABHI) marked its 30th anniversary this year. In that time our industry has changed significantly, from being product-based, to delivering value-based service solutions and increasingly incorporating new fields of science, utilising digital data, artificial intelligence and robotics.

We represent 280 member companies, and as their devices, diagnostics and digital technologies have become increasingly sophisticated, treatment for the likes of cancer and stroke is now quicker and more targeted, supporting improved survival rates and life expectancy. Yet with the well understood demographic shifts comes a rise in chronic conditions, often perpetuated by factors such diet and



lifestyle, and increased rates of diabetes and obesity, which are now the primary drivers of strain on what is already an over-stretched healthcare system. We must now identify, diagnose and treat patients in a holistic manner and as early as possible to manage or halt diseases.

Digitally enabled solutions and data driven products, that make the most of the NHS' rich information pool, could be the answer we sorely need. There will always be a role for the hospital, but with the right use of technology, we can start to look at delivering care in alternative environments, such as the home or workplace. Through monitoring and predictive algorithms, we are positioned to manage our own health, with added focus on prevention and protection, thus alleviating pressures on the system. It's not all apps, robots and telemedicine though.

There are currently over 10,000 HealthTech employees working in the UK; applying their trade to infrastructure projects, such as hospital

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and GP information systems. Programmes that will equip the NHS to deliver on what is arguably its prize asset: its data. As the world's largest single health-payer system the NHS has a rich data pool. Large datasets, utilised effectively, mean three things for care: it can be more predictable, more personalised and more precise.

This data pool gives us the opportunity to deliver against the four Vs of data (Velocity, Volume, Veracity and Variety). However, this data pool cannot be constructed or utilised without the involvement of patients. Patient consent to data sharing must be the foundation for any revolution in digital health. We must engage citizens to have an informed public debate on the beneficial uses of health data. This is particularly the case when commercial entities form part of the data cycle. For this reason, ABHI is partnering with organisations to ensure we support the debate on informed patient opt-in.

Research suggests that the public does

not, in principle, want their health records being shared with commercial organisations and several high-profile issues regarding the sharing of patient data outside of the health system have not helped perceptions. Regulation around data security is a must. The public must trust that their information is being used appropriately.

This underpinning principle must be supported by a regulatory framework that encompasses product, service and data regulation. Data protection legislation provides the framework for sharing data and further guidance has been provided in the code of conduct for HealthTech from the Department of Health and Social Care. Cloud-based services can help overcome this by providing a route to share anonymised data with entities outside of the consented area. Blockchain/distributed ledgers also have great potential to support sharing of health data, both at an organisational level, but potentially in the future as a basis for personal control of data. And so, whilst GDPR has enshrined the basics of data regulation into law, the sensitivity of health data and its sharing with industry may need further governance to build the trust and reassurance with the public.

Given the complexity of the digital landscape, collaboration is crucial. Developers, researchers, clinicians, users and funders all have a role to play. However, a great idea will remain an idea, if it is not given the necessary support needed to scale. This will require: access to capital, access to data on appropriate commercial terms, clear regulation and governance, and support to navigate and implement within the NHS infrastructure.

The UK invests heavily in research, and rightly so, however there is much less emphasis on implementation. ABHI are working to develop networks that promote communication and innovation with a strong direction towards implementation.

There is a role for companies, regulators, patients and the NHS to come together and design a system of

transparency and privacy, that works for everyone. The prospect that digital technologies will make our health system more convenient, more coordinated, and more responsive to consumers' needs is enticing. The opportunity for population health management with a focus on healthy living is even more exciting with a focus on engaged citizens preventing chronic disease and self-managing conditions.

Data is the fuel that powers digital technologies and the ability to collect, aggregate, store, and analyse "big data" is crucial to realise the potential advantages. It is perhaps not surprising, then, that in his first week in the job, the new Health Secretary Matt Hancock made technology one of his top three objectives, further tying the recently announced £20bn NHS funding uplift to the adoption of the latest technology and recently publishing his vision for digital technology in health and care.

As Hancock has stated: "The potential of cutting-edge technologies to support preventative, predictive and personalised care is huge." This fourth industrial revolution, characterised by a fusion of technologies that blurs the lines between physical, digital, and biological spheres, offers the opportunity to radically change the long-term expectations, delivery, structures and outcomes from our health and care systems.

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Can AI help to solve the mental health crisis?



Rohan Banerjee looks at the new apps and services that aim to treat mental health problems using machine learning techniques

According to the charity Mind, one in four people in the UK will experience a mental health issue in their lifetime. With mental health budgets failing to match other areas of the NHS despite the government's 2012 pledge to achieve "parity of esteem", services such as cognitive behavioural therapy are frequently oversubscribed. A report from the British Medical Association has warned that thousands of people with serious mental health issues are waiting up to two years to receive specialist support.

The growing demand for and limited availability of healthcare professionals have created opportunities for digital healthcare. Artificial intelligence or machine learning is a growing part of this, in a number of new apps that analyse people's symptoms – usually self-reported using a chatbot – and spot patterns before offering advice to

patients or healthcare workers on what action to take.

Holly* has been using one such app, Woebot, for just under a month. Woebot launched last year and is free to download and use. It was designed by the American psychologist Dr Alison Darcy to offer advice, based on the principles of cognitive behaviour therapy, in response to text conversations. Holly, who has previously been diagnosed with depression, social anxiety and obsessive compulsive disorder, describes the interface as being "a bit like Whatsapp".

In response to Holly's statements about her mood, Woebot makes suggestions about what she could be suffering from and encourages her to take action in the form of self-reflective tasks, such as "writing out lists of what is bothering me". The app is "multiple choice for the most part," Holly says, "and while that is limiting in some ways,

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it does get you to keep on one issue at a time rather than going off on a tangent, which from my experience, is a bit of a risk with human therapy sessions.”

Holly says that Woebot’s responses “encourage the user to self-appraise and explore the illogicality of negative thoughts. If you say something, it will question why or how you came to that conclusion.” She says that the app “uses language tactically... it makes sure that it uses collective pronouns – ‘we can get

Woebot gets 2m messages every week

through this together’ – and it will use positive reinforcement to encourage you to share more.”

The app also offers a “check-in” service, asking the user about their mood at regular intervals, and allows them to track their progress through different charts and illustrations.

Woebot, which claims to receive two million messages a week worldwide, is frank about “not being a replacement for a human”, and the company does not claim that its app can diagnose conditions or prescribe or recommend medication.

Does Holly view Woebot as a suitable substitute for therapy? As far as she can tell, she says, “Woebot can only check what you’re telling it against the limited library of information that it has. So it can’t recognise complex language or understand metaphors.” However, she says it “could be a great stop-gap” between someone acknowledging that they have a mental health issue and actually going to a therapist in person.

But Holly admits that her “extensive knowledge of mental health problems, which has been informed by experience” means that she “finds Woebot more insightful than perhaps it is... I am obviously familiar with my symptoms and I know how to describe them, which means that Woebot can identify them more quickly. I don’t think everyone would have the same experience.”

Woebot received \$8m from venture capital firm New Enterprise Associates in March and has confirmed that a subscription-based version of the app, which will “give users access to more features” is in development. Would Holly be willing to pay? “Having used the free version of the app, I’d say I am curious as to what else it could do. But affordability is usually a big consideration for anyone going to therapy. I would be willing to pay so long that it was genuinely affordable.”

With the demand for NHS-provided therapy so high, the private sector has experienced a sharp growth. Bark.com, an online marketplace for personal services and training opportunities, has reported a 65 per cent increase in the

demand for private counselling in the UK since 2016. When Bark.com surveyed its customers in the summer, nearly 80 per cent of people who had signed up for counselling and therapy treatments through the site indicated that they had turned to the private sector because NHS waiting lists were too long for them.

Sally Brown, a therapist in Bedford, blames excessively long waiting lists on the IAPT (Improving Access to Psychological Therapies) programme, which launched in 2008 and replaced the in-house counsellors at GP surgeries with external service providers, commissioned by the local CCGs. “In many areas,” Brown explains, “patients are required to complete a guided self-help programme, attend group information sessions and then go on a waiting list for six sessions with a psychological wellbeing practitioner before they can even go on a waiting list to see a therapist. The result is that only 15 per cent of people with depression and anxiety end up receiving therapy. Those who can afford it go privately, but a great many end up not getting any help at all.”

Brown says that AI’s ability to detect patterns “could be very useful” but warns that apps such as Woebot “lack the face-to-face support that is so important” in therapy. “One of the most commonly experienced symptoms of depression and anxiety is feeling alone, or not understood by others. How can tapping responses into a laptop or smartphone help someone with that?”

Peter Trainor is the co-founder of Us Ai, a software developer specialising in artificial intelligence. Trainor and his team have developed SU, which he calls an “add-on bot” that could run in existing chat apps, such as Facebook Messenger and Twitter Direct Messages. “Many mental health charities or groups already have some sort of support tool on their websites,” Trainor explains. “SU can be latched onto these tools to help detect ‘trigger’ words or phrases, which can alert the professional on the other end and then triage a reaction, or offer up content and links. SU has been trained to

“AI can identify crisis points and get help quicker”

recognise ‘intent’, and it uses machine learning to match language against different situations or conditions.”

SU, due to launch next year, is being developed using advice from the Campaign Against Living Miserably (CALM). “Specifically,” Trainor says, “SU looks for a loss of purpose; that could be a job loss or a divorce, for example. Burdensome language is also flagged, for example when someone feels that their family would be better off without them.”

SU, Trainor says, is being developed in response to the “shocking” prevalence of male suicide. “Suicide is the biggest killer of men aged under 45. Suicide can happen so quickly, so the idea is to use AI to identify those crisis points and get help to the person in trouble a lot quicker. Suicidal ideation might develop over a period of time, but when someone contacts a support group like CALM, the act itself can happen in a matter of minutes, so pushing someone up in a queue of calls could be a life-saver.”

As well as recognising emergency situations, SU can also be used to point people in the direction of specialist help. “SU picks up on key words, so if the programme on a charity’s chat tool, for example, managed to identify that a person was ex-military and suffering from PTSD, then it could help to direct them to a specialist charity that dealt with that, like Help for Heroes.”

Dr Paul Tiffin and Dr Lewis Paton, both of the department of health sciences at the University of York, recently conducted a study into the opportunities and challenges associated with using artificial intelligence to treat mental health problems. Paton says technology can “increase access to psychological support”, and that “guided self-help is a pre-existing technique for treating mental health issues.” Where this previously involved using books and exercises, Paton acknowledges that apps made responsive by AI “may be better than receiving no treatment at all.” He points out, however, that “computerised and online therapies do tend to have higher dropout rates compared to those

that involve a human.”

To what extent can a machine’s insights into mental health really be trusted? Tiffin says that because clinicians “often have to override a computerised decision”, machines are “viewed more negatively for making mistakes” than humans are. The accuracy of a machine’s insights, he says, depends on the examples the system has been trained to understand. “There are well-recognised situations where algorithms have turned out to be biased due to the individuals that provided the training data.”

Given the broad range and complexities of mental health conditions, the availability of good training data could be a major issue for any developer of this technology. “Therapies based on behavioural principles, namely those that encourage people to spend more time in activities they find pleasurable and/or rewarding,” Tiffin says, “lend themselves to automation. That is because they are relatively unsophisticated and are based on the ‘here and now’.” However, therapies that “involve delving into the patient’s past in order to understand their current difficulties would be much more difficult for an artificially intelligent system to ever mimic.”

Paton believes the long-term role of AI in treating mental health problems should involve a “blend of both real and artificial therapists’ time”. While there seems to be a consensus across the mental health community that identifying problems quicker would be useful, there remain doubts over the technology’s ability to differentiate between symptoms, to diagnose and to simulate the empathy that patients value in human counsellors. Holly says her experience of Woebot suggests it could be a useful short-term fix, but Sally Brown warns that such technology, however valuable in its own way, should “not be viewed as a solution to chronic understaffing or underfunding.”

**Name has been changed.*

Harnessing human factors in healthcare

Dr Jen Blair and Jess Wadsworth, company directors at Being Human in Healthcare Ltd, discuss a fresh approach to patient safety

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The 2013 concordat from the National Quality Board advocates that human factors and ergonomic thinking should be integrated into healthcare by frontline providers, helping to create a positive and just culture. Traditional aviation-style human factors training within healthcare has tended to focus on non-technical skills and crew resource management. However, over emphasis on an individual's cognitive and social skills can position the responsibility for patient safety directly with healthcare professionals' actions, and does not consider the complex elements of the current healthcare system.

The Chartered Institute of Ergonomics and Human Factors (CIEHF) 2018 white paper for health and social care highlights the need to think about human factors from a broader systems approach. Inter-related activities or entities, united in a common purpose (including the clinical environment, equipment utilised, relevant systems and processes, alongside human or departmental interactions) should all be considered to enable healthcare professionals to work safely.

It is also vital to consider the emerging paradigm of Safety II, a concept that acknowledges the complexity of modern healthcare (Hollnagel). The current Safety I ideology, that patient safety incidents can be deconstructed in a simplistic, bi-modal, "cause-and effect" linear way is outdated, yet we persist in

doing just that with timelines and root cause analysis. These current methods are reactive and have not resulted in a significant reduction in patient safety incidents over the past 20 years.

Safety II shifts our attention from safety incidents to looking at "ordinary work", in other words, paying attention to what really happens day to day (*Varieties of Work*; Steven Shorrock). This proactive approach can help us anticipate potential systems issues, enabling staff working within the system to work safely. However, the success of this approach to safety is reliant on all levels of government, judiciary and management finding a consensus. Staff will not speak up about "ordinary work" until they feel safe and empowered to do so, near misses will go unrecorded and valuable safety messages lost. Safety II views people in the system as the most valuable, resilient resource, not a problem to be fixed and constrained. It is time to engage with frontline staff and pay attention to "ordinary work", with an aim to work safely every day.

"Learning from Serious Incidents within Acute NHS Trusts" (CQC, 2016) recommends human factors should be utilised to find future solutions following serious incidents. Being Human in Healthcare believes an understanding of human factors, Safety II and systems thinking can help healthcare leaders and frontline staff achieve this goal together. Set up in 2018 by Dr Jen Blair, a consultant anaesthetist, and Jess Wadsworth, a senior nurse educator, their vision is to bridge the gap between human factor theory and the realities of an emergent and complex modern healthcare system. Engaged directly in "ordinary work" within healthcare and clinical education themselves, Being Human in Healthcare is an expert translator who ensures its training resonates with healthcare professionals, enabling them to work safely every day.

For more information, please visit:
www.being-human.org.uk

Collaborating to transform healthcare's frontline

Lucy Morrissey, deputy director: strategy at Barts Health NHS Trust, shares her insight into the opportunities for collaboration between industry and the health service



As the nation celebrates the 70th year of the NHS and all that it has achieved, there has also been focus on its long-term sustainability and what the future might hold. There's no denying that there continues to be a spotlight on the increasing pressure on hospitals, particularly as we enter the winter period.

The government has announced increases in NHS funding over five years, beginning in 2019/20, with the NHS tasked with contributing to a ten-year plan for how this funding will be used.

Like most NHS Trusts, we are always on the lookout for ways to improve patient outcomes and productivity without driving higher costs. When our orthopaedic product tender came up for renewal, we saw the opportunity to do things differently. We wanted to find a solution that supported our mission to transform the service provided to patients and improve pathways to care through innovation.

Defining the objectives of the partnership

In short, we set out to find an external partner that would help us do a number of things, such as improving patient outcomes whilst reducing time spent in hospital; releasing capacity in our orthopaedic theatres; increasing the Trust's income by improving patient throughput; optimising the patient pathway through raising the standard of clinical practice; and achieving good value in procurement by innovating in the way we undertake commercial partnerships.

When Johnson & Johnson Medical Devices Companies (JJMDC) put in its tender, which included the value-based CareAdvantage offering, we were really pleased as we felt that this matched what we were setting out to achieve.

Diagnostic and goal-setting

A dedicated team was put on-site to work with us and, following an extensive diagnostic exercise to identify

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The aim is to treat more patients

areas of improvement, a number of plans and ways of working were put in place to help us meet our objectives of delivering increased utilisation of hospital resources, specifically via:

- ▮ Improving elective joint length of stay by 1,500 days per annum.
- ▮ Improving theatre utilisation within elective orthopaedic theatres by 12 per cent.
- ▮ Improving Patient Related Outcome Measures (PROMs) scores by one point.

Implementing the partnership

As part of the implementation phase of the partnership, we moved to standardised products across three of our large sites to streamline our supply chain. We also standardised clinical best practice and reduced process variation having refreshed our multi-disciplinary team approach to comply with enhanced recovery principles with the support of the JJMDC change and project managers. They supported us in achieving protocols and standard operating procedures for consistency across the patient pathway. In turn, this contributed to reducing length of stays in hospital and releasing bed capacity.

We implemented a range of initiatives to support and inform our patients, with effective messaging and expectation setting, completing a refresh of patient literature and collaborating cross-site to standardise this. We are developing an engagement app to provide a digital approach to patient engagement and put them more in control.

Measuring results

Thanks to the introduction of a standard utilisation measuring tool and on-the-day visual management, we have seen an increase in activity throughout our theatres and achieved higher levels of utilisation. The creation of “super-lists” to optimise theatres has enabled us to treat five patients per day instead of the previous three, giving more patients access

to care and in turn driving increased income for the Trust.

These outputs have reduced patients’ length of stay and released bed capacity with initial results showing the partnership to be on track to deliver 1,500 bed days and a 12 per cent increase in theatre utilisation.

These are fantastic results and there are multiple ways that the project has demonstrated additional value to the Trust. The value created by team working and learning from the external support team who have brought an industry voice to our working practices has in itself been hugely beneficial. In addition, the collaboration of teams across the board – be it in theatres or on the ward – has enabled our front-line staff to work together to solve problems and improve patient outcomes.

Stakeholder engagement has been a crucial part of the success of the project, with a range of methods being introduced. These included regular workshops to engage with key players across each site. Cross-site interactions were key to gaining agreement on multi-site initiatives, such as educating carers and patients on the positive changes taking place within the Trust and the opportunities of these changes was important in securing further buy-in.

Sharing best practice

A real sign of the partnership’s success is how the practices implemented within the orthopaedic theatres have been expanded to other theatres outside the project scope. The whole project has been a collective effort across multiple professions at various levels across the organisation, working together and sharing successes.

The possibilities that collaboration between the NHS and industry holds make it an exciting era for us. At a time when we need seamless, integrated working more than ever before, I believe partnership is a key element to the successful future of our healthcare system.

Femtech: healthcare for 51 per cent of the world's population

Health technology for women is a growing market. **Dorothy Musariri** looks at how “femtech” could change women’s lives around the world

Women’s healthcare has long been characterised as underresearched, underfunded, and inadequate. Before smartphones, if a woman wanted to take a fertility test she would have to visit a clinic on the third day of her period. Until just over two years ago, women were often excluded from medical trials, and many products and services have been developed with scarcely any female input. But with the advent of digital healthcare and the “femtech” – female technology – industry, this is rapidly changing.

Women make up 51 per cent of the population and working-age women spend 29 per cent more per capita on healthcare than men. Women’s health technology has an estimated market potential of \$50bn by 2025.

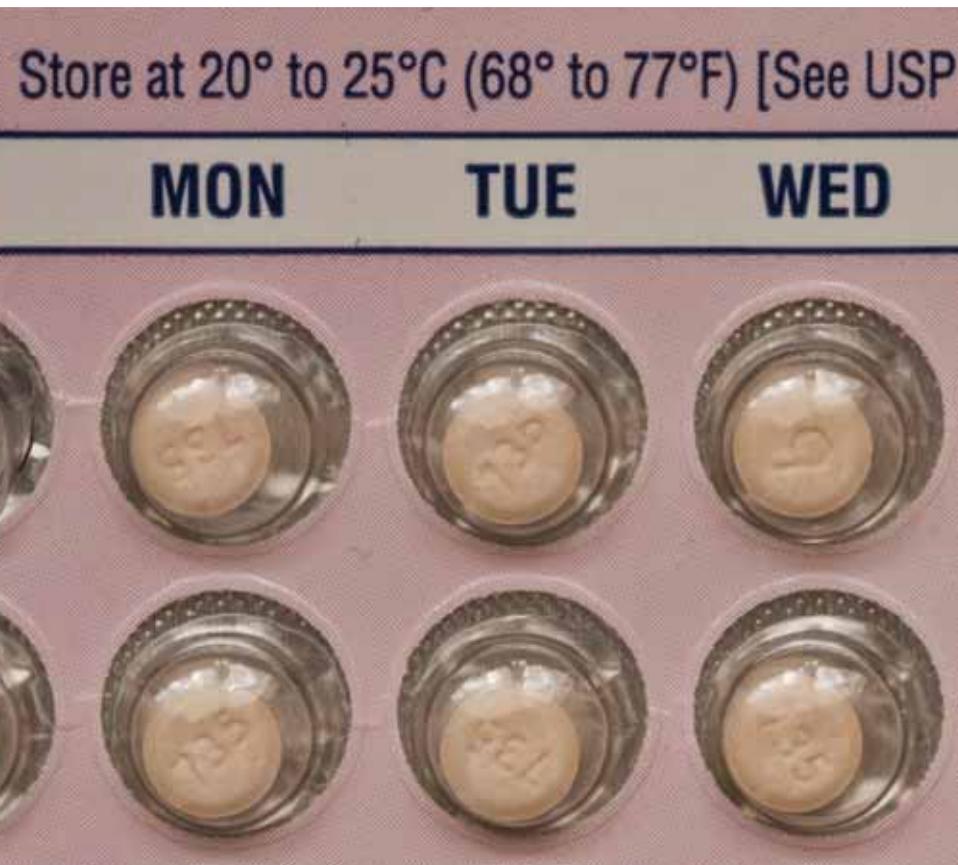
The term “femtech” was coined by the

Danish entrepreneur Ida Tin. In her early 30s, Tin was frustrated by the lack of anything other than drugs – namely the contraceptive pill, which has unwanted side effects for many women – to help plan and control her reproductive health. She developed an app called Clue to solve this problem; it helps users track periods, measure fertility and manage reproductive health, and it now claims ten million users in 190 countries.

“When it comes to the future, investing in, and building, female-led, female-focused tech isn’t just a step towards gender equality,” says Tin, “it makes business sense. While the femtech industry has grown significantly, menstrual health is still considered to be a niche or even taboo subject by many. The conversation around female health needs to become

The pill changed women’s lives; could femtech do the same?





more open. To do this, femtech companies and reproductive health in general needs its champions: from other startups, through to doctors and researchers.”

The interest and investment in Clue has allowed it to become more than a simple tracking app. It now partners with the University of Oxford, Stanford University and the Kinsey Institute in

Women's health tech could be worth \$50bn by 2025

SHUTTERSTOCK/DAVID DEA

the US, carrying out in-depth research into menstrual cycle health. “The more information we have on women’s cycles, their health and everything else that falls under female healthcare, the more advancements can be made, both in terms of research and the technologies produced,” says Tin.

Natural Cycles, a fertility app, was the first to win FDA approval as a method of “digital contraception”, and has proved popular, with more than 125,000 users in the UK. The Ava tracking bracelet, which looks like a fitness tracker and monitors ovulation, offers women more information on fertility and pregnancy, and the Braster offers app-connected breast examinations with data analysis from the company’s medical team.

It is in developing countries, however, that femtech could have most impact.

Five billion people around the world have little or no access to advanced medical treatments, and health and wellness in the third world are in dire need of solutions that are cost effective and practical. Research conducted by the World Health Organization shows that more than 800 women die of pregnancy-related complications every day, and most deaths occur in low-income countries such as India and Africa, particularly in rural areas where healthcare facilities are in short supply. Apps and portable devices could provide valuable support in these areas.

For example, while developing economies may lack large-scale resources to screen for women’s healthcare issues such cervical cancer and breast cancer, the iBreastExam by UE Lifesciences is a low-cost, battery powered and handheld device, currently being used in Africa and south Asia for screening breast health. More than 175,000 women have now received an iBreastExam test and over 120 cancer patients have been diagnosed through a number of public and private healthcare programmes.

The Eva System, too, could prove particularly valuable in the developing world, where 80 per cent of cervical cancer cases occur, causing around 190,000 deaths each year. The device is made by MobileODT and captures high-quality images and videos for cervical, vaginal and vulva examinations. The scans can only be accessed by the provider, physician or consultant. Even in rural or remote areas where women might struggle to get a WiFi connection, the patient’s data can still be stored on the Eva device until they have internet access, and the files can be updated and made ready to be reviewed by a consultant.

In India, a company called CareMother is helping to detect high-risk pregnancies in early stages through mobile monitoring tools and an algorithm that screens the data collected. The company says it has helped the Indian government, medical colleges and doctors to double their reach and reduce operational expenses by 50 per cent.

Bhaumik Sangvhi, co-founder and

“Menstrual health is still considered to be niche”

director of UE Lifesciences, is confident that femtech technologies can “cross social, cultural and economic barriers and create access, which earlier was impossible... Whether it’s monitoring menstrual cycles or tracking and monitoring personal health data, women are now able to achieve it using technology while maintaining their privacy within the comfort of their location. These technologies also help guide women on issues which otherwise are considered taboo in some of these developing countries.”

Sanghvi says femtech may also help to overcome cultural issues that impede healthcare in the developing world, by “offering solutions that are minimally invasive and personalised to the needs of the patient. What’s needed in a developing country is a solution that is less intrusive and more practical, and femtech is focused on that.”

However, devices and apps are not without their own challenges in developing countries. One of the setbacks, Sanghvi explains, is the lack of visibility and communication of femtech products. “Additional pain points also include social and cultural barriers and overall affordability. So, awareness and education will be the biggest factor [for] fuelling this movement,” he says.

As in any area of healthcare in which new solutions are being offered, it’s imperative to ask how reliable they are. Fertility tracking apps have come in for particular criticism regarding their accuracy. Natural Cycles was investigated by Sweden’s Medical Products Agency after a significant number of women seeking abortions at one Swedish hospital were using the app as their only means of birth control. In 2016, researchers at Georgetown University in the US compared 40 apps that predicted a fertility window. Only six apps were able to predict fertile days without any false negatives.

Helen Stokes-Lampard, chair of the Royal College of GPs, says that although femtech apps have science behind them – to varying degrees – people who use them “shouldn’t completely rely on

them, and should still speak to a healthcare professional”.

Paljit Sohal, principal consultant at global growth partnership company Frost & Sullivan, points out that a Facebook advert for Natural Cycles was banned in the UK after the Advertising Standards Agency (ASA) ruled it to be misleading. While Sohal says that “the number of pregnancies was in line with the published typical use effectiveness rate for Natural Cycles (93 per cent), which is based on a study of over 22,000 women,” the team behind Natural Cycles have “distanced themselves from traditional methods” enough that the medication-free technology can be seen as “contraception 2.0”.

Illustrating some of challenges the “nascent market” still faces, Shruthi Parakkal, another consultant at Frost & Sullivan, says it’s important to consider the bigger picture. “Anything that can make healthcare more accessible, easier or affordable for women is good. Women in the third world have a pressing need for more accessible care, whether it is due to the demographics or the urban-rural divide, or because there are no screening programmes. Socio-cultural norms often make women’s healthcare issues taboo subjects, especially for infertility, menstrual health, birth control and sexual wellness.” Parakkal thinks femtech could address concerns around access to portable screening equipment, better communication with healthcare professionals, remote consultations, and self-management using wearables.

But as long as complications surrounding social and cultural barriers and cost still exist in emerging countries, femtech will have major hurdles to clear. At the same time, women in the developing world are increasingly receiving an education and entering the workforce in ever greater numbers, and their purchasing power is only going to keep increasing. As the products and solutions of femtech become more easily accessible, they could start to contribute towards health and wellness among women the world over.

Future-proofing the NHS through partnerships

Neil Davis, strategic capabilities director at Johnson & Johnson Medical Devices Companies, UK & IRE, explains how value-based healthcare is improving outcomes as well as cutting costs

The 70th year of the NHS is a time to celebrate the history of our beloved asset, but also to put a spotlight on what the future might hold and how can we secure its success for the next 70 years. It can't be denied that the NHS is facing more pressure than ever before. By 2030, it is estimated that there will be around 15m people in the UK over the age of 65. The increase in life expectancy from where it was in the post-war era of 1948 when the NHS was launched is a huge achievement, but with it comes the challenges of an aging population, underpinned with a continued expectation on the NHS to improve outcomes while reducing costs.

Today, industry has a responsibility in shaping the future healthcare landscape by partnering with the NHS to co-create solutions that deliver value to providers, improve patient outcomes and satisfaction. We know that we need to deliver more than product-based solutions – we need to collaborate to support healthcare providers to find ways of addressing both their clinical, operational and cost-based issues.

It was with this mindset that Johnson & Johnson Medical Devices Companies (JJMDC) launched CareAdvantage, a more holistic approach to co-creating solutions with our health provider partners. Our data-led approach showed us that the changing healthcare landscape requires a new type of partnership between industry and the NHS. It reflects our joint commitment to

improving the future of healthcare through innovation and collaboration.

We are incredibly proud to be collaborating with a number of NHS trusts across the country with this value-based offering and of the results being generated. What's become very clear, is that there are a number of recurring challenges within each trust. These include bed capacity shortages, long referral times and waiting lists, theatre processes that need streamlining and, of course, supporting patient outcomes, all while reducing costs.

To tackle this, we have created processes and pathways to help trusts embed clinical best practice and reduce process variation, which are designed to align to initiatives such as Getting It Right First Time. We aim to take a whole system approach, which means we can provide support in theatres from a non-clinical perspective, such as data-driven planning and theatre visualisation, through to developing standardised patient messaging to drive consistency of care pathways. Collaborating in this way generates an increase in activity throughput in theatres, meaning higher levels of utilisation can be achieved, ultimately translating into being able to treat more patients, more efficiently.

Our embedded approach within hospital teams not only differentiates our offering, it also allows us to become more than a vendor of products and services. We have become a fully vested and integral part of our partner trust's outcome delivery programmes, both clinically, operationally and financially.

I truly believe that it is this collaboration between the NHS and industry that will help to secure the success of the NHS for the next 70 years. By keeping the patient experience and hospital need at the centre of the partnership, we can tailor an approach to generate solutions that get to the heart of the challenges faced, and ultimately create better outcomes for our end user, the patient.

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Connected care: how AI is improving outcomes

Artificial intelligence is healthcare's best chance of genuine innovation, writes **Neil Mesher**, CEO of Philips UK and Ireland (UKI)

“In the 21st century NHS, it might not be the sound of a bedpan dropping that is heard in Whitehall, but that of a robot picking it up. The NHS turns 70 this year but we must turn our sights to the future. We should not accept an analogue NHS in a digital decade.” – Lord Darzi, former health minister¹.

The use of data and artificial intelligence (AI) forms part of a new transition to connected care, a care model tasked with realising the promise of a value-based healthcare system – in other words, creating a health service that focuses on improved patient and healthcare professional (HCP) outcomes, at a sustainable cost. The data revolution, connected care and AI, presents us with exciting new opportunities to improve the accuracy and speed of diagnosis, to better manage complex diseases.

This emphasis on building exciting digital solutions for better outcomes is the focus of Philips' most recent global market survey of HCPs, the Future



Health Index² (FHI). The report reveals that digital innovations are currently pushing towards two considerable gains: improved data collection and analytics, including electronic health records (EHRs); and care delivery, such as telehealth, diagnosis and treatment solutions. The report concludes that an integrated approach delivers the most value.

AI is something that we all come into contact with on a day to day basis, for example when selecting a “recommended” video on YouTube or ordering an Uber. However, within the context of healthcare, the term AI can alarm people due to the perception that this will involve the transfer of tasks from human hands to robots. In reality, this is not the case.

EHRs can lay the groundwork for data-driven health systems, while AI can be used to support the valuable analysis of this data, aiding diagnosis and offering insights for HCPs and patients. By extracting insights from multiple sources of patient data, for

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example from radiology, pathology and genomics, that are almost impossible to analyse independently, AI-enabled solutions can facilitate the delivery of more personalised medicine and support clinicians to optimise their work flows, including planning, procedure times, and, vitally, diagnostics so clinicians select the right exam for the right patient.

Take mammograms, for example. Unfortunately, it is common for mammogram results to be misinterpreted due to differing perspectives by the human and digital eye. This has the potential to cause great distress and worry. However, AI visual recognition software is estimated to be five to ten per cent more accurate than the average physician, thus using this tool could decrease the false-positive rate and prevent numerous cases of unnecessary concern³.

In addition, the ability of AI and the latest software to sift through large amounts of data can help hospital administrators to identify trends to

improve the efficiency, sustainability and overall standard of their hospital. Who would say no to shorter waiting times in A&E?

The need for increased efficiencies in pathology labs was highlighted recently in a survey by the Royal College of Pathologists, which found that 97 per cent of NHS histopathology labs were understaffed. This has led to some patients experiencing distressing delays in receiving appointments and results⁴. Digital pathology provides the means to speed up and simplify access to histopathology information across the laboratory, helping pathologists to work more efficiently and accurately.

Philips is currently working with the NHS to bring next-level cancer care to the UK through data and AI, including in the field of pathology. The iCAIRD (Industrial Centre for Artificial Intelligence Research in Digital Diagnostics) project with NHS National Services Scotland, aims to create one of Europe's largest fully-digitised pathology labs. iCAIRD will involve the development of a system whereby AI can assess digital diagnostics, pathology and radiology data within Scottish NHS pathology data, and consolidate the information in one digital location. The initial focus is on gynaecological cancers, to increase speed and accuracy of diagnosis of this complex area, so HCPs can provide patients with the best care possible.

Philips and University Hospitals Coventry and Warwickshire NHS Trust, along with four digitised NHS trusts, are also working on project PathLAKE to create a centre of excellence for AI. Alongside accelerating the provision of world-class training and education to pathology and computer-science communities, PathLAKE will assess diagnostic efficiencies and develop novel AI tools to track potential response to treatments.

Through ongoing education around the world, we can build belief in the power of data and AI to drive connected, personalised and better care. To build trust in this new era of digitalised

healthcare, governments, businesses and healthcare institutions should continue to invest in developing digital solutions that address the needs of the population.

We need to educate about AI and underscore the benefits of its use in the healthcare setting. We do not want AI to be misconceived as a replacement for physicians, but acknowledged as another tool in the treatment and care arsenal. One which can free up HCPs from certain tasks and assist them in accurate decision-making, allowing them to dedicate more time to provide quality care to more patients.

This year is a monumental year for healthcare in the UK, with the 70th anniversary of the NHS. Whilst the NHS of 1948 may have evolved considerably, the operating principle of providing free care to all still remains. An ageing population and tight budgets put pressure on the men and women of the NHS to deliver high-quality care. However, with data and AI we have the tools to continue to support and accelerate the innovations and medical excellence of this country.

For more information, please visit:
<https://philips.to/noboundsc>

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Big data poses big questions for patients' privacy



Data sharing can inform innovation but requires a strict ethical code, according to **Chris Green MP**, chair of the APPG on medical research

Data, data and yet more data. Technology has always been driven by knowledge, and our ability to acquire and amass information is accelerating. Profound change would once have been achieved by an individual genius or a chance discovery but we are now past that stage and no more so than in medical technology.

The opportunities of the fourth industrial revolution and big data are immense but do we have the tools not just to acquire, access and interpret that data but also to do so within a robust ethical and regulatory framework? How these frameworks are applied and evolve could, if too restrictive, hold back medical advances and give a competitive advantage to other countries but, if too lax, could undermine confidence, lead to failure and provoke a public backlash.

We all want to live longer, healthier lives but it is getting harder and more expensive to make each incremental advance. The synthesis and manufacture of aspirin followed centuries of people using extract of willow bark, but a new blockbuster drug from a pharmaceutical

company may now cost over \$2.5bn. The development cost is still going up, the 20-year patent life is eaten into during the development process and the applicability is becoming more niche, so the challenges for the traditional pharmaceutical industry are mounting up.

This is where a transformation in the way we use data can deliver better outcomes, improve targeting of treatment and accelerate the development of new treatments. Data gathering is increasingly not in a laboratory or hospital setting and is not just for professional use. Smartphones enable the acquisition and integration of real-time data into patient records as well as informing the patent. An app called Remora (Remote Monitoring on Rheumatoid Arthritis), for example, alerts patients to prevent “flare-ups” from becoming serious. This allows people to take control of the management of their own health.

Naturally, this data can be used to develop treatment plans, triaging of outpatient appointments and provide a



wealth of other information that will be of use to the patient, the doctor but also to companies and charities working in the sector. This then raises the question of the ethics, regulation and access of patient data.

The sharing of and access to data raises a wealth of questions, not least who is to benefit. Should your data, which helps the development of a new blockbuster drug for a corporation as well as massive profits, mean that you should have a cut of those profits? If not you, should charities or the NHS take a slice from the data the corporation has access to and how will it be worked out in a way that does not pour too much money into the pockets of lawyers?

The NHS has enormous potential as a data-rich resource for the development of innovative medical technologies. A national system that almost the entire population uses could present a wealth of longitudinal data when collected in a consistent and coherent way. As an organisation the NHS would have a moral authority when it comes to the use or commercialisation of data and, due to its size, the clout to negotiate and work with global corporations on a level playing field.

Unfortunately, it doesn't quite work that way. We all know how difficult government finds delivering IT projects, but there is a strong sense that the NHS should be performing at a far higher level when it comes to using its unique qualities to develop new medical technologies. The fragmented nature of the data and the challenges of sharing it can be overcome but it will be an immense challenge. Perhaps though, Matt Hancock is the right man, in the right job, at the right time. His background in DCMS and his depth of knowledge of all things digital should mean that if anyone can deliver, it will be him.

Having dodged the question of Brexit so far, I cannot avoid it any more. This will obviously be challenging and far more needs to be done to give certainty over the relationship between the UK and EU institutions. We fully participate

in the EU's R&D programme and Horizon 2020 but do we want to wholly buy into the successor, Framework Programme 9, when it is likely to shift focus away from investing in excellence, where the UK has done well, and towards capacity building, which will give more of a boost to recent-accession states? Recognising the strength of British universities, research institutes and research-intensive charities, many of which are world leaders, it is in the interest of the EU nation states to maintain and enhance our relationship, just as it is for us in the UK too.

As a former engineer, having served on the Science and Technology Select Committee and currently chairing the APPG on medical research, it is abundantly clear how important personal relationships are in science. The members of different global scientific communities know one another as well as their work. Post-Brexit, we must ensure that our international relations are strengthened and our migration policy reflects this need.

Brexit and maintaining personal relationships are not the only challenges that lie ahead. *New Statesman* readers will well understand the concerns over civil liberties and the protection of an individual's data. If we are too restrictive over it, the cost of developing the next medical breakthrough may be prohibitive, and so the next lifesaving drug or technique may never be delivered.

Are we happy for the NHS to have our data? If so, can they use it in collaboration with a charity but not with a company? This complex situation would be impossible to navigate, so it would prevent the development happening here. In doing so, this would send companies, jobs and profits overseas, leading to the crippling our research-intensive sectors.

There are huge opportunities in medical research to build upon the advances we are already making, and we have every chance of taking them but so much hinges on our personal data being made available and used for the good of all society.



Protecting data could also slow research

Delivering digitally empowered healthcare

Nancy West, head of enterprise services at Siemens Healthineers, explains how technology in healthcare offers an opportunity to improve long-term patient outcomes



While the advances of modern medicine are a triumph, the reality of a population that is living longer represents a great challenge for the future. Sadly, as the United Kingdom's public services are starved of significant funding, the circumstances of economic austerity are such that there is a pressure to do more with less. People won't stop getting sick, so how can we treat them better, and make sure they are sick less often?

Technology, specifically digitisation, can make services more efficient. But more streamlined data processing that saves on folders and filing cabinets is simply the start. Technology, if used effectively, can transform every aspect of a patient's pathway, from diagnosis through to treatment and discharge. The aim of implementing technological solutions into the National Health

Service is not just to cut costs – although that is a welcome side-effect – but rather to progress speed, quality and provision of care, through more informed decision-making, and to make sure that patient outcomes are actually improved.

At Siemens Healthineers we take a holistic approach to using technology to advance healthcare. We are constantly innovating our portfolio of products and services in our core areas of diagnostic and therapeutic imaging and in laboratory diagnostics and molecular medicine. We are also actively creating Value Partnerships™ to combine our entire portfolio of technology and services, as well as providing digitally enabled performance management services and even architectural re-design and construction of hospital departments

Our innovative Value Partnerships™

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business models help to increase organisation-wide value in order to meet immediate and future goals. Within the context of a modern, digitally-enabled health system, we develop lasting, performance-oriented relationships focusing on: enhancing processes, streamlining operations and improving patient experience. We are adding new capabilities and scaling up existing ones to transform care delivery, elevating the quality and precision of care delivery by advancing the level of innovation in the organisation.

As an example, our managed equipment service (MES) offers a proven partnership model, which allows an NHS trust to have access to innovative Siemens technologies for a fixed annual fee, with Siemens managing all equipment-related concerns, such as maintenance or replacement, in a

bespoke arrangement tailored to that trust's individual needs.

Financially, the benefits of the MES are obvious. Upfront capital costs have become more challenging during austerity, and with MES contracts typically lasting somewhere between ten and 25 years, this makes budget forecasting for the trust more consistent and manageable long-term. The MES also promises to develop at the same pace as the technology itself, with Siemens taking on the responsibility for updating equipment as and when required, thereby removing that stress from the trust.

Among Siemens Healthineers' flagship Value Partnerships™ are the contracts with Kingston Hospital NHS Foundation Trust and Guy's and St Thomas' NHS Foundation Trust. At Kingston Hospital NHS Foundation Trust the partnership includes the provision, update and maintenance of imaging systems, such as x-rays and ultrasound. Siemens Healthineers manages equipment planning, staff training and provides technical support on-site relating to all machines used.

Siemens Healthineers' Ysio Max, a high-end digital x-ray machine, offers unique automation that makes sense. It uses auto-positioning, responding only to the touch of a human hand, and automatic detector identification. The Trust also uses Siemens Healthineers' Definition Edge CT scanners and Cios Connect – a robust multifunctional "C-arm" for everyday surgery.

At Guy's and St Thomas' NHS Foundation Trust the digitally enabled radiology performance management service (RPMS) developed by Siemens Healthineers, provides a sustainable programme of process improvement facilitated by analysis and visual management of their operational data. This comprehensive approach allows Trusts to review work flows, set goals for change and satisfy a culture of continuous improvement.

Using technology to collate information swiftly and securely will enhance patients' and clinicians'

experiences in equal measure. For example, having patients' medical histories, including any useful information about allergic reactions, available in real time, will help doctors to reach their diagnoses more quickly. Specifically within the context of imaging, granulated data analysis can help to follow up incidental findings from a scan effectively.

As for a patient's perspective, being diagnosed on the spot rather than having to wait weeks for test results, is not only helpful in terms of improving the chances of treating whatever condition they have more promptly, but is also a way of providing peace of mind.

Delivering digitally empowered healthcare, ultimately, is not just a case of a trust buying a flashy bit of kit and patting itself on the back. Equipment is only useful if medical staff and patients alike both know how to get the best out of it. Trusts should aim, then, to create digital ecosystems, with interconnectivity recognised as their guiding principle. Smartphones, for instance, could become advanced tools in the hands of thousands of patients and practitioners. Equipped with the right software, they could provide user-friendly, alternative solutions to major medical challenges – preventing the over-prescription of medication, promoting self-care, encouraging positive lifestyle changes and warning of the early signs of health problems.

Digital healthcare, crucially, must make better use of big data analytics and the ability of machine learning algorithms to mine that information and make sense of it, noticing the patterns that are difficult, even impossible, for humans to see. Recognising problems sooner speeds up the diagnostic process and leads to more timely treatment. Treating people more quickly, and more effectively, can reduce the risk of repeated or lengthy stays in hospital. An already stretched NHS would certainly welcome that change.

For more information, please visit:
www.healthcare.siemens.co.uk

How data science is shaping the modern NHS

Data has the potential to transform the future of healthcare, writes **Aziz Sheikh**, director of the Usher Institute of Population Health Sciences and Informatics at the University of Edinburgh

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Data-Driven
Innovation

The fourth industrial revolution (4IR) is a cross-sector phenomenon. Digitisation, specifically through big data, artificial intelligence and machine learning, has the potential to transform any industry, especially healthcare. With the National Health Service perennially under pressure, from budget constraints and an ageing population, it must find a solution that is capable of driving efficiencies without compromising on quality.

Large data sets, if used effectively, could help to inform earlier diagnoses. Earlier diagnoses, then, lead to faster treatment, which stands to reduce people's time spent in hospital, nipping conditions in the bud, rather than allowing them to drag on. Data should be at the heart of every decision-making process in the healthcare industry, and updated on an ongoing basis. Healthcare as a sector, with all of the longitudinal data it holds on patients across their lifetime, is well positioned to take advantage of what the 4IR has to offer.

That our health service is free at the point of delivery forms a huge part of the reason for its widespread use. That widespread use means that we have a plethora of data that can be recorded. From diagnostics, interpretation of lab tests, scheduling appointments, to personalising care, finding cures to conditions and creating new and innovative solutions to long-standing problems, data is a game-changer for the NHS.

Data can paint a picture for a patient's

pathway. Installing a culture within the health system to not view information in silos, but instead to view data in relation to other data is the key to making the most of the 4IR. If a patient is checked for one condition but also displays symptoms of another, getting into the habit of cross-referencing and collating data is to be encouraged. The aim should be to create a health system that continuously learns and is personalised to individual patients' needs. Digital medical histories not only save on space previously used for paper files, but being able to check the details of past hospital visits in real time is a valuable asset.

At the policy level, we see common problems with data, including the challenges of its collection, curation and storage. But ensuring that there are appropriate security measures in place, tackling the interoperability of software and making sure that we have trained experts who can work with the growing complexity of data systems, is well worth the investment.

As vital as collating and correlating data within a healthcare setting is understanding how that data corresponds to other sectors as well. Several smart city initiatives – such as those designed to monitor electricity grid use, air pollution and more – on some level will have an impact on the NHS. The Data-Driven Innovation initiative is part of the Edinburgh and South East Scotland City Region Deal – a government-led investment in the region where nearly a quarter of Scotland's population lives. As part of this deal, the University of Edinburgh is leading on data science innovation, making use of forecasting trends, risk and probability assessments, genetics analysis, patient behaviour studies, and understanding the true value of digital infrastructure.

Ultimately, in modern healthcare, we should be striving for a system that is predictive and preventive. Data is central to that vision.

For more information, please visit:
www.ddi.ac.uk

MEDICAL TECHNOLOGY

The latest contracts, jobs and training

THESE CONTRACTS ARE NOW OPEN FOR TENDERS

Crown Commercial Service

Health and social care access services
 Contract value: £500m
 CCS is looking for private partners to provide cloud-based data management software across several NHS trusts.
 Bid deadline: 22nd May 2020
 Contact: hscndps@crowcommercial.gov.uk

Countess of Chester Hospital NHS Foundation Trust

National framework agreement for GDPR-compliant IT disposal and secure data destruction
 Contract value: £50m
 Countess of Chester Hospital NHS Foundation Trust is open to bids for software engineers who are able to destroy former confidential patient data records in compliance with GDPR.
 Bid deadline: 10th December 2018
 Contact: james.flood1@nhs.net

Dorset Healthcare University NHS Foundation Trust

GB Poole: e-consent form for child immunisation
 Contract value: £100k-500k
 Dorset Healthcare University NHS Foundation Trust is digitising its local school immunisation programme. It needs hardware and software capable of scheduling immunisation sessions, gauging vaccine dosages, and processing consent forms filled in by parents.
 Bid deadline: 23rd November 2018
 Contact: craig.miles1@nhs.net

Total value: £550.5m

Tender and framework data supplied by



THE LARGEST CONTRACTS OPEN FOR BIDS SOON

“Pre-Information Notices” give advance warning of contracts that will soon be open for tenders.

Guy’s and St Thomas’ NHS Foundation Trust, London

Guys’ and St Thomas’ NHS Foundation Trust is planning to procure new electric document management software to replace current paper-based systems.
 PIN value: £500k

NHS Wales Shared Services Partnership, Cardiff

NHS Wales’ Tobacco Control Delivery Plan will seek a technology provider to install an electronic client management system to organise appointments, handle patients’ data and issue prescriptions for people trying to quit smoking.
 PIN value: £400k

NHS Counter Fraud Authority

The NHS will invite cyber security companies to bid for contracts relating to fraudulent patient practices, such as identity theft.
 PIN value: TBC

Total value: £900k

MEDTECH JOBS NOW OPEN FOR APPLICATIONS

GP, Babylon

Salary: £90,000 (full-time)
 Location: London
 Closing date: Ongoing
 Private digital healthcare provider Babylon is recruiting doctors to help deliver advice and prescriptions to users of its app.

Human factors engineer, Cambridge Medical Robots

Salary: Competitive plus benefits
 Location: Cambridge
 Closing date: Ongoing
 CMR is on the lookout for an

experienced engineer to work on the safe design of its line of surgical robots.

TRAINING OPPORTUNITIES

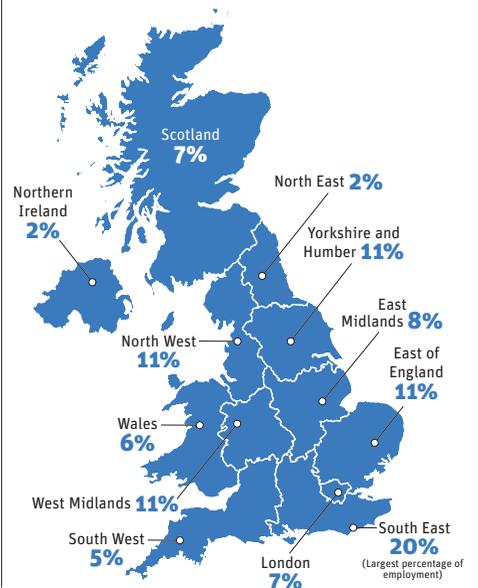
International Health Technology Assessment, Pricing and Reimbursement (IHTA) online diploma, University of Sheffield

The University of Sheffield is offering a two-year distance learning course covering technology-related policymaking in healthcare. This course is ideal for mid-career economists looking to specialise in healthcare budgets.

Clinical Embryology and Assisted Reproduction Technology MSc, University of Leeds

This one-year vocational training programme is for recent biology, biomedical, biochemistry and medical graduates. It covers the latest advanced technologies in IVF and gamete and embryo freezing.

MEDTECH EMPLOYMENT DISTRIBUTION BY REGION



Putting a stop to the mistakes costing the NHS millions

Andy Goldney, general manager UK, Ireland and Nordics at Baxter, explains how technology can help clinicians to get IV infusions right first time

Healthcare systems around the world are grappling with increasing demand, escalating costs and rising public expectations. As healthcare challenges become more complex, the need to find innovative ways to solve them becomes more pronounced. The NHS has embarked on a journey to become one of the safest healthcare systems in the world. Improving safety is about reducing risk and minimising mistakes.

A recent report estimates that 237m errors occur in the NHS medication process in England every year.¹ These errors and mix-ups contribute to as many as 22,300 deaths a year,² according to a major report commissioned by the government. Up to 54 per cent of these errors occur during drug administration¹. Research by the National Patient Safety Foundation (NPSF) indicates that the risk of errors involving injectable medicines is higher than for any other dosage route³.



We estimate that 61.4m errors occur in England per annum that have the potential to cause moderate harm, and 4.8m which have the potential to cause severe harm¹.

Many IV medications are administered using infusion technology, which does allow infusions to be controlled offering a level of safety necessary for higher risk medicines. However, there are a huge number of different brands and models of infusion pumps that can be configured in different ways – which can open up the possibility of errors made by staff when administering prescribed medications across different pumps.

In many cases hospitals have followed the recommendations made over ten years ago by the NPSF to use as few different kinds of devices as possible. At that time the two most common sources of error identified were that there were inadequate systems to:

- 1 Disseminate drug knowledge to physicians and nurses³.

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Drug libraries are a valuable resource for clinicians

Ensure the right drug and dosage prior to bedside administration³.

Advances in infusion technology continue to be made. “Smart pumps” have been widely available for some years now. These are able to recognise manual errors – for example, an incorrect rate of infusion for a specific medication – and either alert and warn staff or prevent the infusion from beginning altogether. This is done through the use of drug error reduction software (DERS) and a drug library, which allows a hospital to curate a list of medications and fluids and dosages. For each infusion, the software checks programmed infusion parameters against pre-set limits for each drug and clinical area within the drug library. Limits may be “soft” (in which case they can be overridden following confirmation by a clinician) or “hard” (in which case they cannot be overridden).

In theory, smart infusion pumps sound like an obvious way to address IV patient safety issues, but there are barriers to implementing such systems. For example, it is clear that a “one size fits all” drug library is not suitable across different clinical areas, such as critical care or neonatal units, which each have specific requirements. This is where technology combined with knowledge and support come in to play. Putting in place a multidisciplinary team of IT, engineering, nursing, pharmacy and medical staff along with the technology providers will ease the process of establishing a drug library, with standardised concentrations and doses.

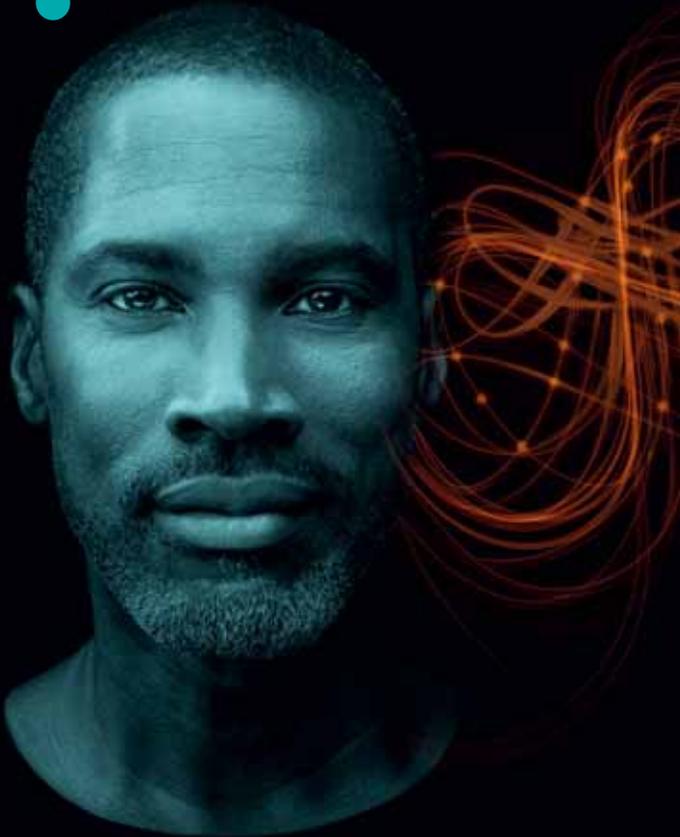
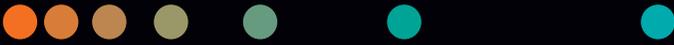
Then it is important to utilise the technology that now exists, and being introduced by Baxter in the UK, that helps to make drug library compliance easier. The technology automatically defaults to the drug library at power-on. It requires fewer programming steps to start an infusion and provides dosing feedback at the point of use – not only the drug name but also soft and hard safety limits. The technology also enables easy drug library updates to ensure that programming is based on the most up-to-date parameters.

In the United States, where the use of smart pumps is more widespread, the industry average for drug library compliance is 81 per cent, which still leaves millions of patients at risk⁴. To date, the available UK literature reports on the use of smart infusion drug libraries in single specific clinical ward areas⁵ meaning that many clinical areas are not utilising technology that could help reduce medication errors. Even when smart pumps are successfully deployed, the percentage of staff using them correctly varies widely. Many hospitals in the UK have purchased smart pumps, but only relatively few sites have established drug libraries⁶ meaning the technology cannot be used to its full potential.

Baxter recognises that implementing technology in practice can be challenging and therefore in addition to the comprehensive support that we offer when hospitals choose to implement smart pumps we have also created a toolkit to support the innovative use of technology more broadly in practice.

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