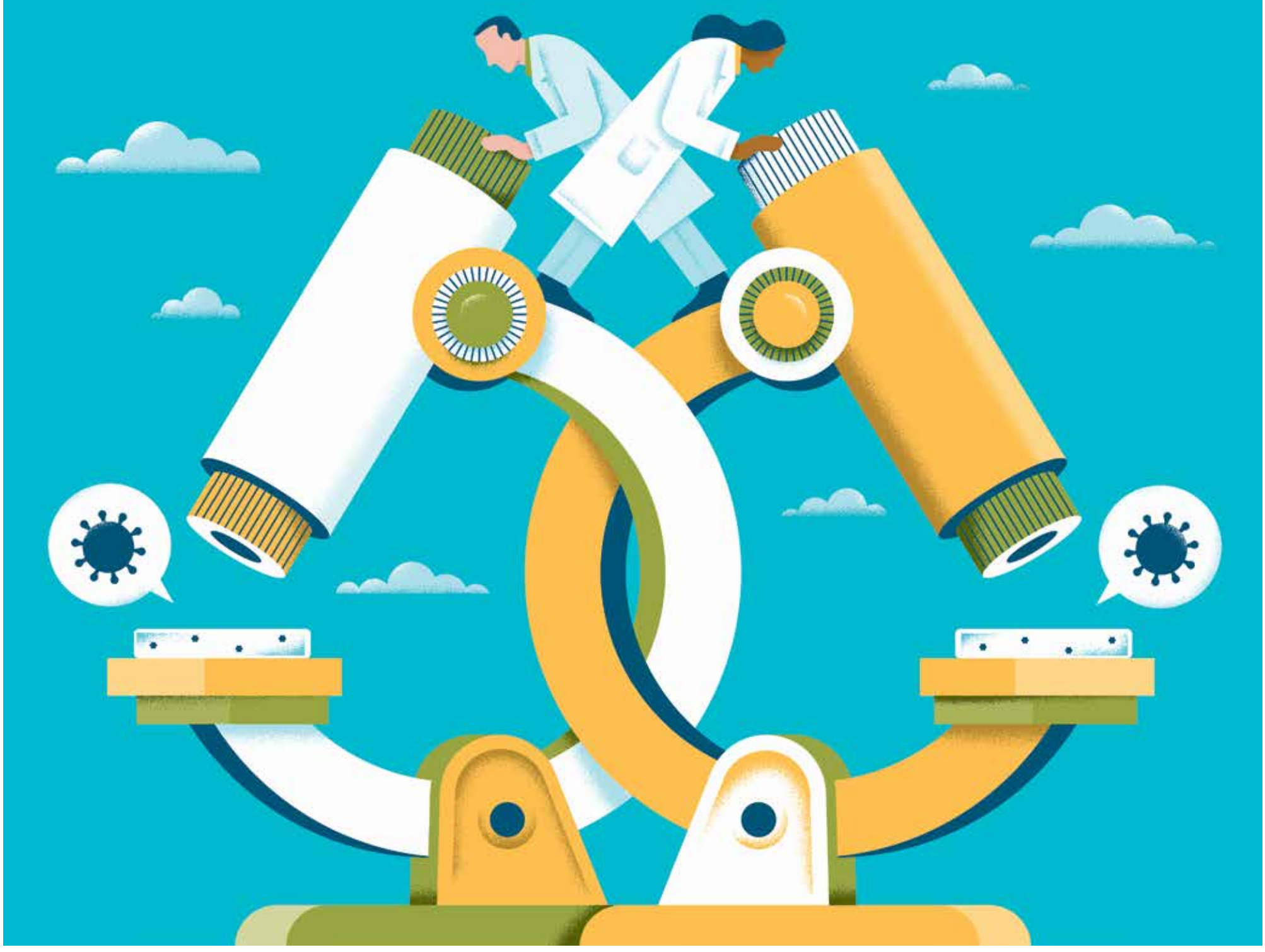
FUTURE OF HEALTHCARE



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FUTURE OF HEALTHCARE

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CORONAVIRUS

Ushering in a new age for medicine

The global race to battle the coronavirus has led to an unprecedented wave of collaboration between pharmaceutical companies, public and private sectors, but could this be a catalyst for future innovation?

Danny Buckland

Scientists are in the spotlight and giant pharmaceutical companies are bathed in a rare positive glow as public and private healthcare forges new alliances to combat the coronavirus. The gravest threat to global health has been met with heroics, ingenuity and inspiring collaboration, but how we emerge from the shadow of this deadly pathogen will be as significant as how we tackled it.

Families have been torn apart and economies wrecked by the pandemic, but its legacy could be a recalibrated healthcare system featuring a more flexible and resilient NHS, which has many big battles ahead. Aside from potential secondary or winter waves of the virus, healthcare is facing the relentless march of non-communicable diseases and a growing, ageing population living with multiple morbidities.

The uplifting view is that public and private healthcare can work together and operate comfortably with the pharmaceutical industry. Previous lines in the sand have been obliterated over the last six months with private health providers making staff, equipment and facilities available to meet the COVID-19 patient surge.

Vaccine research has been accelerated thanks to government flexing clinical trial regulations while AstraZeneca, partnering with Oxford University's Jenner Institute, has agreed to manufacture and supply two billion doses on a not-for-profit basis.

"COVID has changed everything. The NHS reacted brilliantly, but so did a number of private companies," says Andrew Corbett-Nolan, chief executive of the Good Governance Institute, a consultancy that advises NHS executives, health authorities and commercial clients. "But we need grown-up conversations about where we go next. The NHS should be free at the point of delivery, but we need to think seriously about what percentage of national wealth we commit to caring for our citizens and we need to deal with social care.

"It is lazy thinking to characterise private healthcare as solely caring about money. They don't spend their time discussing balance sheets; they are proud of what they do and talk passionately about treating patients. They can innovate, move at pace and can energise public services. Private healthcare is not a panacea, but we need to take this opportunity to work together to create a better health system."

David Cliff/NurPhoto via Getty Images

The Independent Healthcare Providers Network (IHPN), which has 70 member groups across the UK, freed up 8,000 hospital beds, supplied 1,200 ventilators and made 10,000 nurses, 700 doctors and 8,000 clinical staff available to the NHS during the pandemic. The deal demonstrated the benefits of collaboration in healthcare and was so successful that the NHS has signed a £3-billion extension.

"It was absolutely the will of the sector to respond because at that stage there was a worry the NHS would not be able to cope on its own," says IHPN chief executive David Hare. "The last few months have demonstrated that high-quality service provision in normal and emergency times requires the public and private healthcare sectors to work together. The exam question is how you make that work properly, not whether you do it at all.

"The NHS has to evolve and NHS England has set out very well the challenges of an ageing society and it is now incumbent on all of us in healthcare to solve them and put some of the divisions of the past behind us.

"If we get the political and cultural debate right, we can move forward with confidence that everyone is trying to improve the quality of care for patients, not agonising over ownership structures."

The NHS Confederation, which represents healthcare organisations and leaders, is advocating an NHS Reset Campaign that restructures the way care is planned, commissioned and delivered post-pandemic.

"We now look forward to a reshaped future in which social care, the independent sector, and voluntary and community services are seen as part of an integrated system, rather than wholly separate from one another," says Dr Layla McCay, director at the NHS Confederation.

"Of course, it is vitally important to make sure there is adequate funding going forward, for the NHS and social care too, as pouring money into the NHS will not be enough if its sister service cannot cope, as well as to rebuild local service provision to meet the physical, mental and social needs of communities hit by massive economic and social disruption."

Collaboration, an established trend in pharma, has been supercharged with companies, academia and health systems joining forces as patent rights have been waived and proprietary data shared to accelerate clinical trials.

The life sciences industry in the UK, which supports 250,000 jobs and generates £70 billion in economic value, believes the benefits of collaboration in healthcare are improved services and faster adoption of technology.

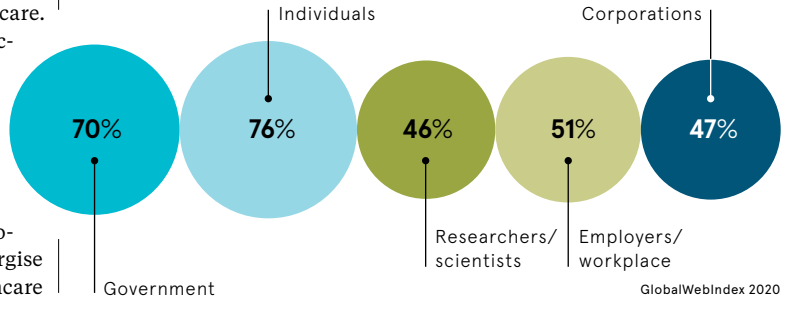
Dr Richard Torbett, chief executive of the Association of the British Pharmaceutical Industry, believes the unprecedented public and private healthcare union through the pandemic must be a template for the future. "It's important that the lessons learnt from COVID-19 collaborations are taken and used in the fight against other diseases for which there are currently no treatment options," he says.

The NHS was already en route to a more technologically focused existence, but COVID-19's convulsions present a golden opportunity for improvement if it can blast through concreted regulations and practice, and ensure the public does not equate change with a betrayal of principles. Many politicians and unions remain concerned that a race to embrace the private sector could corrode the provision of free care to those in need who cannot afford alternatives.

But Corbett-Nolan believes successful healthcare must include an enriched mix of private and public healthcare. "It is an undoable task if you don't work with the private sector. The more the NHS looks in on itself, the harder it will be; now is the time to reach out to other sectors," he concludes.

ATTITUDES TOWARDS RESPONSIBILITY FOR MANAGING SPREAD

Percentage of UK adults who believe the following are responsible for managing the spread of COVID-19



GlobalWebIndex 2020

MENTAL HEALTH

PTSD fears for frontline workers post-pandemic

Healthcare workers have risen to the challenge during the coronavirus pandemic, but the distressing events of the past few months could lead to long-term mental health problems

Natalie Healey

TOLGA AKMEN/AFP via Getty Images

Every Thursday at 8pm for the first ten weeks of lockdown, the British public put their hands together for frontline workers, celebrating the bravery, resilience and pure determination to turn up to work each day to fight the pandemic. But despite the nation's outpouring of goodwill, experts have warned of the lasting mental health impact of coronavirus for doctors, nurses and care workers, some of whom will have experienced the most distressing incidents of their working lives.

Studies from the SARS and MERS outbreaks suggest epidemics increase the risk of anxiety, depression and post-traumatic stress disorder (PTSD) in healthcare professionals.

Justin Walford, an A&E nurse at Brighton and Sussex University Hospitals NHS Trust, says that while his team is very resilient, the last few months have been challenging, with many nurses experiencing panic attacks. "One time, I had a bit of a cough in the middle of the night," he says. "You tell yourself you're probably not going to die in two weeks, but those feelings can be very difficult."

The most haunting aspect of the pandemic has been preventing patients' loved ones visiting them in hospital, he says. "It goes against everything people working in medicine stand for. You don't want people to die alone," says Walford.

Potentially passing the virus on at home has been another source of significant stress for frontline workers. Nine in ten nurses surveyed by the Royal College of Nursing said they worried about risks to family members during COVID-19 because of their clinical role. Respondents reported ongoing depression, anxiety, stress and emerging signs of PTSD.

Respiratory nurse Brooke McCutcheon from Bristol Royal Infirmary says her hospital leapt into action at the start of the pandemic, creating new COVID wards and redeploying staff, but the initial uncertainty was terrifying. "I remember the matron coming in and saying we had to prepare for the whole hospital to be on ventilators and pointing out that some of us might get really sick," she says. "Frontline workers felt like cannon fodder at that point."

During the lockdown, things were made even more difficult by not being able to socialise on days off. "It felt like all you were doing was working, dealing with horrible situations and then having no outlet. It was isolating," says McCutcheon.

It's too soon to know the long-term mental health impact of coronavirus on frontline workers and whether rates of PTSD will increase. Research from the Royal College of Psychiatrists has pointed to a "tsunami" of mental illness still to come in the general population. Some 43 per cent of psychiatrists have seen an increase in urgent and emergency cases following the COVID-19 lockdown.

A phenomenon of particular concern for healthcare workers is "moral injury", a term that originated in the military. It occurs when psychological distress results from actions which violate someone's sense of right and wrong. Those who develop moral injury are likely to experience negative thoughts about themselves and it can lead to PTSD.

"Staff have been asked to make tough decisions where there's no right answer," says psychologist Alan Barrett from Manchester. "Deciding who's going to get the ventilator because you haven't got enough of them; that weighs heavy on people."

When the coronavirus crisis hit, many hospitals adopted measures to protect staff mental health. The Royal Marsden Cancer Charity emergency appeal raised £1.6 million, some of which will fund psychological support for staff. And at Barts Health in London, the chaplaincy introduced a 24/7 helpline for frontline workers.

88%

of nurses are worried about risks to family members during COVID-19 because of their clinical role

Royal College of Nursing 2020

43%

of psychiatrists have seen an increase in urgent and emergency cases following lockdown

Royal College of Psychiatrists 2020

But psychologist Joanne Lusher from the University of West Scotland believes the mental health impact of coronavirus and the level of support that could be required in years to come must not be underestimated. "The psychological burden that is going to follow the response to COVID-19 is going to be immense," she warns.

There's also the question of salary. Nurses, care workers and junior doctors have been excluded in the government's recently announced pay rises for public sector employees. Walford describes a pay freeze as a "kick in the teeth" for staff "who stepped up to the plate during the pandemic".

The weekly clap for carers might have stopped, but the crisis isn't over yet. Psychologist Barrett points out that healthcare workers are already anxious about a possible resurgence in cases. "They're not sure whether they've got a second wave in them," he says. "The first one was so exhausting, frightening and stressful."

Greater Manchester Resilience Hub

Manchester Resilience Hub was set up after the Manchester Arena terrorist attack in 2017 to support the local community. The centre now also provides psychological help for frontline workers and their families who have been affected by the coronavirus crisis. Hosted by Pennine Care NHS Foundation Trust, the hub is a collaboration between four NHS mental health providers in Greater Manchester.

The hub offers frontline workers a variety of support options, from an NHS staff wellbeing helpline to a specific service for BAME (Black, Asian and minority ethnic) healthcare staff who are at higher risk of becoming seriously ill from the coronavirus than their white colleagues. NHS workers can also access bereavement support and specific advice is available for parents and carers.

The centre's clinical lead Alan Barrett explains that demand for the service may increase as healthcare staff who were redeployed to work on COIVID-19 wards return to their usual positions.

"Often when people are in the middle of a crisis, they run on adrenaline," says Barrett. "People have a lot more time to reflect once they are away from the frontline and that's when they might start ruminating or having self-critical thoughts about their actions."

Tech improving patient care and easing NHS burden

Digital technology has been increasingly recognised as a potent weapon to wield against the coronavirus pandemic, as well as a significant influence in shaping the future of healthcare

Use of connected devices, cloud-based capabilities, data and remote monitoring has the ability to energise clinical care, improve patients' quality of life and generate economic value across the NHS.

ResMed, a pioneer in digital healthcare for people with obstructive sleep apnoea (OSA) and chronic obstructive pulmonary disease (COPD), is at the forefront of technology transforming care provision.

With a 31-year heritage of designing and manufacturing masks, devices and software to treat and care for patients with these debilitating conditions, ResMed has enabled clinicians to leverage data from its devices to enhance patient treatment and outcomes.

In 2014, the company recognised the transformative role of digitalisation in healthcare and innovated cloud-based solutions, facilitating streamlined and remote care alongside data analytics. Together, these inform optimal care pathways, identify necessary patient interventions and promote health-system improvements.

"The decision to enable all ResMed devices with connectivity was driven by our aim to help care providers and their patients address health issues more promptly and efficiently," says Antoine Valterio, UK and Ireland country manager for ResMed.

"The data provided through our devices and software programmes give clinicians and patients valuable insights, with our smart algorithms offering individualised coaching to patients via an online tool. This tool has been demonstrated to improve patient adherence to therapy and thus deliver better outcomes for the patient, the care provider and the health system."

Currently, more than 2.5 million OSA patients globally have signed up for the ResMed myAir programme to track their therapy and receive coaching and advice.

In addition to offering individualised care solutions, ResMed's connected products – devices, masks and ventilators – along with its cloud-based software and services, enable patients to be treated in their own homes or in out-of-hospital care settings. Clinicians and care providers can monitor and modify the therapy delivered to the patient without the need for in-person consultations.

"The result is that pressure on hospitals and healthcare professionals can be relieved, as they continue to effectively manage their patients' care," says Valterio. "Clinicians are then able to offer additional support to patients who may be struggling with their treatments and may need further intervention."

OSA and COPD continue to be rising healthcare burdens in the UK. The British Lung Foundation estimates that 1.5 million are living with OSA[1] while 1.2 million people are living with COPD in the UK, with the prevalence rising by 27 per cent in a decade.[2] The annual economic burden of COPD on the NHS is estimated at £1.9 billion[3], and respiratory disease is a prime target for transformation under the NHS *Long Term Plan*, the UK's blueprint to promote efficient and effective care.

Valterio says: "OSA and COPD, if untreated, are associated with a range of co-morbidities with serious consequences, such as cardiovascular disease and diabetes, so by monitoring and controlling these conditions we can minimise costs to healthcare systems."

Given the growing prevalence of these patient needs, ResMed has established telemonitoring for a significant number of OSA and COPD patients in the UK and Ireland. It is also engaged in clinical trials to demonstrate the benefits of its technology and how it can become part of the digital healthcare mainstream.

> **Pressure on hospitals and healthcare professionals can be relieved, while continuing to effectively manage their patients' care**

ResMed has been proactively working alongside the NHS to develop services to assist in care delivery and free up NHS capacity and has also had dedicated teams supporting NHS staff and patients during the coronavirus pandemic.

"We would like to highlight the efforts of the NHS in adopting new pathways and technologies during this period, demonstrating what can be achieved with digitalisation," says Valterio. This aligns with the NHS *Long Term Plan*.

Moving beyond the continued success and innovative work in the UK, ResMed is currently the custodian of over six billion sleep and respiratory therapy data points globally that can enable large-scale scientific analyses.

The impetus of its innovative platforms, which have helped more than 110 million people globally with OSA and COPD over the last year, is to maximise the full potential of data and inform groundbreaking care.

"The use of device-enabled data is vital to a robust, effective NHS, and medtech is a highly regulated industry governed by security protocols, which ensure the data is put to good use safely," says Valterio. "It offers both individualised solutions tailored to patient-specific needs and general, aggregated insights, which are harnessed and put back into the hands of clinicians to provide better outcomes to the care system as a whole.

"If we use our digital resources, we will enable those healthcare systems to perform optimally and sustainably by empowering patients and clinicians alike."

Through these innovations in OSA and COPD care, ResMed is committed to its journey towards improving 250 million lives in 2025.

1 https://www.blf.org.uk/support-for-you/obstructive-sleep-apnoea-osa/health-care-professionals/health-economics-report
2 https://statistics.blf.org.uk/copd
3 https://www.england.nhs.uk/ourwork/clinical-policy/respiratory-disease/

For more information please visit www.resmed.co.uk

ResMed

ResMed is committed to its journey towards improving

250m

lives in 2025

'Healthtech is an absolute essential'

Health technology is accelerating to meet the increasing demands of the UK's growing and ageing population.

New devices, artificial intelligence and integrated systems have enabled millions of patients to monitor and control their conditions away from hospital settings and have relieved pressure on the stretched NHS.

"Health technology is not a nice to have; it is an absolute essential and we can only see its influence increasing over the coming years," says Andrew Davies, digital health lead for the Association of British HealthTech Industries, which represents a sector that employs 127,400 people across 3,860 companies and generates a £24-billion annual turnover.

"Technology has been vital during the pandemic, helping treat people away from hospitals, and it is part of a really important shift in how we deal with long-term conditions as no one wants to see these patients revolving in and out of hospital.

"We can use data and integrated systems to empower the patient to understand what is going on, work with their clinical team and have better health prospects.

"ResMed is a really interesting example as it moved from manufacturing medical devices to being a data-driven company and that shows a lot of vision. It has the ability to intervene differently in their patients' lives by using technology to enable community and self-care to help keep people out of acute settings.

"This has been significant during the pandemic and fits with the long-term goal of doing more outside hospital. There are no downsides to this approach."

Davies predicts British healthtech companies will continue to drive innovation and a competitive market that will benefit patients and the NHS as it recalibrates how healthcare is delivered.

INEQUALITY

Why race is still a factor in antenatal care

Statistics show overwhelmingly that Black women are more likely to die during pregnancy than white women, and discrimination is often to blame for differences in treatment and support offered by healthcare professionals

Jose Luis Pelaez Inc/Getty Images

Annabel Sowemimo

The coronavirus pandemic has placed racial health inequalities under a sharp spotlight. A research team at University College London showed mortality is almost three times higher than expected among Black women, 2.4 times higher in Asian women and 1.6 times in white women. Yet racial disparities in healthcare are nothing new and nowhere are the differences more striking than in antenatal care.

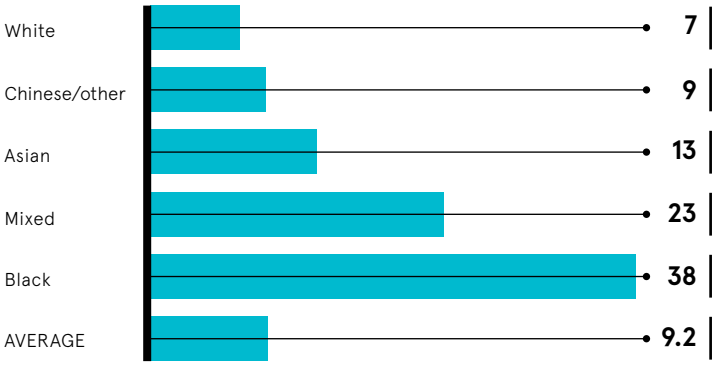
In November 2018, a report into maternal morbidity in the UK was released by researchers at Oxford University, citing that Black women are five times more likely to die in pregnancy, childbirth or in the postpartum period, compared with their white counterparts. Asian women were twice as likely to die compared to white women.

This staggering imbalance isn't exclusive to the UK. The maternal mortality is similarly high in the United States with Black and indigenous Americans being two to three times as likely to die of pregnancy-related causes, according to official figures.

While overall maternal mortality in the UK remains relatively small at 7 per 100,000, it is 38 per 100,000 for Black women, which is similar to that of Egypt, a country whose healthcare spending per capita is one seventh of the UK's.

INEQUALITIES IN MATERNAL MORTALITY

Proportion of UK women from the following ethnic groups who died during pregnancy or up to six weeks after childbirth or the end of pregnancy; deaths per 100,000 between 2015 and 2017



University of Oxford 2019

In March, Five x More, a community organisation, launched a government petition to raise awareness on the disparities in antenatal care and the postpartum period; currently the petition has more than 185,000 signatories and is awaiting parliamentary debate.

Racial disparities are likely to be multifactorial, perhaps due to a greater prevalence of conditions such as pre-eclampsia, obesity and high blood pressure among Black women.

However, healthcare providers must also acknowledge that the way care is delivered may unconsciously disadvantage some groups based on their ethnicity, socio-economic status or pre-existing health problems. So how far does racial discrimination impact patient care?

Dr Christine Ekechi, a London-based obstetrician and co-chair of the Royal College of Obstetricians and Gynaecologists' (RCOG) racial equality taskforce, describes how a conversation with a white colleague encouraged her to tackle the issue.

"My colleague looked at me and said, 'You know Christine, if any other person had a five-times greater risk of dying due to a condition, we would place a health warning on that condition, wouldn't we? So what are we going to do for Black women?'" says Ekechi, who is the RCOG's spokesperson on racial equality.

Since then, it has become Ekechi's mission to tackle racial disparities among patients and also the attainment gap among doctors working within obstetrics. She says that if we are going to address the health disparities in maternity care, we must start to look at how these inequalities exist across the entire reproductive cycle.

For example, research published by the American Public Health Association has found, compared with white women, Black women are more likely to undergo a hysterectomy and also receive diagnosis of gynaecological cancers at a much later stage.

She recalls an unfortunate incident when a Black woman had undergone surgery for a fibroid, a benign, muscular growth of the womb lining thought to be three to fives time more common in Black patients.

"She went home thinking she had a myomectomy [removal of a fibroid], was experiencing abdominal pain and was worried about a complication," says Ekechi. "Only for me to read her notes and realise they had opened her up and closed her again because they deemed the myomectomy too difficult. Which is clinically fine, yes, but obviously this had not been communicated to her at all."

> **We need to not be more likely to die, to not have as much postnatal depression, and to start having more positive experiences**

A midwife's story

Kyia Omoshebi trained as a midwife in Bristol where she wrote a dissertation on racial disparities in UK antenatal care after feeling many of her colleagues were disinterested in the issue.

The only student of colour in her cohort, she became dissatisfied with the response from white students of racial disparities evidenced in a report by Oxford University. "The fact that it really didn't stir any conversations and that group didn't even flinch at the statistics definitely left me feeling devastated and in tears," she says.

Omoshebi stresses that racial disparities in healthcare are often examined as a homogenous group, without looking at the needs of specific communities. For example, she feels stereotypes surrounding Black women are a contributing factor in why they may experience antenatal care differently.

"It's the projections that we put on women to be strong, not to be vulnerable and to be stoic and get on with it, that Black women experience a lot, which almost becomes a self-fulfilling prophecy; they have to be that strong as they don't have anyone else to lean on," she says.

While change will no doubt be difficult and there is much to do, Omoshebi feels that a strong focus on medical development, including anti-racism training, could greatly benefit her colleagues, of all races, in understanding the needs of marginalised groups.

Ekechi was left both upset and embarrassed by the experience, having to explain to the woman that she had not had the myomectomy that was necessary to improve her chances of conceiving. The campaigning obstetrician is emphatic that the patient was not given "the value she deserved" because of her skin colour; the patient was a well-educated, middle-class woman who would have understood if the information was relayed to her.

Four years ago, Sandra Igwe established the Motherhood Group, a social enterprise that delivers events and education to Black mothers, following her own difficult experiences of antenatal care and childbirth. She feels health professionals did not seem to know how to interact with her and believes Black women are often misjudged as having an "attitude".

"I was screaming in pain and I was being told by the midwife, 'Why are you screaming now? You are not supposed to be screaming now.' Apparently, I was only supposed to be screaming during the contractions, but I was in pain throughout and she didn't even check if I was OK," says Igwe.

A study published last year in *Obstetrics & Gynecology* revealed that non-white patients in the United States are less likely to receive pain relief despite experiencing more pain during delivery. In the first 24 hours after birth, white women were asked about their pain levels an average of 10.2 times, in comparison with 8.4 to 9.5 assessments for all other mothers.

While Igwe's husband was present, she feels it is often difficult for birthing partners to know how to navigate the medical system and advocate for their spouse. By starting the Black Mum's Support Fund, she is campaigning for greater access to birth advocates and better access to counselling for soon-to-be mothers.

Igwe also believes the poor experience of childbirth could have triggered her post-natal depression (PND). Research published by Springer has shown that being a mother from an ethnic minority background significantly increases the risk of developing PND. But there have been very few studies exploring the factors that contribute to poor mental health and even fewer studying the Black community in particular.

Her experiences meant she did not feel comfortable reaching out to medical professionals to access support and she continued to struggle with her mental health on her own. She believes that many other women may disengage from care due to negative encounters with professionals early on in pregnancy.

My Midwives Initiative was founded by Georgia Allan and Sheridan Thomas, independent midwives who have undergone additional training to become professional midwifery advocates to encourage reflective practice among midwives. Allan says: "To provide culturally safe care, we need to have an understanding of the lived experience of the people we care for and how this has impacted on a woman's maternity journey."

Despite the large gaps in care that remain, Igwe is optimistic the effects of racial discrimination within the healthcare system can be reduced. "We need to not be more likely to die, for us to not have as much post-natal depression, to bring that percentage down to as low as possible, and for us to start having more positive experiences with childbirth and encounters with healthcare professionals. For us to be able to really say we were not treated differently simply because of the colour of our skin," she concludes.

Protecting care homes from COVID-19

A pioneering digital solution helped mobilise 100,000 healthcare workers to fight the transmission of the coronavirus, signalling the dynamic potential of real-time data analytics to contribute to effective healthcare solutions

At the start of the coronavirus outbreak, health authorities in British Columbia, Canada moved swiftly to draw up legislation aimed at restricting the movement of long-term care home workers to a single site, to protect staff and vulnerable patients from infection.

To help frame the new laws, they tasked Appnovation, a global full-service digital consultancy, with mapping the existing movement of staff across care homes and how this needed to change, to minimise the risk of transmission.

Smart cloud computing architecture and real-time analytics designed by Appnovation mapped staff movements and deflected pinch points in rota systems as health officials battled to avoid virus transmission while ensuring safe staffing levels.

The agile digital solution used real-time data collection and analysis to make the best use of resources and maintain high levels of care.

The project helped to drastically reduce the virus spread across care homes, protecting residents and workers, including nurses, administrators and support staff, who have been among the most exposed and at-risk groups during the pandemic.

Georg Arthur Pflueger/Unsplash

"We were able to identify areas of staffing need ahead of problems arising so decision-makers could react quickly and be well resourced," says Andrew Dunbar, Appnovation's general manager, Europe, Middle East and Africa. "It illustrates the potential of using data and integrated systems in a healthcare setting."

Appnovation prides itself on collaborating with clients to achieve clear and measurable results. Its hallmark is identifying the core business need and then designing innovative, human-centred systems that deliver measurable change.

"We were founded on the promise of designing and developing digital solutions to help healthcare organisations and companies across a wide range of different sectors, accelerate progress and become more effective in improving people's lives," says Dunbar. "We believe in that promise. We want to build solutions that have a genuinely positive impact on the world."

Appnovation deployed cloud architecture and analysed encrypted staff data within days as it collaborated with the Canadian province's health departments. They devised a system that was easy for staff to use and quickly drove positive results across a challenging landscape.

"We bring a wealth of cross-industry experience that helps our healthcare partners make the most of technology," says Dunbar. "We are always looking for ways to drive value for organisations."

Appnovation, which has its European HQ in London, has also worked with Hammersmith and Fulham Council to develop an easy-to-use digital healthy lifestyle service, providing residents with personalised recommendations and free tools for managing their health.

"We have an ageing population that needs increasing levels of care from a system that's under pressure to deliver greater efficiencies. We need to ask what we can do with automation, machine learning and mobile devices to solve that," he says.

Appnovation has established trusted techniques to ensure its technology is designed to integrate with legacy systems, as well as multiple stakeholders, and can function across diverse settings such as schools, care homes, education institutions and prisons, which have multiple sites and workforces.

"We understand how people interact with technology and how to design systems that are intuitive and quick to use. They get the best from people and resources rather than adding extra bureaucracy," says Dunbar.

Appnovation has been asked to replicate its digital solution by other Canadian provinces and is exploring other routes to improve hospital and healthcare system performance over a range of staff and resource sectors.

Its systems and ethos are closely aligned with the growing demand for digital engagement from the public who are keen to use technology to drive improvements in their health, lifestyle and work experiences.

For more information please visit www.appnovation.com

appnovation
Inspiring Possibility

Fighting the transmission in British Columbia: the numbers

Appnovation's Digital Healthcare Solution collected staffing data in real time for over...

100k

healthcare workers working at...

1,200

facilities. It was up and running in...

5 days

Outcome: Post-launch, less than 1 per cent of care facilities reported a COVID-19 outbreak (late April to early May 2020)

TELEMEDICINE

Virtual healthcare comes of age

Telehealth and home-monitoring services have surged in popularity during the coronavirus outbreak, which could prove to be a turning point in adoption across the world

Lucrezia Lozza

After years of hype and promises to revolutionise healthcare, digital health solutions have finally entered the mainstream, but it took a pandemic to be the catalyst.

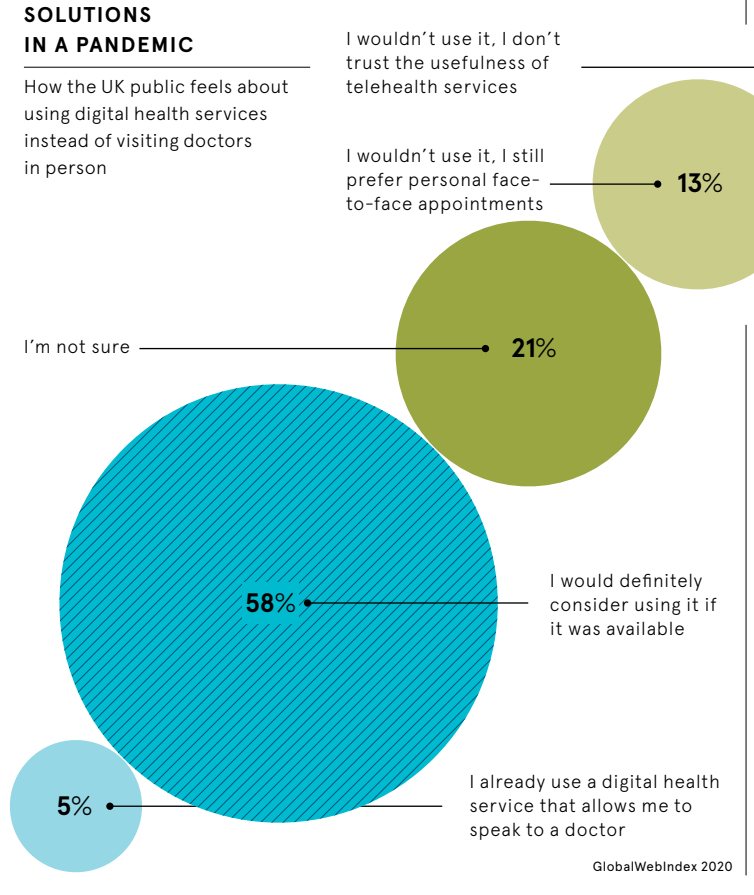
Telehealth or virtual healthcare, which can range from simple emails, texts or video chats with health professionals, to devices and apps that share patient data in real time with doctors and nurses, have surged in popularity over recent months.

Government-mandated lockdowns, social-distancing measures and fears of going to hospital or visiting doctors during the pandemic have prompted people to use telehealth solutions, both for minor ailments and more chronic conditions. According to the *STADA Health Report*, across Europe, those in favour of digital health solutions, such as consultations over webcam, rose from 54 per cent in 2019 to 70 per cent in 2020.

Meanwhile, in the United States, 57 per cent of healthcare providers now view telehealth more favourably than they did before the COVID-19 outbreak, according to McKinsey. In fact, the consulting firm estimates that, because of the acceleration of consumer and provider adoption of telehealth services beyond simply urgent care, the US virtual care market alone could be worth some $250 billion, compared to annual US telehealth revenues of $3 billion in 2019.

USING DIGITAL HEALTH SOLUTIONS IN A PANDEMIC

How the UK public feels about using digital health services instead of visiting doctors in person



GlobalWebIndex 2020

A few days into lockdown, Geneva-based medical appointment platform OneDoc launched a video telehealth service alongside its traditional booking platform as physical appointments started to decrease. Like many other healthcare professionals who have used the OneDoc platform, Dr Arabelle Rieder, a GP who specialises in addiction, was pleasantly surprised by the positive health outcomes that telemedicine has offered.

Virtual care, she says, is an excellent method for follow-ups, examination assessments or triage for minor conditions, especially for those living in isolated locations. She also explains how useful it is to carry out check-ups on patients with chronic diseases or addiction, and avoid any unnecessary physical contact. "When the diagnosis wasn't clear, and I needed more information, they would come to the practice," she adds.

Digital health solutions can also dramatically improve care and support for patients with mental health conditions. For them, the continuity of the treatment amid such a disruptive period is vital.

In Italy, Centro Medico Santagostino, a healthcare network of specialist clinics with more than 1,000 doctors working across various specialisations, has transferred


Geber86/Getty Images

90 per cent of its psychotherapy online since the pandemic hit. "Despite some initial scepticism from therapists, 50 per cent of patients don't want to go back to face-to-face appointments," says Andrea Porcu, managing director of the network.

Telehealth could also be an asset for chronic diseases and geriatric healthcare, as well as facilitating check-ups for people with mobility issues.

At the San Giovanni hospital in Rome, daily care continues even after patients are discharged. The hospital gives each patient a briefcase containing a smartphone, an ECG device and a glucometer, that is able to communicate with hospital staff, and doctors can check the wellbeing of the patient in real time and act in a timely manner.

"Telemedicine has already been proven effective in chronic disease management, in many cases showing improvements when compared with standard care," says Dr Carmelo Velardo, senior researcher in digital health at the University of Oxford's Institute of Biomedical Engineering.

A randomised controlled trial conducted by Oxford University compared the efficacy of a mobile phone-based blood glucose management system with standard clinical care in women with gestational diabetes, a type of diabetes that can occur during pregnancy. Through the system, midwives could provide almost real-time feedback by way of drug adjustments and advice on lifestyle changes.

The study found that the intervention group, who had more frequent blood glucose monitoring, had fewer C-sections and lower rates of preterm birth. "These have proved extremely effective in lowering several potential complications that may present later during the pregnancy and that might have potential long-term effects on the health of women and their babies," says Velardo, who worked on the study. "By providing a longitudinal and comprehensive set of data, those patients could see greater benefits when the data is used to personalise disease management and treatment."

Engagement and empowerment of patients are also key factors in the success and adoption of telehealth services. In the Oxford University study, for example, the intervention group reported a higher satisfaction of care throughout their pregnancies.

Meanwhile, when Ines Iacovella had a minor health issue during the pandemic, she picked up her smartphone and started a video call with her doctor. Immediately after the doctor confirmed her diagnosis, the prescription was ready at the local pharmacy.

"During lockdown, when going by train to the city was impossible, telemedicine greatly helped me," says Iacovella, who lives in a remote Italian village. "Telemedicine is a game-changer when office hours don't match with the doctor's opening times or when you need advice on laboratory exam results."

In Switzerland, Basel-based Medgate, the largest telemedicine centre in Europe run by doctors, has been providing telehealth services since 2000, but now runs video appointments with doctors via the Medgate mobile app. During the peak of the lockdown, the company experienced a 20 per cent increase in its services.

But telehealth adoption is highly dependent on different countries' regulatory frameworks. In Switzerland's case, healthcare is provided through mandatory private health insurance, whereby citizens can choose between a traditional GP or telehealth solutions. But other countries still have a long way to go.

> **Despite some initial scepticism, 50 per cent of patients don't want to go back to face-to-face appointments**

"Even today, only a handful of countries in Europe have well-determined regulation for telehealth visits and include them in public reimbursement schemes," says Maria Shivkova, consultant at Research2Guidance, a digital health market analyst company.

Data privacy is also a major challenge when it comes to public buy-in of telehealth services, with patients keen to know that their video chats and clinical information are safely stored. A 2018 survey by Deloitte found that one third of US physicians cited data security as a top challenge of using virtual care technologies.

OneDoc, for example, doesn't use public technologies to communicate with patients, but relies on its own encrypted video services built in-house. "Suffering a data breach would be detrimental for our company," says OneDoc founder Arthur Germain.

Yet, with a more regulated market, fears of digitalisation are dissipating, says Oxford's Velardo. "It is important to establish a culture of care for the data that the company handles and an attention to adherence to already existing guidelines and laws," he says.

Age has been a major factor inhibiting the overall growth of virtual care up until now, with older generations hesitant about using mobile devices to access their GP. But in Switzerland, where telehealth has been an integral part of the healthcare system for many years, there are few demographic differences. Medgate, for example, has patients of all ages with varied conditions and some telehealth solutions are even built specifically for geriatric patients.

"It is, however, important we don't forget that designing principles will certainly differ for two generations," says Velardo. "So an older group will require attention to details and a design approach different from that used to reach the large portion of users of new technologies."

Although telehealth could never be a substitute for traditional medicine, it can be an additional tool to aid the productivity and efficiency of doctors, and help patients receive more consistent treatment, especially during a pandemic when physical contact must be kept to a minimum and social distancing maintained, for the time being at least.

Unsung heroes of the pandemic kept drug supplies flowing

Generic medicines are a powerhouse in the coronavirus pandemic and have the ability to transform healthcare to meet future challenges

The generic medicine sector, which supplies around 80 per cent of all medicines to the NHS, was instrumental in supporting the nation's hospitals as they battled the surge of coronavirus cases.

"The heroes of coronavirus have been the clinicians, care workers and support staff who have worked tirelessly, but I believe we have played a vital role in ensuring they have the tools to do their job," says Dr James Burt, executive vice president, Europe, Middle East and North Africa, of Accord Healthcare, the UK's largest supplier of generic medicines by volume to the NHS.

"I am proud of our industry and how hard everybody worked, and how dedicated they were under extremely difficult circumstances."

Accord, which has invested more than £150 million in skilled staffing of production lines and equipping state-of-the-art facilities in the UK since 2017, stands at the fulcrum of clinical delivery with its role of manufacturing affordable drugs and connecting hospitals, pharmacists, wholesalers and other frontline healthcare providers.

In a world often fixated by high-profile, high-cost drugs, the average cost of a month's supply from Accord is less than the price of a cup of coffee.

Around one in five generic prescriptions in the UK is filled with an Accord product and the company also has one of the most dynamic pipelines in the pharmaceutical industry with a portfolio of 200 molecules across therapeutic areas.

"Accord was established to provide improved access to high-quality, affordable medicine. It is in our DNA," says Burt, who has helped drive the company's market presence with a sustained growth, compound annualised, of more than 45 per cent in each of its first eight years. "We are constantly looking to innovate and provide added value to stimulate the next generation of healthcare."

The task is immense. Accord has to source, manufacture, deliver and develop new medicines and devices against a landscape of growing demand, but constrained national finances. It also has to navigate the rapids of complex and often politically charged medicines pricing.

"Over the last decade, we've been investigating novel products across a spectrum of innovation from reformulating well-known agents and improving safety features to creating novel chemical entities," says Burt.

"We have exciting new products coming through in oncology, treating autoimmune conditions and addressing central nervous system issues such as addiction. In everything we do, we are keen to look for ways to do it better and improve medicines that we provide, whether it be through finding a better way of administrating the medicine or a therapeutic use, which ultimately benefits patients."

The role of the generic medicines sector can be under-appreciated, but its performance during the pandemic illustrates its importance and ability to respond to a series of challenges that threatened to derail healthcare provision.

Accord started gearing up for the coronavirus onslaught when its European delivery hubs were challenged by the initial rise of COVID-19 cases in Italy during late-February. Its strong clinical team, led by former senior NHS figures, realised that a secure supply of a cocktail of drugs would be vital to treat patients needing mechanical ventilation.

"We started to create our own pandemic modelling in March to get a handle on the different medicines that would be needed, creating bespoke supply lines to ensure vital medicines were where they needed to be and matched the most urgent need," says Burt.

"Working with Medicines for Europe and key players within the industry, we tasked consultancy firm A.T. Kearney to model volume outputs and identify potential stresses and strains across different countries, which was really effective.

"Getting that right meant hospitals did not run out of critical supplies during the first wave of the pandemic. The strain on hospitals and supply chains was incredible, but it was a very agile system and it almost certainly helped save lives as a result."

Accord also moved swiftly to deal with a bottleneck emerging in intensive care units (ICUs), where nurses or pharmacists were reconstituting medicines from vials or ampules for the most severely ill patients.

"COVID-19 patients on mechanical ventilation needed huge doses of a cocktail of drugs to keep them in induced comas so they had six pumps going continuously and nurses spending large amounts of time making up syringes," says Burt.

"Again, we had to be really agile here; we re-pivoted our production, in a very short period, to prioritise any of these agents that we could make which were a priority for ICUs and acting on the moral rather than commercial imperative.

"We were having to react on a day-to-day basis to massive demands for ICU medicines and it was a hard few months with people working round the clock. We had the logistics of lockdown to deal with, but managed record outputs thanks to the efforts of our people and new recruitment to cope with demand.

"Looking back, we achieved an amazing amount and should be proud of the performance of the generics industry and all its staff."

This agile approach displays the type of innovation that is the essence of Accord. The company, part of the

ACCORD INVESTING IN UK MANUFACTURING TO IMPROVE PATIENT HEALTH

1 in 5

approximate number of all generic medicines supplied to the NHS from Accord

6 billion

amount of doses produced each year by Accord, an average of four packs per person (across whole population)

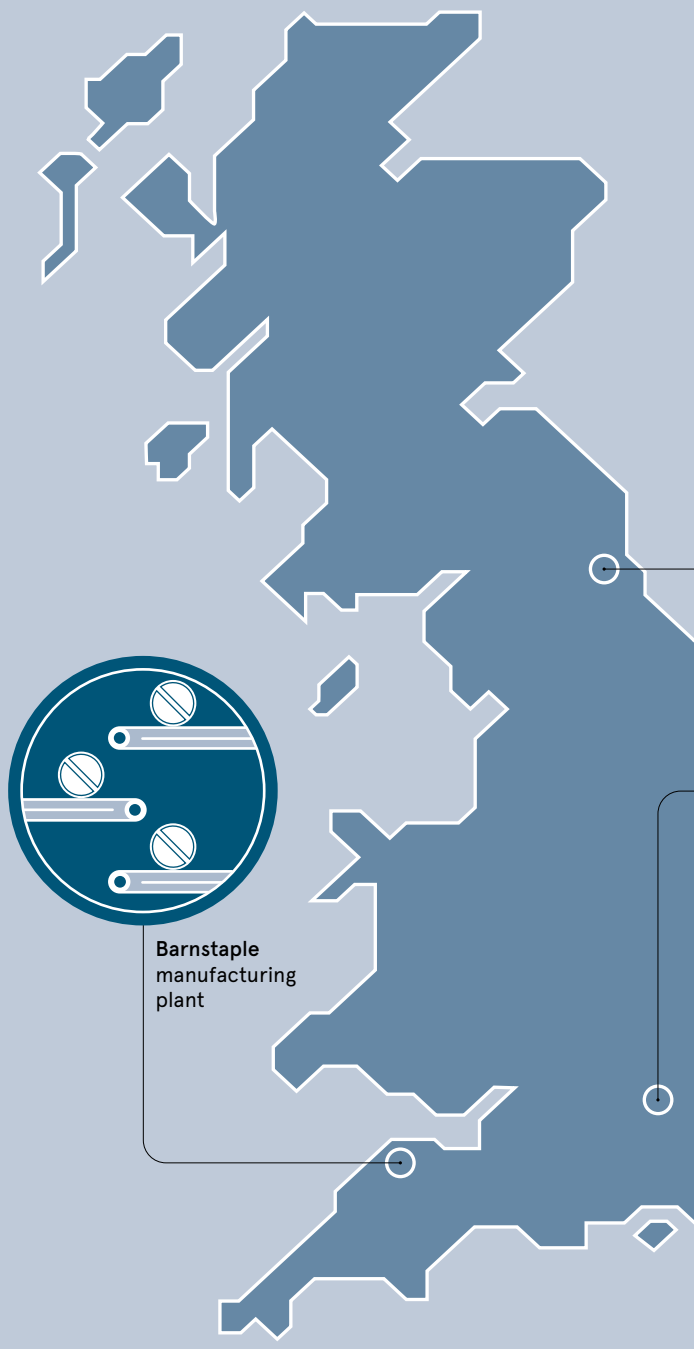
£1.30

approximate average cost of a 28-day supply of medicines supplied by Accord to the NHS, saving the NHS £2-3 billion per year

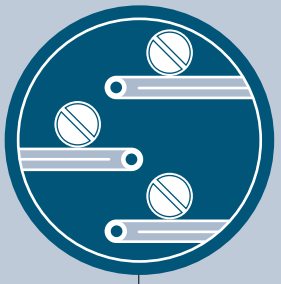
>85%

access provided by Accord to medicines used in some of the UK's more prevalent cancers

FOUR KEY ACCORD SITES ACROSS THE UK



> **We have a range of innovative products and have flexibility in our systems, so if there is another pandemic, there is added resilience in the UK medicines market**



Fawdon
manufacturing plant

ACCORD'S LEVEL OF INVESTMENT IN THE UK

>$1bn
invested into the UK since 2017

>£150m
invested into skilled staffing of production lines and equipping state-of-the-art facilities in the UK since 2017

1,200
people employed in the UK and added over 100 jobs during the COVID-19 pandemic

Didcot
Largest manufacturer-owned storage facility in the UK

Harrow
Test and release laboratory

Accord Didcot – largest manufacturer-owned storage facility in the UK

Pricing break-out

Intas Group, has grown its UK operation from less than 50 staff in 2010 to more than 1,200 across its sites at Barnstaple in Devon), Didcot in Oxfordshire and Fawdon in Tyne and Wear, an empty 22-acre site that has been regenerated over the last two years, as well as its headquarters and laboratories based at Harrow, Middlesex. It has established a strong base for export to Europe and continued to grow, employing an additional 600 staff across the region.

Accord's core products of injectables and medicines are bolstered by its novel pipeline with several products in phase-III trials and its fast-paced growth puts it on target to reach the goal of becoming a top-five pan-European generics and biosimilars company by 2021.

"We have quality systems and quality staff and there is huge potential to bring medicines to patients at affordable prices, but there is a critical need to recognise this is a business that invests and innovates and is not simply a vehicle for low costs," says Burt. "The value of our innovation needs to be recognised and supported with fair reimbursement.

"We have a range of innovative products and have flexibility in our systems, so if there is another pandemic, there is added resilience in the UK medicines market.

"Accord has invested heavily in the UK and we believe our new products will make a significant difference to patients, many with unmet needs, and our continuing growth strengthens the ability of the NHS to treat people and meet future healthcare challenges."

For more information please visit accord-healthcare.com

accord

Generic and biosimilar medicines save the NHS more than £13 billion a year along and generate improvements across the healthcare range, such as the packaging and delivery of medicines to the patient.

But its core attribute of providing value at the heart of healthcare is being threatened by a push to squeeze prices down as the world wrestles with increased demands from ageing populations living with multiple conditions.

Accord Healthcare, one of the UK's biggest generic medicines suppliers, believes that innovation needs to be valued and protected so that the sector can continue to play an influential role in the health of the nation.

"The race to the lowest possible price is one of the biggest challenges we face," says Dr James Burt, Accord's Executive Vice-President EMENA. "We are all here to get medicines to patients in the most affordable way, but it is a false economy to believe that the generic sector can be continually squeezed.

"Taking that approach creates behaviours that are not compatible with a safe and progressive health system. It can degrade safety features in packaging and encourage the aggregation of supply chains in pursuit of economies of scale. It also impacts our ability to research and develop products to improve patients' lives."

Buyers, such as healthcare systems and wholesalers, are exploiting competition among generic companies to derive discounts and drive down drug prices, which could cause supply chain frailties leading to disruptions and shortages and, ultimately, reducing investment in the sector.

A study by the British Generic Medicines Association (BGMA) estimates that generic versions of patent expired drugs are 89 per cent cheaper than the branded originators but warns that increasing downward pressure could jeopardise future efficiencies and treatment options.

"A race to the bottom and focusing solely on price is unhealthy for everyone – the NHS, patients, the government and the generics industry," adds Dr Burt. "There is a greater understanding in the hospital setting that there needs to be some weighting on non-price attributes here and that the approach should be about the best value, not the lowest cost.

> **The race to the lowest possible price is one of the biggest challenges we face**

"There is a push for more green procurement linked to environmental impact and reducing carbon footprints but that will be hampered if prices are forced down.

"It actually removes resilience from the system and we have seen in the pandemic how damaging this can be and how it is not advisable to have something like 70 per cent of the world's Active Pharmaceutical Ingredients (API) coming from one place."

The sustainability of healthcare systems is a global challenge and cost containment is seen as a potent weapon. But Medicines for Europe, the representative body of the generics and biosimilars industry, believes that this approach undermines dynamic multi-source competition and encourages stagnant monopolies to flourish. It advocates a range of measures to protect innovation, including the most economically advantageous tender (MEAT), a European Union directive that recognises that tenders should be valued on more than price alone.

"The focus should not only be on the lowest price of the medicine, but a holistic view should be adopted and additional relevant criteria considered that do not undermine access to generic, biosimilar and value added medicines," it stated in a position paper. "These criteria should ensure the best value for money for the benefit of patients and healthcare systems."

Dr Burt adds: "Our strategy is to ensure that more patients get access to high quality affordable medicine with all the benefits that this brings to individuals, families and society.

"Better access to better medicine has been a significant driver of a near doubling of life expectancy in the last 150 years. The generic industry has played a very critical role in facilitating this access and its performance and potential should be recognised and celebrated."

UNDER PRESSURE

Making the case for virtual appointments

When the pandemic hit, many people felt uncomfortable with attending a doctor's appointment in person. Now, the huge success of virtual appointments may mean that it is here to stay.

GENERAL PRACTICE PRESSURES

1 in 5 GPs are approaching retirement

Royal College of General Practitioners 2020

28.3k

full-time GPs in the UK as of December 2019, down 1 per cent from the end of 2018 and 3 per cent lower than the end of 2017

BMA 2020

1.3k

drop in the number of GP practices across England between July 2013 and July 2020

NHS Digital 2020

1 in 20 appointments were recorded as `did not attend' in 2019

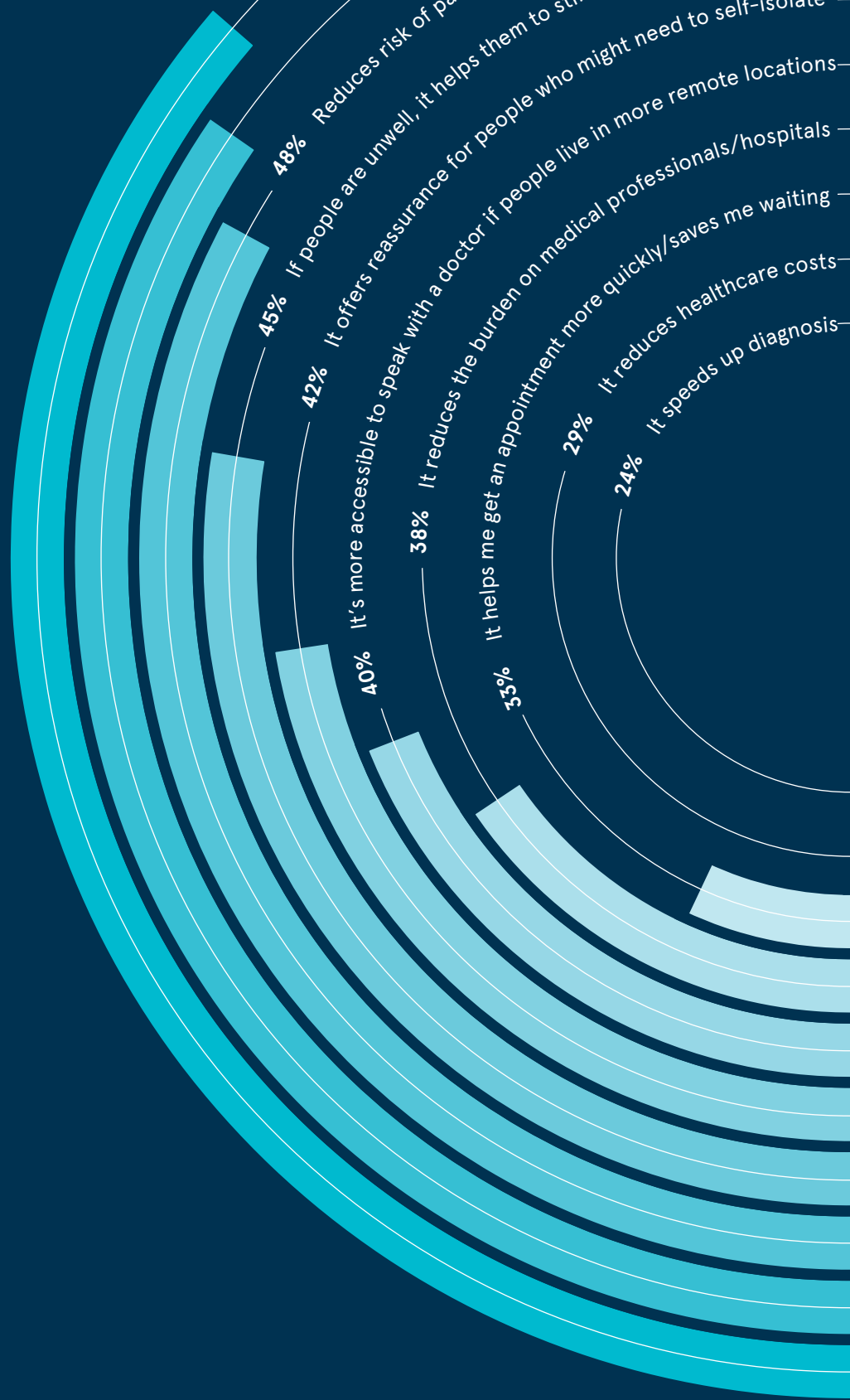
NHS Digital 2020

88% of GPs say they would like greater use of remote consultations in the future

BMA 2020

BENEFITS OF DIGITAL HEALTH APPOINTMENTS IN COVID ERA

Survey of UK adults who currently use/would consider using digital health appointments



60%

of UK and US consumers are either already using a digital health service or would consider using it in the future, if it was available

Global Web Index 2020

GlobalWebIndex 2020

SOCIAL DISTANCING

71% of routine GP consultations were delivered remotely in the four weeks to April 12, compared with 25 per cent the year before

Royal College of General Practitioners 2020

41.5 average number of patient contacts that UK GPs have every day – 60 per cent more than the number that's considered safe by European GPs

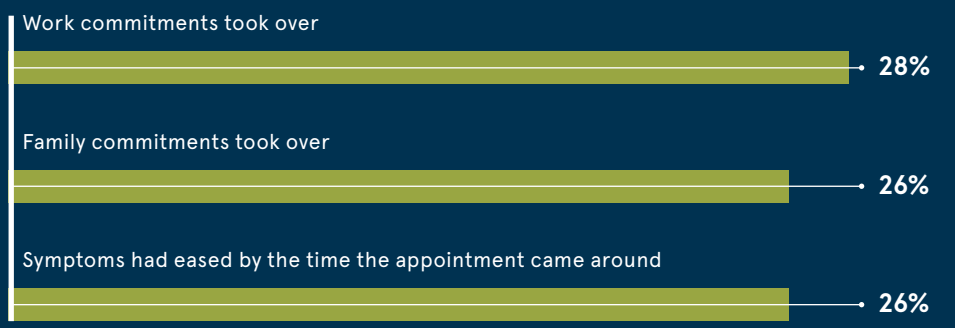
Pulse 2018

61% of UK adults believe digital health appointments would be effective in helping to manage the spread of coronavirus

GlobalWebIndex 2020

FITTING AROUND BUSY SCHEDULES

Most common reasons for skipped/cancelled appointments



AXA PPP 2020

SAVINGS FOR UK BUSINESSES

£74.8m potential annual savings in patient travel costs from virtual appointments, based on an average travel cost of £1.42 to each consultation

44mins estimated working time could be saved for each appointment if patients had online GP consultations

£1.5bn could be saved by UK businesses by eliminating the travel time required to attend GP appointments

Centre for Economics and Business Research 2020

May 2020: a day before the new Nightingale North East hospital opened in Sunderland, in response to the coronavirus pandemic

NHS

Experts hopeful transformation spirit will stick

The NHS adapted to the coronavirus outbreak at a rate previously considered impossible, but can this culture of rapid transformation last long term as normal service resumes?

Martin Barrow

A lasting memory of the coronavirus pandemic will be the weekly applause of families standing at their front door to show appreciation of the NHS during lockdown. Our love affair with the health service has never been stronger. But can the NHS achieve the digital transformation it needs to deliver excellent care and retain public support?

Even the NHS's most committed supporters were probably surprised by the speed at which it was able to transform itself to be ready for the first wave of coronavirus. New Nightingale hospitals were built in days and many existing NHS hospitals were completely reconfigured.

Change that might previously have taken several years in the health services was implemented at speed and without resistance. This was a major factor in ensuring hospitals were not overwhelmed by the virus and that many lives were saved.

For example, at Barking, Havering and Redbridge University Hospitals NHS Trust in Essex, 20 wards were transformed to care for COVID-19 patients, with a five-fold increase in critical-care capacity. Almost 6,000 patient appointments were held over the phone in April alone, reducing the need for people to come to hospital. Tony Chambers, chief executive, described it as "an incredible transformation".

Similar stories are told of hospitals around the country. But as the UK begins to adjust for life after the pandemic, will this spirit of transformation survive beyond COVID-19? Chris Hopson, chief executive of NHS Providers, believes it will. "Hospital trust leaders feel they've been given permission to get on with things in a way they haven't been before," he says.

There is widespread agreement that change is overdue in health and social care. The challenge is to find consensus for what NHS England should look like in ten or twenty years and how it should be paid for. Should change be mandated from the top and driven by the Westminster government or should local NHS leaders be empowered to create systems tailored to their own communities? One thing seems certain: privatisation is off the agenda, for the time being at least.

Beyond the NHS organisational structure, digital transformation holds the key to a sustainable, publicly-funded health service. Slow adoption of digital technologies has been a major obstacle in the delivery of NHS long-term plans. Some of this is down to funding priorities. But there are also structural and cultural barriers in an organisation that still had more than 8,000 fax machines in 2019 and has only recently banned them.

Digital transformation has long been seen as critical in GP practices, which have struggled to cope with increased demand for services. But persuading patients, and some doctors, to use online consultations has been a major challenge. During COVID-19, almost all GP appointments have taken place online or by phone.

Health and social care secretary Matt Hancock has suggested that in the long term more than half of GP consultations could take place remotely. Yet NHS Digital's own research shows that patients still overwhelmingly prefer face-to-face consultation and would like to return to old ways after the pandemic.

Amid concern that it could take four years for waiting lists to return to normal, NHS trusts have become emboldened to put forward ambitious plans for change which would have been unthinkable just a few months ago.

Take the NHS in London, for example. After years of much discussion about change, but relatively little action, health chiefs in the capital are now planning to shift fundamentally the way healthcare is delivered in the wake of COVID-19. "It is critical that London enables a continuation of the culture of pace," says Sir David Sloman, NHS regional director for London. "This means accepting a different kind of risk appetite than the one we are used to."

The plan includes a new NHS organisational structure in London, with greater integration of health services, a permanent increase in critical capacity and remote delivery of more services. This is likely to be done at speed, with a new system in place from November 2021. To achieve this requires a level of digital maturity not often associated with an NHS organisation.

The government is also looking at ways to ensure the appetite for change and reform in the NHS is not lost and in so doing making sure it has greater control over additional billions of pounds of funding it has promised to the health service.

> **"Hospital trust leaders feel they've been given permission to get on with things in a way they haven't been before**

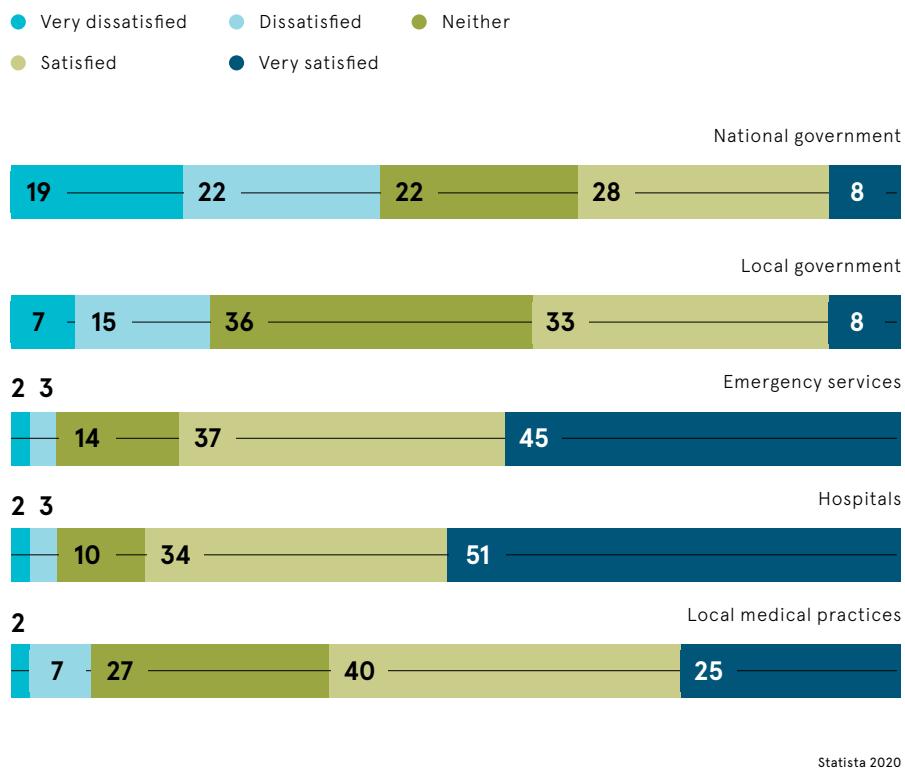
This includes a plan to beef up what are known as integrated care systems (ICSs), informal groupings of NHS trusts, providing acute, community, mental health, specialist and ambulance services. They could be given formal legal status and put in charge of budgets with billions of pounds. The ambition is ICSs would tackle workforce, financial and waiting-time problems at a regional level, rather than leaving individual trusts to each do their own thing.

Of course, change will come at a cost. In the short term, NHS England will continue to draw on the chancellor's blank cheque. The NHS cannot be caught out by a second wave of COVID-19 and there is also great pressure to alleviate waiting lists, particularly around cancer care, while maintaining infection controls. For the same reason, the NHS is redoubling efforts to move care out of hospitals and into the community, something that has been promised for many years.

But in the longer term, NHS England will need to demonstrate change brings real financial benefits to the taxpayer, as well as improving patient care, and this cannot happen without digital transformation.

PUBLIC SATISFACTION WITH THE RESPONSE TO THE PANDEMIC

How satisfied/dissatisfied UK adults were with the following at the end of May



Statista 2020

How digital is reshaping your doctor's world

As the coronavirus distances doctors from their patients, not to mention crucial clinical updates, support and collaboration, a digital platform offers a lifeline

The role of a doctor is ever changing. For centuries, they have sought to continually expand their understanding of the traumas and diseases that affect the human condition, so they can respond effectively and think more critically to deliver the best patient outcomes. The methods they use to do this are also evolving, a fact that has been brought sharply into focus by the coronavirus pandemic.

Like patients, doctors had begun to embrace the advantages and convenience of digital and online platforms to access the latest medical updates and advances in both general health and their own specialties. Also crowdsourcing information from colleagues in the medical community, both nationally and globally, to advance their own knowledge and using telemedicine to provide patients with the opportunity for virtual surgery visits.

Then, in March, as the world retreated behind a collective closed door as the pandemic spread, doctors began to increasingly rely on these digital tools to engage with the medical community and communicate with their patients.

As COVID-19's grip tightened, specialists and GPs lost their primary channels for information, as medical congresses, regional symposia and even visits from pharmaceutical representatives with information about new treatments were no longer viable. Surgeries throughout the UK shuttered, with care being shifted to virtual platforms and online doctor consultation services and all but emergency care sidelined.

As the leading platform in Europe for clinical news, health information and point-of-care tools for doctors, Medscape saw the momentum for digital transformation increase during the outbreak. Specialists and GPs moved quickly to respond, ensuring patients could continue to receive necessary care while, importantly, offering reassurance they were available virtually; all while confronting a novel disease that was highly transmissible and lethal.

According to research from Medscape, 62 per cent of UK doctors treated patients with COVID-19 and 34 per cent knew of colleagues who contracted COVID-19 while working. Medscape heard from these doctors and responded with news about shortages of personal protective equipment and calls for more testing for healthcare workers, while giving them tools to connect with colleagues around the world, who were facing similar risks, challenges and fears.

Pre-pandemic, medical conferences and large congresses were crucial in the dissemination of knowledge throughout the medical community and one of the key ways doctors stayed up to date with new clinical data, which could enhance their practice and help improve patient care.

Research has revealed that three quarters of doctors believe real-time information from conferences, whether COVID-related or otherwise, is extremely important, particularly considering the rapidly evolving medical landscape in 2020.

Doctors shift to digital

Just as digital platforms enabled the public to stay connected with family, friends and work colleagues, so they also allowed doctors to continue to practice at a time when COVID-19 was emerging as a global threat, with broad implications for patient care.

Medscape medical news, reports and features kept doctors updated on breaking medical news, while patient simulation and continuing medical education provided e-learning for new clinical and treatment information, not only on COVID-19 but also on cancer, heart disease, diabetes and other clinical issues that were not disappearing.

And at a time when in-person conferences weren't possible, Medscape Consult, a crowdsourcing platform, gave doctors a lifeline, enabling them to access hundreds of insights and answers from colleagues around the globe. As the pandemic has continued, Medscape Consult has established a crucial channel of communication for doctors, who need community and connection more than ever, and will continue to when the pandemic has passed.

Doctors and patients post-pandemic

According to research by Medscape, almost one third of patients have used telemedicine since the start of the pandemic and more than half say they plan to continue doing so as society adjusts to living with the disease. This means that on the other end of the line there needs to be doctors who are willing to connect and change the way they work to embrace a spectrum of digital channels. Doctors also anticipate they will adjust how they gain information.

Practices up and down the country are taking great care to help patients feel safe to come back and see their GP, while at the same time continuing to offer telemedicine. But underpinning both settings is the need for learning and the latest information and research. However, COVID-19 has cut doctors off from some of the more traditional ways they receive this knowledge.

"Medscape is continuing to cover all the major congresses, which are now releasing data virtually. Physicians are still coming to us to learn about the latest data in their particular specialty areas," says Jeremy Schneider, group general manager of WebMD and Medscape Global.

"It's pretty powerful for a physician in London to be able to look at a video from a physician who dealt with the exact same thing in China months earlier. This is not something that would have happened before sites like Medscape."

Such innovation continues as we emerge from global lockdown and Medscape works with the top infectious disease doctors who are writing articles and blogging on the Medscape platform to give a real-time overview of their local situation, so other specialists around the world can learn from their experiences.

All these digital resources combine to deliver something that traditionally has been in short supply for GPs and hospital doctors: time. By relying more on online resources, healthcare professionals can structure their day more efficiently and make the most of their working hours. In this way, Medscape is providing a more efficient way to get the right information to the right people, so doctors gain knowledge and insight quicker and patients obtain the healthcare that they need.

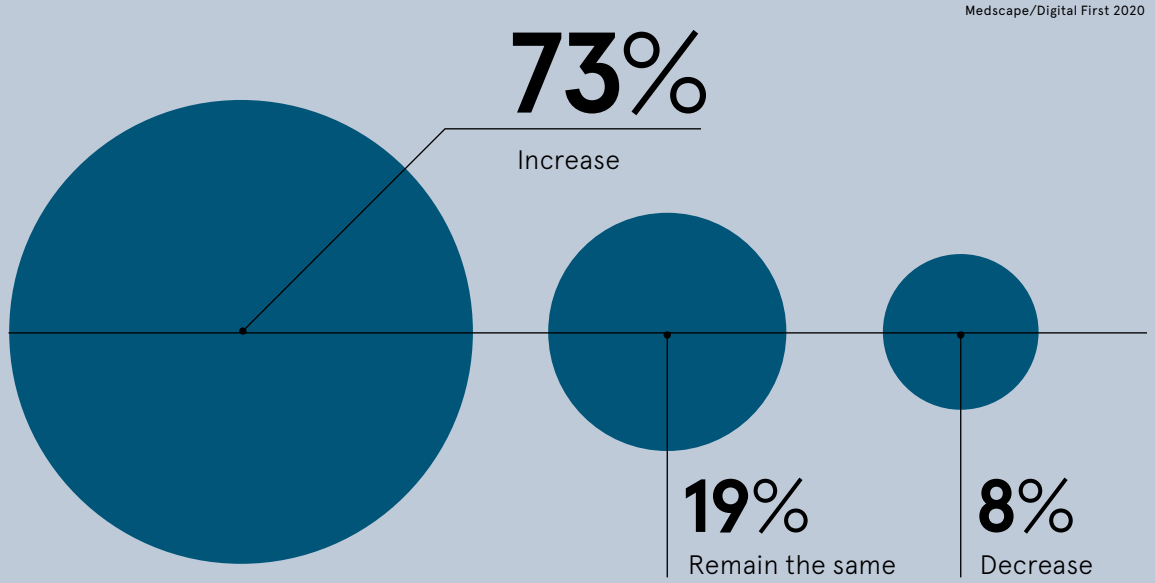
The question that remains is if it's also possible for doctors to gain access to the knowledge they so badly need, how will they seek to relay it to patients as 2020 unfolds? Interestingly, it looks like this will come from a mixture of both telemedicine and the more traditional settings patients and doctors are used to.

What hasn't changed throughout all this are those same doctors' needs for an up-to-date and trustworthy information source, which they can rely upon to put them in the best possible position to offer advice and treatment, whether digitally on a Zoom call or mask-to-mask in the surgery.

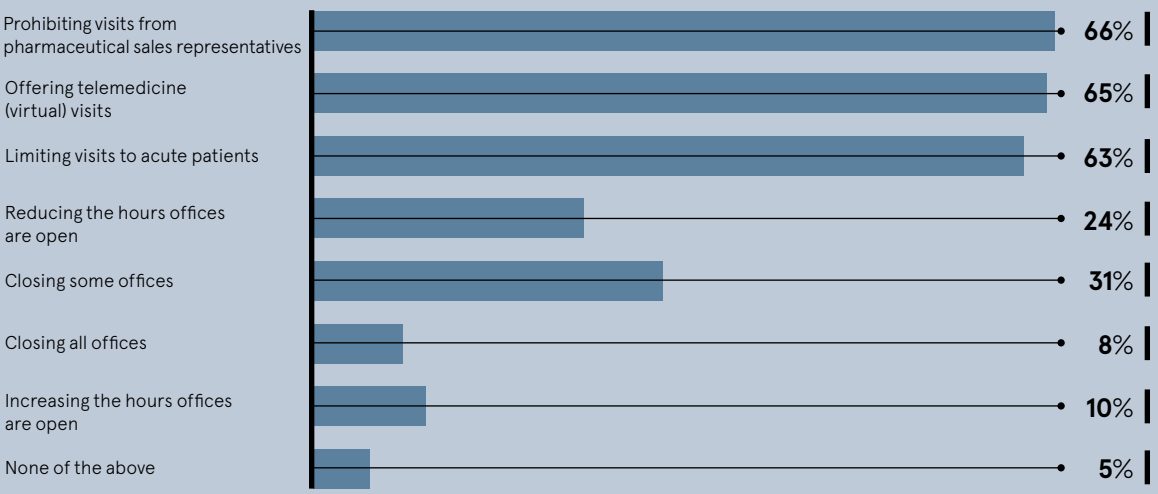
> **It's pretty powerful for a physician in London to be able to look at a video from a physician who dealt with the exact same thing in China months earlier**

COVID-19 IMPACT:
UK DOCTORS' PLANS TO ATTEND VIRTUAL MEDICAL CONFERENCES

Medscape/Digital First 2020



HOW UK DOCTORS ARE MANAGING THEIR PRACTICE IN RESPONSE TO COVID-19



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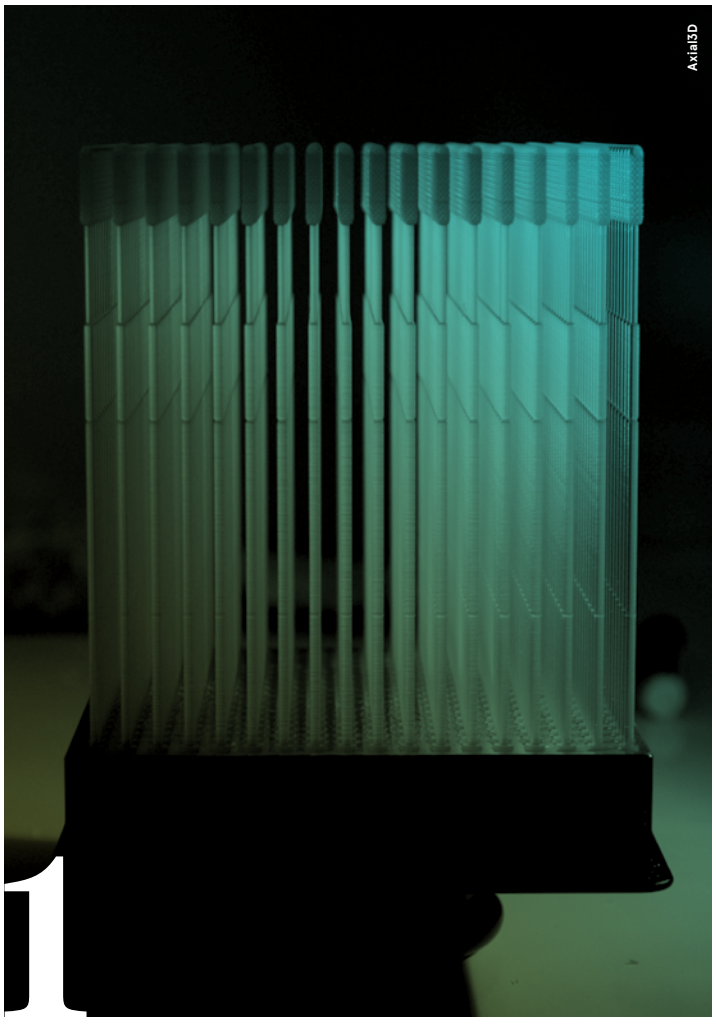
TECHNOLOGY

Ten innovations in the fight against COVID-19

Around the world, organisations are deploying tried-and-tested technologies and developing new ones to accelerate healthcare innovation and fight the coronavirus. From revolutionary CRISPR techniques to 3D printing of personal protective equipment, here are ten of the most exciting examples

Rachel Jones



Over-the-counter COVID-19 tests

CRISPR, the new class of molecular tools, is being used in multiple ways as a prophylactic strategy and to increase vaccine yields, for example. CRISPR-based platforms are also being employed to develop diagnostic tests as a scalable means to address disease detection, since the standard technique, RT-PCR, is too limited to offer the mass testing epidemiologists say is needed.

US-based Mammoth Biosciences, co-founded by CRISPR pioneer Dr Jennifer Doudna, is now collaborating with GSK with the aim to deliver "extremely accurate and robust tests in a rapid format" by early next year. "People think of CRISPR as an editing tool, but we think of it as a search engine for biology," says Mammoth co-founder and chief executive Dr Trevor Martin.

The test, which could provide results in 20 minutes from a nasal swab, uses guide RNA and a programmed sequence specific to SARS-CoV-2, the current strain of coronavirus, with viral evidence triggering a "molecular shredder" that creates a release of colour to display a read-out. "CRISPR diagnostics can have a large impact in this space," says Martin, "particularly in a pandemic."

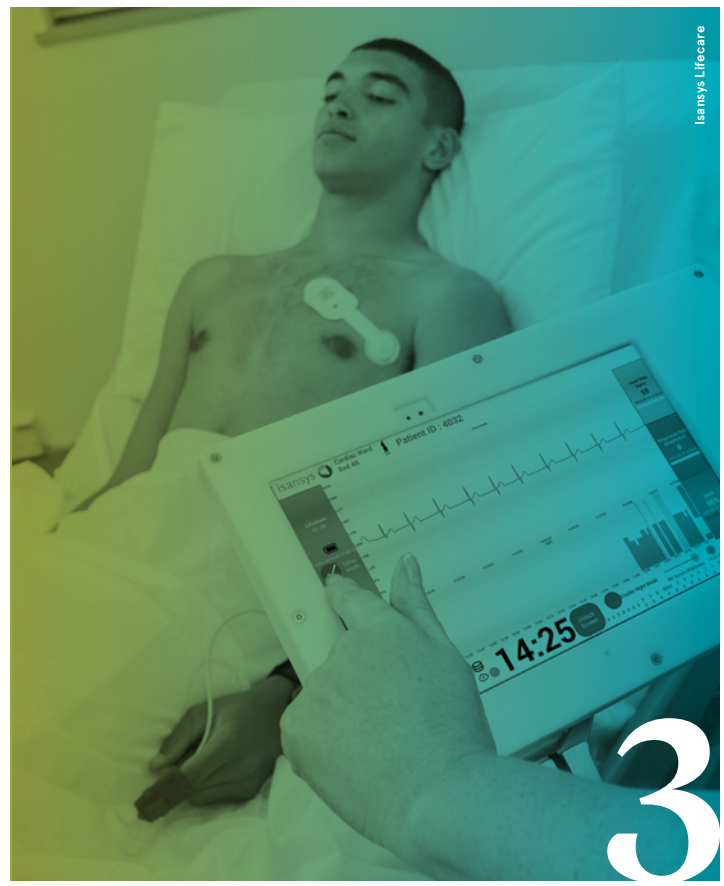
3D-printed swabs designed with AI

Belfast-based Axial3D, an artificial intelligence software company specialising in medical 3D printing to create anatomical models, has deployed its 3D capability in new ways to print face shields, ventilator parts and nasopharyngeal swabs for testing.

Following clinical trials in New York and Florida, it has sent hundreds of thousands of specially designed swabs to capture COVID-19 samples across the United States, Europe and Asia. Measuring around 15cm, these are produced on Formlabs printers on surgical guide resin and keep samples more intact than traditional swabs; they can also be condensed into tubes. Each printer produces 1,000 a day.

"3D is sometimes seen as a [slow] last resort, but the function of a printed swab can be better than the traditional swab," says Axial3D's chief executive Roger Johnston. His firm employs just 30 people, but local partnerships helped expedite regulatory approval and scale up this healthcare innovation.

"Our primary market has been the US, where demand is huge," says Johnston. Acceptance of 3D printing for personal protective equipment and clinical applications is accelerating. "There won't be a turning point backwards," he says.



Applying AI to real-time patient data

The Patient Status Engine (PSE) automates the collection of raw patient data and decision-support tools for clinicians, combining wearable sensors with wireless networks and big data to provide high-resolution patient monitoring. Currently used in two NHS trusts and globally, it's a class-2 medical device that's FDA-approved in America and, says maker Isansys Lifecare, the only medically certified end-to-end digital solution of its kind.

"Bedside equipment in hospitals gives clinically accurate data, but isn't portable, while wearable products generally don't provide information accurate enough to make clinical decisions," says chief executive Keith Errey. He likens the PSE to an app store for healthcare. "People are developing their own artificial intelligence to run within our platform," he says.

Installed behind hospital firewalls, this healthcare innovation includes wireless connections as part of its design, with patients connected through an Android "gateway" running Isansys applications that receive incoming data from sensors via doubly encrypted Bluetooth. High-dependency isolation wards can be created rapidly, says Errey.

"With COVID-19, the needs we've been talking about for years have become very apparent. This is smart tech, but the key is usability and meeting customer needs," he says.

Monitoring social distancing

Chris Stretton and Adam Bykowski met while studying telecoms engineering and founded Locilabs last November to develop a precision tracking product based on ultra wide band (UWB) technology.

As the COVID-19 pandemic began, they pivoted to an application for social distancing, launching their SafeSpace system. Via badges and watches, this measures how closely and for how long individuals come into contact, by monitoring the time of flight of radio signals between units. It also triggers alerts and real-time feedback via a cloud platform to identify those at risk of COVID-19.

"With UWB, we can define a distance with a 10cm margin of error, which is more accurate than Bluetooth or radio-frequency identification," says Stretton, who previously worked on big telecoms and major infrastructure projects. "We can say definitively when contact occurred and give total exposure time. Tangible data could help to avoid use of quarantine."

Its (ingress protection) IP67-rated hardware, European CE and FCC (US Federal Communications Commission) approval mean major organisations are already trialling the innovation. Stretton believes their system offers potential to track COVID-19 cases in healthcare systems.

Detecting COVID-19 via smartphone

Docdot is a mobile app that uses artificial intelligence to enable clinicians to monitor vital signs remotely. Developed by Italy-based SDG Group, it has undergone clinical trials in Canada, India and Japan, and is now used in US hospitals.

The app works using light signal processing technology known as remote photoplethysmography, or rPPG, through which a smartphone camera records light reflected by blood vessels beneath the skin. Blood volume in micro-vascular tissue varies in response to respiration, blood pressure and other changes; the app converts this into measurements reportedly 90 per cent as accurate as hospital-grade monitors.

Docdot enables people to look into their smartphone's screen and share early indicators of infection. It records heart rate, oxygen saturation and stress, collects data in real time, geo-references it and collates this to show COVID-19 cases and hotspots.

"Use of this technology for virus monitoring and detection is new," says Heather Beardmore, SDG Group UK chief executive. "This healthcare innovation is the first remote-monitoring and triage tool with potential to transform diagnosis and management."

Ventilating through the cloud

The coronavirus pandemic led San Diego-based ResMed, a market leader in sleep and ventilation devices, to accelerate the release of AirView, its patient data management software.

With this cloud-based system, cellular chips in ventilation devices send data which is then sorted and made available to clinicians in an easy-to-read format, enabling "management by exception", triaging patients and troubleshooting. Medical staff can also change settings remotely.

UK and Ireland country manager Antoine Valterio says: "With COVID-19, clinicians are short of time, so this enables them to ensure the right patient gets the right care." Remote monitoring allows other patients to remain at home and avoid visiting the hospital unless necessary.

ResMed is now training healthcare providers virtually to use the software. "The NHS has adopted cloud-based technology at an incredibly fast pace," says Valterio.

"An inflection point brought about by COVID-19 means digital health is being adopted at an accelerated rate, benefiting patients, clinicians and the healthcare system. Capability is there to drive a virtual care pathway and tools are available."

F1 speeds innovation

In a project kicked off by a professor of intensive care medicine at University College London, engineers from Formula 1's Mercedes-AMG collaborated with UCL colleagues to create a COVID-19-specific non-invasive ventilation device – continuous positive airway pressure – the UCL-Ventura.

Teams reverse-engineered an off-patent mechanical device, previously used in the NHS, to create a less oxygen-hungry version. This involved redesigning the entrainment port and improving flow and pressure. Mercedes set up a rig to do flow tests on filters, while simulation engineers, more used to designing inlet ports and compressors for F1 engines, improved fluid flow through the jet pump.

Applying motorsport characteristics of competitive ingenuity and adaptability helped to drive the success of this healthcare innovation; from idea to hospital testing took just 100 hours, with Medicines and Healthcare products Regulatory Agency approval gained in ten days.

"We delivered a 70 per cent improvement in oxygen requirement which could be measured clearly," says Andy Cowell, managing director of Mercedes-AMG High Performance Powertrains. The Department of Health and Social Care ordered 10,000 devices and 100-plus countries are now using the UCL team's designs.

Low-cost quality ventilation

Another COVID-19 healthcare innovation launched by a clinician is JAMVENT. The spark for a low-cost high-performing emergency ventilator model, which assembles quickly and simply using commonly available components, came when senior anaesthetic registrar Dr Jakob Mathiszig-Lee, also an honorary clinical research fellow at Imperial College London, began treating COVID-19 cases.

Crucially, JAMVENT doesn't use proportional solenoid valves, but simpler on-off valves which are cheaper, maintenance friendly and available from numerous manufacturers. Importantly, too, it has a breath-sensing mode to help ventilated patients recover their ability to breathe.

"Our original plan was to produce the design and put it on the internet for everyone to pick up and run with," says Dr Joseph Sherwood of Imperial's bioengineering department, the project lead. The regulatory side was "the bottleneck in the process" but the team, now awaiting emergency FDA approval, points to JAMVENT's significant performance improvements compared with other models, combined with a "basic-enough design to be nowhere near the costs of intensive care".

Portable protection for the pandemic

Personal protective equipment (PPE) has been a major point of discussion throughout the outbreak. Aerosol-generating airway management procedures create particular risks for medical staff, so Dr Egidio da Silva, a consultant anaesthetist at the Royal Orthopaedic Hospital NHS Foundation Trust in Birmingham, sought help early on from Mat Campbell-Hill, a senior fellow in novel medical technologies at the University of Birmingham.

With input from his GP wife Lydia, Campbell-Hill and colleagues developed the AerosolShield, an inexpensive, disposable four-component pop-up tent that covers a patient's head, neck and chest area to give workers portable, continuous protection.

"It can take up to seven minutes to correctly and safely apply full PPE," explains Campbell-Hill, now scaling up production with Airquee, a specialist manufacturer of clinical isolation tents. While recent changes to resuscitation guidelines might delay early and urgent interventions, this healthcare innovation can, he says, enable staff to form a rapid but workable protective barrier before carrying out lifesaving procedures.

Already deployed in GP practices, care homes and major hospitals, AerosolShield could find uses in emergency services and under-resourced settings globally.

Providing comfort for clinicians at risk

A further healthcare innovation to protect workers involved in risky, aerosol-generating procedures is the PeRSo, a powered air-purifying respirator developed in just weeks.

Clinician Paul Elkington, professor of respiratory medicine at the University of Southampton, realised medical staff working long shifts needed more comfortable respiratory protection that was sufficiently robust.

A Southampton-based academic team, including bioelectronics professor Hywel Morgan, took forward the idea. It created a lightweight design which features a small portable unit delivering clean air through a high-efficiency particulate air filter, with a battery-powered fan mounted on a belt pack.

Dr Alex Dickinson, a mechanical engineer now helping develop PeRSo for low-resource settings, says: "We made careful decisions in specification and design relating to use for COVID-19 cases." Preventing neck fatigue and promoting ease of cleaning were vital.

"We were constantly talking to users and to Paul Elkington, our clinician champion, to understand more." The team has since published its prototype computer-aided design and open specification, with 4,000-plus PeRSo devices now being used in hospitals.

Online triage takes centre stage in the age of hybrid healthcare

The coronavirus pandemic has brought the future of healthcare much closer, with online triage technologies transforming the patient experience, checking their symptoms online while driving drastic cost-savings

The healthcare sector has traditionally lagged behind others when it comes to allowing technology to challenge traditional processes. In few areas has this been more evident than triage, the process of assessing, prioritising and directing patients to the right healthcare. It is one of the most important components of any well-run hospital or GP surgery and healthcare providers have long been reticent to change the way it is done.

However, triage for primary healthcare is a highly inefficient and slow process. Before accessing any specialist care or treatment, patients have to fix an appointment with a GP, which could often be days or weeks in advance. The GP then makes an assessment and starts guiding the patient through the healthcare system depending on their condition.

This archaic process creates a major bottleneck in the system, particular as data compiled from surgeries that use the Doctorlink app has shown almost a third of patients, who seek a GP appointment, should be directed to a more appropriate form of care, such as looking after the condition themselves or going to a pharmacy. This equates to around 99 million GP appointments that could be freed up each year if there was effective prescreening. With an average appointment costing the NHS about £30, this would result in an annual saving of around £3 billion.

"The main reason this inefficient and costly system has remained in place for so long is because we have always felt it necessary to accept a certain amount of inefficiency in the system to ensure no, or at least as few as possible, mistakes are made," says Rupert Spiegelberg, chief executive of health-tech firm Doctorlink. "This assumption is based on the premise that humans are the only option we have to pre-screen patients before they enter the system. However, that is no longer the case, making the assumption wrong.

"Technology drives efficiencies in all industries, improves throughput and enables a better customer experience. The same opportunities are available in healthcare, with online triage technologies now just as good as medical professionals at initial screening of patients and equally as safe too. Yet, despite the huge advantages provided to patients, including 24/7 access and instant response times, and the improved demand management and prioritisation offered to healthcare systems, resistance has remained."

That resistance has endured in recent years even as patients have increasingly embraced digital healthcare services. More than three quarters of healthcare patients requested repeat prescriptions electronically in 2019, up from two-thirds in 2016. And more than half of patients used remote or telemonitoring devices to record their own health indicators in 2019, compared to 39 per cent in 2016, according to a study by Accenture.

The COVID-19 pandemic has significantly accelerated this trend, with the huge spike in demand for screening practically forcing healthcare providers to embrace online triage technology. In April, every patient in the UK was triaged before a GP appointment, compared to two in five in 2019, and only 7 per cent of appointments were face to face. The success of this approach, in conjunction with the existing system, showed healthcare providers how it powers a better experience without compromising safety.

"Imagine a cohort of a hundred people displaying COVID-19 symptoms," says Spiegelberg. "Some, let's say twenty, do not have the virus, but simply a cold or type of flu, forty may have mild symptoms that could be dealt with by some good advice and self-care, ten have no condition at all and the remaining twenty are at risk of developing quite acute symptoms.

"In a traditional model, they would all book a GP appointment, which would have to be spread over a long period. The GP then has to assess each one, despite over half not needing their attention. An online triage tool can direct everyone to the right place without GP intervention, ensuring those with genuinely concerning symptoms get prioritised faster, while the remainder stay at home with their anxieties alleviated."

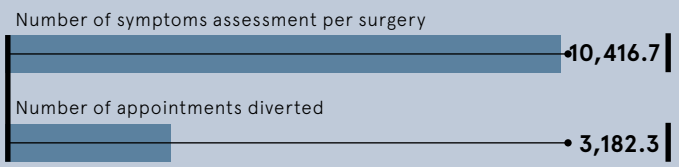
> **Online triage technologies are now just as good as medical professionals at initial screening of patients and equally as safe too**

As the UK's leading health technology solutions provider, Doctorlink has provided more than 62 million health assessments in recent years. The company's solutions are used in 1,500 GP clinics across the country, covering more than 12 million NHS patients. It also includes a health risk assessment tool used by health insurance providers, as well as telemedicine solution tool called Video consultation, for which there was a huge spike in demand after COVID-19 hit.

Doctorlink is also launching an online triage platform for A&E units to help reduce unnecessary visits and bring down waiting times at hospitals and walk-in centres that receive around 25 million patients a year, with each visit costing on average about £150 and 88 per cent experience waiting times of four hours or less. Some 16 per cent of emergency department attendances between 2015 and 2017 were defined as unnecessary, according to a 2018 National Institute for Health Research study.

Built by doctors, healthcare experts and technology visionaries, daily usage of its app grew almost tenfold this April compared with April last year, as COVID-19 eliminated many face-to-face meetings.

"Taking a sample of ten GP clinics that use its technology, Doctorlink found that those with between ten thousand and thirty thousand patients have been able to drive GP and admin time-savings equivalent to up to £270,000; this figure depends on practice size, patient registrations and app usage. The average total cost of appointments saved at those ten sample surgeries neared £1 million. The solutions can similarly help health insurers as it offers their members instant access to healthcare, reducing the cost of unnecessary claims, increasing customers' satisfaction and retention rate," Zainab Ibrahim, head of marketing at Doctorlink, concludes.



Case study looking at ten GP surgeries: The data above shows the average number of symptoms assessment per surgery and the number of appointments diverted away from the GP.

"We have seen some up to 32 per cent of appointments freed up thanks to our pre-screening, enabling surgeries to take on more patients without having to increase their costs and doctors to operate at the top of the licence and focus on those with the most urgent need," says Mr Spiegelberg. "On top of this, these surgeries have been significantly better equipped to handle the huge surges in demand generated by the COVID-19 crisis.

"Patients, meanwhile, get clinically-vetted pre-screening advice anytime at the touch of a button, and no waiting queues. If this awful pandemic has taught us anything, it should be creating a real impetus for change so we can create a healthcare system that is fit for the 21st Century. Online triage is crucial not only in anticipation of a potential second wave of the COVID-19 virus but also as part of the ongoing digitisation of our healthcare system to enable it to keep up with the ever-growing gap between supply and demand."

For more information, visit www.doctorlink.com

Patients can download the app if their own GP surgery is a partner of Doctorlink – the app is available on Apple and Google Play.

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Healthcare Anytime Anywhere

CORONAVIRUS

A catalyst for the symptom tracker market

Is the use of symptom tracker apps set to explode in a post-pandemic world?

Jonathan Weinberg

When the history of the coronavirus pandemic is written, a key chapter will surely talk of the growing acceptance in the global psyche of the symptom tracker app.

The success of ZOE, developed by King's College London and the NHS, has led to it becoming the largest community monitoring of COVID-19 in the world, downloaded on an opt-in basis by more than four million people in the UK.

Reporting symptoms in real time for further analysis and symptom study is now a firm pointer on the roadmap for the future of healthcare.

For example, Apple's HealthKit, originally released in 2014, is one increasingly useful tool for health service clinicians and health data scientists given the prevalence globally of the iPhone. At its Worldwide Developers Conference in June, Apple announced 13 new symptoms were to be added for tracking, taking the total to 39, including night sweats, mood changes, bladder incontinence and nausea.

And this, with other advances by developers working alongside clinicians, could pave the way for an explosion in symptom tracking for all kinds of conditions, including diabetes, cancer, inflammatory bowel disease and rheumatoid arthritis.

One such healthcare app, MyIBD Care, already offers great outcomes. It is being used by 35,000 sufferers of Crohn's disease and ulcerative colitis, and was developed in 2016 by Ampersand Health and consultant gastroenterologists Dr Gareth Parkes at Barts Health NHS Trust and Dr Bu Hayee of King's College Hospital NHS Foundation Trust.

Parkes says: "Firstly, mobile apps allow a much more detailed picture and richer data set of a patient's condition to be built up, rather than relying on a three, six or twelve-monthly visit. Secondly, they allow patients to be managed remotely if they are well rather than coming up to the hospital, which has cost benefits to the NHS. Lastly, and most importantly, they empower patients and offer opportunities for self-management.

"Apps also have the potential to monitor new therapies and allow early changes in those that are clearly not working, which should improve patient care."

During lockdown, MyIBD Care was used to improve mental wellbeing and exercise levels in patients shielding, and Parkes says it improved anxiety levels, as well as control of the conditions. "The future is utilising apps as a digital therapeutic, which can safely deliver tailored advice to patients to improve their health and reduce inflammation," he adds.

> **We are now able to use data in ways not done before. It provides GPs and oncologists with vital, real-time health information**

Not every symptom tracker app is used manually though, as others take a more internal approach, such as the Vectorious' V-LAP, the world's first in-heart microcomputer designed to detect heart failure.

Oren Goldshtein, chief executive of Vectorious Medical Technologies, explains: "Most people interact with the healthcare system when they start to see or feel clinical signs and symptoms. Sometimes though, these come too late. Medical professionals are beginning to increasingly rely on implantable devices to triage issues, long before symptoms appear, informing physicians of any, potentially life-threatening, changes."

Digital advance warning is also important when it comes to patients feeling like they don't want to waste a doctor's time with a symptom that may be nothing.

Paul Landau, chief executive of Careology, a platform for cancer patients to enter key markers through the mobile app, says: "Clinicians generally rely on patients to get back in touch with them if they experience issues during cancer treatment. Understandably, patients can get the reporting of these time-critical symptoms or side effects wrong or there may be a delay in when they can see or speak to the clinician, meaning issues become more advanced and complex.

"We are now able to use data in ways not done before. It provides GPs and oncologists with vital, real-time health information that can be instantly interpreted and enables doctors to remotely manage and proactively support patients. Using this data to facilitate early and proactive clinical intervention has the potential to be lifesaving."

The safety of our health data is naturally a key concern, but research shows a greater willingness to share it with a symptom tracker app or healthcare app.

Jens Koegler, healthcare industry director at VMware, Europe, Middle East and Africa, says its research in 2018 found 39 per cent of British people were nervous or scared by the prospect of sharing personal lifestyle data with their doctors. But its most recent study saw just 15 per cent reporting they wouldn't be willing to do this. In fact, a quarter said they would be more willing to provide this health data as a result of the recent pandemic.

However, Adam Mayer, senior manager at business intelligence company Qlik, highlights an important issue, which is the gulf between a symptom tracker app offering health data and a NHS trust's ability to analyse it to reveal patterns and identify individual opportunities for early interventions.

He points to a recent report by Qlik that found nearly two thirds of data analytics tools deployed by NHS trusts do not have the capabilities to support the identification of population health patterns (60 per cent) nor can they inform the creation of clinical pathways (57 per cent).

Mayer cautions: "Without the analytics to reveal useful insights behind the data harvested by symptom trackers, healthcare professionals are not able to use the data to improve patient care."

However, one patient who is feeling the benefit is Crohn's disease sufferer Ziyad Al-Dibouni, who is known as @thegrumblinggut on social media. Al-Dibouni, who works as a NHS diagnostic radiographer, believes using a healthcare app such as MyIBD Care has been a huge positive for his life.

He says: "This app would have been so useful when I was diagnosed in 2007. I remember feeling so overwhelmed and confused as to what to do or where to go for information.

"To be able to track your symptoms and how you're feeling is a great way to look back on your week and see if you can try and replicate the days when you were feeling well.

"It allows you to have a greater control over your IBD [inflammatory bowel disease] and gives you an opportunity to learn how to self-manage it. I used it extensively during the lockdown to keep up to date with any new information that related to IBD and COVID-19.

1 in 46

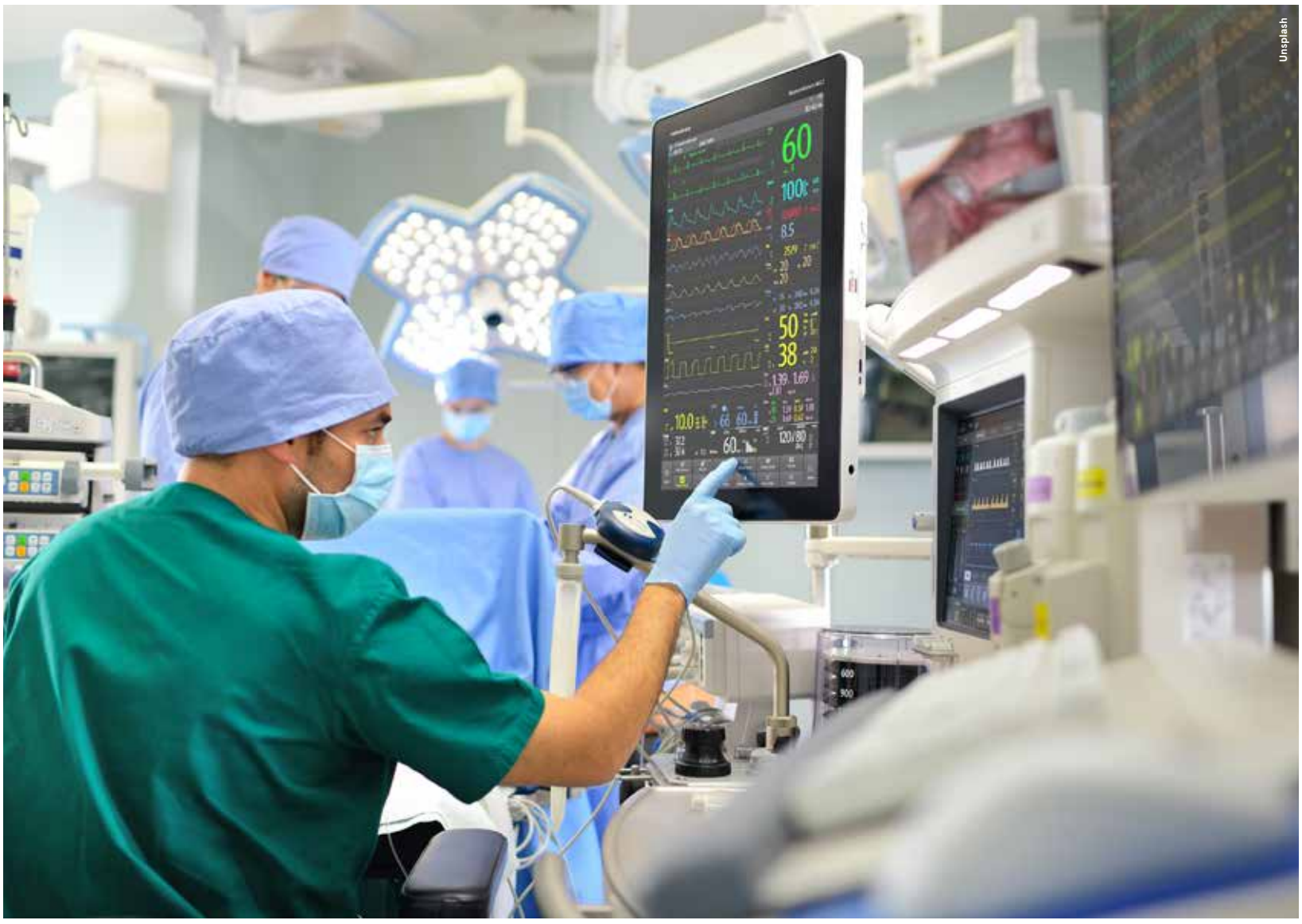
mobile apps access users' health data

Symantec/Broadcom 2019

INTERNET OF THINGS

Cyber uncertainty as medtech evolves

Connected technology will make diagnoses and treatment simpler than ever before, but it could leave healthcare open to a whole new range of worries


Unsplash

Suchandrika Chakrabarti

The medical technology industry is facing more cyberattacks than ever before. Healthcare continues to be the most targeted industry, with healthcare providers accounting for nearly four out of five data breaches, according to US-based Black Book Market Research. This will cost the healthcare sector an estimated $4 billion over the course of 2020.

"Scientists have been warning about the cybersecurity risks associated with medical devices for at least a decade. As these devices continue to proliferate, the warnings will only get louder," says Rafi Azim-Khan, head of data privacy at Pillsbury.

Medtech devices connected to the internet of things (IoT) have huge potential to improve almost every aspect of healthcare, by linking devices and real-time data through digital networks. Yet these same features can leave users reliant upon technologies that are vulnerable to a variety of potential cybersecurity threats and these risks can threaten patients' lives. It seems that the pace of technology has so far left the medtech industry behind.

The key challenge for the sector is to stay ahead of bad actors who attempt to hack into devices for financial gain by stealing sensitive patient data. And with the connected medical devices market expected to treble in size over the next five years, expanding from $23 billion in 2019 to $77 billion by 2025, according to figures from a Mordor Intelligence report, these risks will only increase.

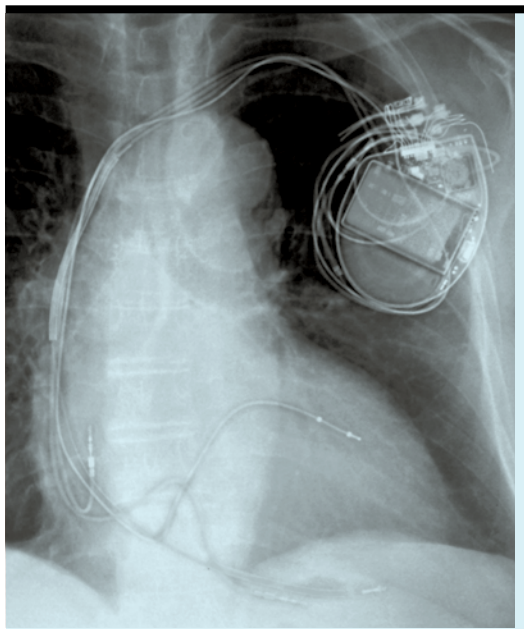
Flaws in medtech devices could have horrifying consequences. In 2017, researchers Billy Rios and Jonathan Butts of QED Security Solutions managed to hack into Medtronic's MiniMed and MiniMed Paradigm insulin pump lines, using an Android app they built. It would allow remote attackers to withhold doses of insulin, or release too much, leading to a potential fatal overdose.

> **Medtech devices that use IoT are at their core effectively still computers that connect to a network. These attributes make them vulnerable**

"We've essentially just created a universal remote for every one of these insulin pumps in the world," according to Rios. "I don't know why Medtronic waits for researchers to create an app that could hurt or kill someone before they actually start to take this seriously." A week after Rios and Butt demonstrated the app, the company announced a voluntary recall of the devices. At the time, the company said around 4,000 vulnerable pumps were in use in the United States.

The wider industry also faces cybersecurity threats at network level too and points of connection can also become points of vulnerability. "Medtech devices that use IoT are at their core effectively still computers that connect to a network," says Andrew Elia, managing director at Arishi. "These attributes make them vulnerable."

In May 2017, a WannaCry global ransomware hack resulted in one of the largest medtech cyberattacks in history, paralysing the NHS computer system with bitcoin ransom demands. A third of hospital trusts were affected and up to 70,000 medtech devices, including computers, MRI scanners and surgical theatre equipment, were affected. The incident cost the NHS £92 million, including £73 million spent on direct IT costs and further



Pacemaker recall

Nearly half a million pacemakers were voluntarily recalled in the United States in 2017 after cybersecurity flaws were found in the devices by MedSec, a firm that specialises in researching vulnerabilities in the medical devices and healthcare industries.

Six models of pacemaker, produced by healthtech firm Abbott and sold under the St. Jude Medical brand, were found to have cybersecurity flaws. The devices are all radio-controlled implantable cardiac pacemakers. They are fitted to treat patients with slow or irregular heartbeats and to aid recovery in those who have suffered from heart failure.

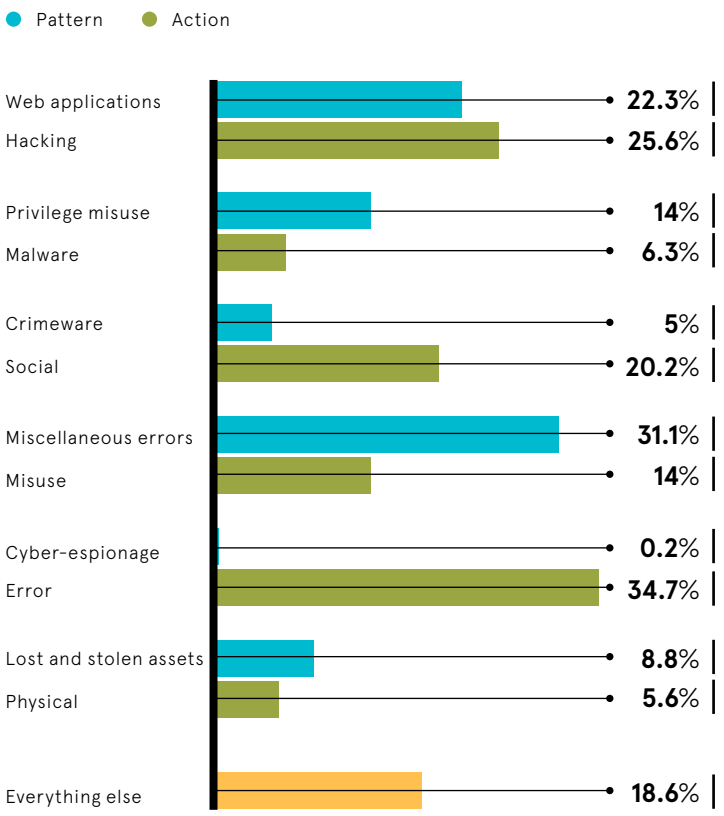
The US Food and Drug Administration said the vulnerability allows an unauthorised user to access a device using commercially available equipment and reprogramme it. The hackers could then deliberately run the battery flat or change the pacing of the device. Both attacks could result in the death of an affected patient.

The recall didn't mean the pacemakers were removed; the manufacturer issued a firmware update which medical staff would apply to secure the vulnerabilities in the 465,000 implanted devices.

Abbott created new software with increased security measures. The update included data encryption, operating system patches and the ability to disable network connections. There have been no known reports of patients being harmed by the security flaw.

HEALTHCARE DATA BREACHES BREAKDOWN

Analysis of over 500 confirmed breaches from the healthcare sector, split by pattern and action



Verizon 2020

IT support needed to restore systems and recover data.

The resulting NHS England report highlighted the complexity of safeguarding a large organisation. A multilayered solution would be needed, involving greater senior management and local trust accountability, the patching of devices and systems, backing up network security and replacing unsupported software, and a new national agreement with Microsoft was signed, which included patches for all current Windows devices operating XP.

"In other industries – financial, industrial and so on – when people attack an organisation, it's usually for the purpose of finding money," says Christopher Gerg, vice president of cyber-risk management at Tetra Defense. The WannaCry ransomware attack did have a financial motive, and while it created expensive chaos for the NHS, the hackers were not paid.

Patient identity information is also valuable to bad actors. The medical data breach of US insurance provider Anthem in 2015 exposed more than 37.5 million records that contained personally identifiable information from its servers, such as medical IDs, social security numbers and income data. The company's response was to advise people whose data had been stolen to monitor their accounts and remain vigilant.

"One of the first things the credit card industry did was create a security standards council," says Gerg. "The healthcare industry is going to need third-party accreditation of these items. The FDA [US Food and Drug Administration] does that with drugs, we should be doing it with medical devices."

Strongly enforced legislation is essential to encouraging the medtech sector to tackle IoT connectivity vulnerabilities.

"The medtech world is notorious for not being as secure as you hope it would be," adds Gerg. "That is unexpected, given how mature the US-based Health Insurance Portability and Accountability Act of 1996 (HIPAA) is." The US Department of Health and Human Services uses the legislation to fine non-HIPAA-compliant healthcare providers for failing to take the approved steps to prevent security breaches.

Within the European Union, the General Data Protection Regulation has been brought in to uphold data protection. "On paper, it is seismic and has handed regulators a powerful weapon in the fight against the misuse of data," says Pillsbury's Azim-Khan. "A concern remains that big business could use huge legal war chests, which dwarf the regulators', to endlessly appeal fines."

Medtech failures can have fatal consequences, and large-scale cyberattacks can cripple healthcare systems for weeks, leading to cancelled appointments and surgeries. They can also cost huge amounts to fix. As the market grows year on year, it is of the utmost importance that IoT medical devices are always produced with the best possible protection for secure data across connected devices. They should be tested for their resilience against a variety of cyberattacks and certified by a standards body that enforces legislation written to keep personal data safe.

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ARTIFICIAL INTELLIGENCE

Inflection point for AI-powered oncology?

Challenges caused by the coronavirus pandemic have accelerated the need for greater use of artificial intelligence in cancer care

Abby Young-Powell

Scientists have warned there could be thousands of excess deaths in the UK in the coming years due to delays in cancer diagnosis and treatment during by the coronavirus crisis.

The pandemic has meant routine screenings, and urgent referrals and treatments, have been delayed or cancelled, leading to a backlog of patients. Researchers at the Health Data Research Hub for Cancer examined data from eight hospital trusts and found that, in a worst case scenario, if delays continue, there could be up to 35,000 additional cancer deaths within a year.

But artificial intelligence (AI) could be a solution. Over the past decade, AI has emerged as a leading technology with the potential to aid the medical community, from speeding up diagnostics and improving accuracy to improving patient outcomes and hospital efficiencies.

One challenge in oncology is early diagnosis. The NHS is good at cancer treatment, but the disease is not always detected early enough and this could be exacerbated by COVID-19. AI in cancer care could help find innovative ways to reach individuals faster and identify early signs of cancer.

"There's interest in how we might be able to use AI alongside personal data devices people have, such as Fitbits," says Dr Jodie Moffat, head of early diagnosis at Cancer Research UK. "These might be able to signal when things are changing sooner than might otherwise have been detected. That's going to help you to identify people who might need some follow up or who are at risk in some way."

AI can be used to help diagnose different types of cancer, such as breast, prostate or skin cancer. John Loder, investment director for Nesta, an innovation foundation, cites Skin Analytics, a healthcare company that is working with clinicians in dermatology and using AI to deliver better patient outcomes. "Dermatology is a leading example because it's an understaffed area and a common cancer," he says.

Data visualisation and machine-learning techniques can also help extract clinically useful knowledge from a huge amount of data. Researchers at the Institute of Cancer Research have developed a large-scale AI database to aid drug discovery research. It brings together data across biology, chemistry, pharmacology, structural biology, cellular networks and clinical annotations.

"With this we were able to start developing AI technology that would allow us to answer key questions. For example, to come up with a risk profile for different patients," says Professor Bissan Al-Lazikani, head of data science at the Institute of Cancer Research.

A study, published in *Nature* journal in January, found AI is more accurate than doctors in diagnosing breast cancer from mammograms. Currently in cancer screening in the NHS, two radiologists must analyse each woman's X-rays.

Researchers from Google Health and Imperial College London tested a computer model on nearly 29,000 women and showed it to be as effective as human radiologists. The AI model was as good as the current double-reading system of two doctors

> **"There is a massive acceleration and we're going to end up in a place where use of AI is a natural part of medicine**

and was better at spotting cancer than a single doctor, they found.

Dr Hutan Ashrafian, one of the lead researchers and an AI expert at Imperial College London, says AI can be particularly helpful in supporting diagnostics. "It's a low hanging fruit for AI at the moment, particularly in supporting radiological diagnostics because the data you get is digital," he says.

Before AI can be used in a clinical setting, it needs to be trialled and evaluated properly. At the moment, researchers at Google Health and Imperial are organising trials across the country to see if they can replicate their results.

42%

of the UK public would be willing to give all their health data into a national database with the intention of artificial intelligence identifying new and better ways to diagnose and treat different illnesses

56%

would be willing to give the doctor access to completely accurate data about their daily life, such as drinking habits and diet

32%

are now willing to have wholly automated medical experience enabled by artificial intelligence – for example, medical consultation with a digital healthcare worker, through to robots preparing and distributing the prescription

73%

have faith in the NHS to oversee the development, implementation and use of technology as a force for good in society – the highest of any public body

VMware 2020

> **We're going to end up in a place where use of AI is a natural part of medicine**

If the results are positive, the AI algorithm could save a lot of time and support healthcare resources. "What we found was quite powerful," says Ashrafian. "In one fell swoop, it could reduce the NHS workload on a national level."

It might not be as glamorous, but clinicians say AI in cancer care could be particularly useful in improving hospital administrative efficiency. For example, AI-based tools could help manage appointments, look after patient pathways and track patients.

Dr Caroline Rubin, vice president for clinical radiology at the Royal College of Radiologists, says: "It can really help to make the system flow more efficiently. It's hugely important that patients don't get lost in systems. It's not something that is currently hugely efficient. It's also quite labour intensive."

Rubin says it's not so much reluctance to adopt new technologies that may have slowed developments down so far, but the need for proper testing, safety and regulations to ensure technology is safe and as effective and efficient as possible.

It's also essential that any new technology fits easily within a hospital setting. "How they are embedded in workflow is hugely important," Rubin adds. "We can't have something that slows us down; it has to be efficient and supportive." Patient consent must also be considered, as well as ensuring data is kept safely within the NHS.

The Care Quality Commission recently released a report into deep-learning in diagnostic and screening services. A key finding was that "more clarity [is needed] on how hospitals should implement machine-learning devices within clinical pathways to ensure high-quality care".

Where there is reluctance, it could be that implementing AI technologies can be expensive, requiring funding and investment. From the point of view of public perception, people trust doctors and some may be wary of machines. "But AI is supportive and works alongside people," says Rubin. "I don't see it ever replacing doctors."

Ashrafian adds: "The pandemic has catapulted the need for digital." Tech can facilitate remote practice as with AI tools there's no need for people to visit hospitals where they could be exposed to COVID-19.

"The way I see it, we are absolutely at the inflection point," says Al-Lazikani at the Institute of Cancer Research. "There is a massive acceleration in this and we're going to end up in a place where use of AI is a natural part of medicine."

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