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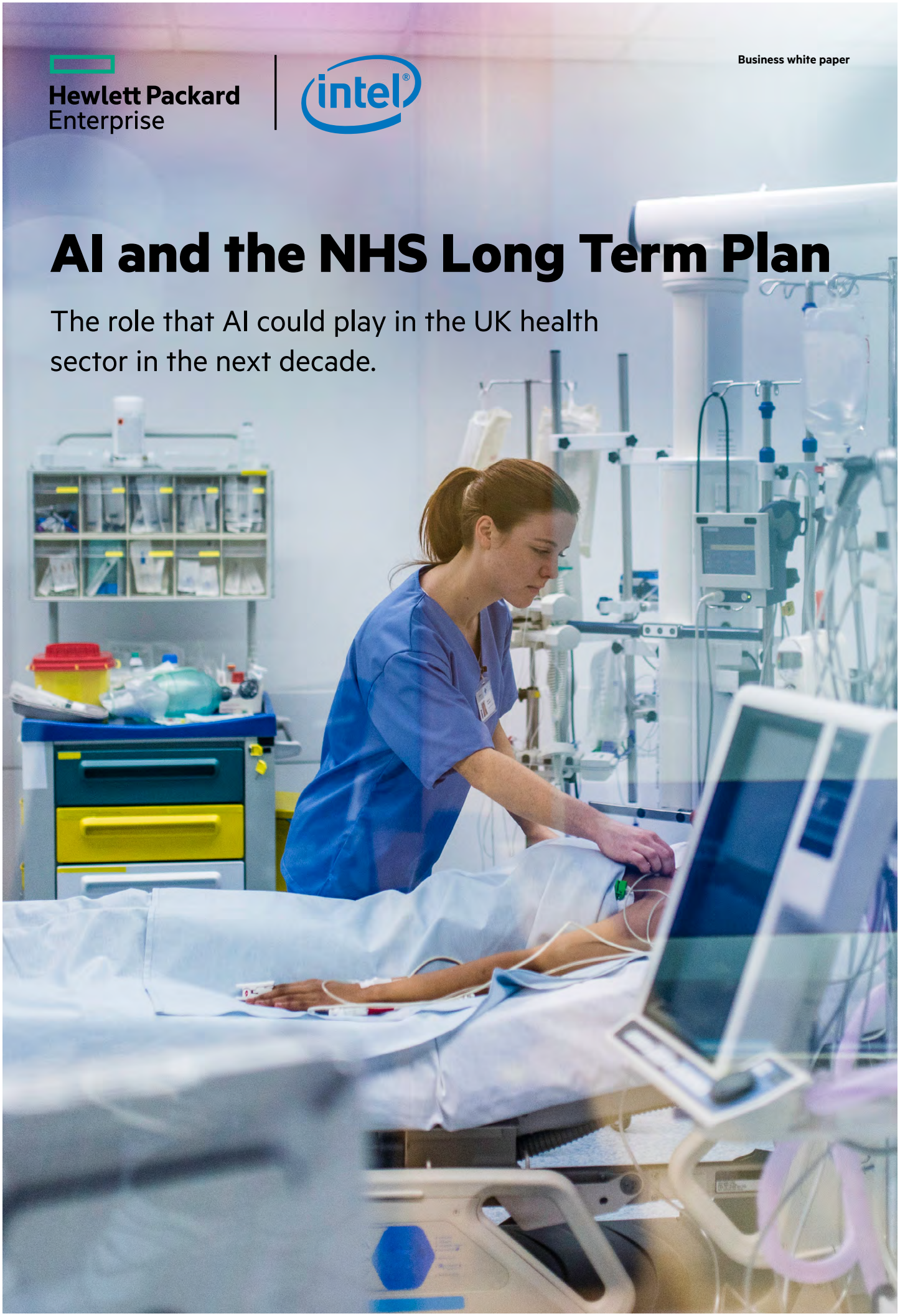
Business white paper

AI and the NHS Long Term Plan

The role that AI could play in the UK health sector in the next decade.



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Introduction

Artificial intelligence (AI) is firmly embedded in modern life. It is in our homes in the form of personal digital assistants, helping detect fraud in our banking systems, identifying inappropriate content on our social media feeds. As prevalent as it may already feel, however, AI is still very much in its infancy.

In Europe, healthcare has been slower to adopt AI than other sectors, but the UK is leading the way, with a third of European AI health start-ups founded here.[1] So, while it is not yet commonplace to see AI solutions in UK healthcare settings, AI adoption is rapidly gathering pace.

In November 2018, the UK government announced £50 million funding injection into AI in healthcare and the NHS has shown increased agency in this area. AI and other digital solutions were prevalent in the Long Term Plan, which set out a strategy for the next 10 years, outlining technology as a key medium of change. The paper described a "redesign of patient care to future-proof the NHS for the decade ahead".[2] AI was centre stage in the Chief Medical Officer's 2018 annual report, too, which looked further into the future, taking "an aspirational view of what health could and should look like in 2040".[3]

There are urgent challenges that need to be tackled, though. With the UK's ageing population and an increasing number of patients with complex, long-term conditions, pressure continues to build on an already struggling system. The NHS must find a way to do more with less to ensure its workforce can keep pace with demand.

The Long Term Plan looks to tackle these central challenges by promising more investment in primary and community services to relieve pressure on urgent and emergency care, supporting people to manage long-term conditions at home, and improving public health to encourage people to stay healthy. It acknowledges that technology will be an important asset in realising this vision and that upgrades are needed to support many of the wider service changes. The paper also states the aim of the NHS for its clinicians to have "ready access" to AI within the next decade, and it highlights key ways AI can help deliver on its central ambitions.

With so many different products and possibilities for affecting change, there is ongoing debate about which AI solutions will add the most value to healthcare settings, support clinicians, and improve outcomes for patients. With limited resources, the next steps must be taken carefully. Leaders need to know where key investments should be made and what can be done today to create an environment receptive to AI.

By reviewing research papers and conducting interviews with industry experts, this paper explores the issues surrounding AI in the NHS, determining the main barriers to adoption – ethical, cultural and logistical – and how they might be overcome. It will look at the clinical settings where AI could be most effective, and how it can be made sustainable, delivering the change the NHS so desperately needs.

What is AI?

Artificial intelligence is broad and covers a range of techniques and technologies. At its most basic, it can be used to describe the ability of technology to analyse complex data and simulate human intelligence to solve problems. A subset of AI is machine learning, which refers to algorithms that allow computers to learn from examples without being explicitly programmed. Machine learning has enjoyed a resurgence in recent years as more and more data becomes available. At this stage, we are predominantly using 'narrow' AI solutions to focus on specific problem spaces and to help us gain value from the vast amounts of data being generated, as opposed to 'general' AI, which is currently more likely to be found in science fiction.

How can AI make a difference to the NHS in the next decade?

Clinicians

Healthcare generates a wealth of data and healthcare needs AI in order to derive value from this data, says artificial intelligence consultant Dr Matthew Fenech. “Healthcare is becoming much more data-driven. Huge data sets are being generated from genomics, from imaging, and it is increasing. AI can process these datasets – we need AI tools to gather insights from this data,” he says. AI is capable of analysing vast amounts of data thousands of times faster than humans, enabling us to gain information and insight that might otherwise be unattainable.

While it can spot patterns, however, AI in its current form is not capable of carrying out tasks that require the application of advanced cognitive skills, and therefore human analysis is still required to turn insight into action. For the foreseeable future, then, AI is therefore likely to remain predominantly a tool to assist clinicians, rather than replace them. This is termed augmented intelligence – a conceptualisation of AI that focuses on enhancing human capabilities.[4] A survey on AI in healthcare by the AHSN Network found that the majority of respondents “see AI as a tool to help doctors and all healthcare professionals become more efficient and deliver a higher standard of care”.[5]

The ways in which AI can assist clinicians are numerous. Perhaps one of the most significant was articulated in a report by the Academy of Medical Royal Colleges: “At a time of widespread clinician burnout and a shortage of staff, AI offers the potential to automate some of the workload and reduce the burden of routine tasks.”[6] Recent studies have shown that many clinicians are spending more time on administrative tasks than they do with patients and AI can shift this balance through the automation of mundane administrative processes.[7] In doing so, it could vastly improve clinical efficiency.

Voice recognition software has already been taken up in some areas of the NHS with very positive results. Capturing notes by voice rather than typing using software integrated into the electronic patient record at Alder Hey Children’s Hospital is estimated to save around 40 minutes per patient per day.[8]

As well as increasing efficiency, speech recognition can also deliver more detailed notes and a richer patient record, which makes for a smoother continuum of care.

AI is proving extremely valuable in driving efficiencies as a diagnostic tool, particularly in medical imaging. Nuffield Council for Bioethics summarised this in a recent report: "AI could reduce the cost and time involved in analysing scans, potentially allowing more scans to be taken to better target treatment. AI has shown promising results in detecting conditions such as pneumonia, breast and skin cancers, and eye diseases."[9] By learning what to look for from previous scans, machines can analyse images at a much faster rate than clinicians and suggest which need further attention, which alleviates the need for clinicians to spend time examining every scan in detail.

The ability of the NHS to speed up the scanning process supports its aim, set out in the Long Term Plan, to increase earlier diagnoses of major health conditions such as cancer. Dominic King, in the CMO annual report, writes that medical imaging and digital pathology are the "the likeliest areas of mainstream AI applications in healthcare", and there are several ongoing trials in the NHS using AI software to evaluate mammograms and diagnose the risk of breast cancer, which is particularly difficult for doctors to detect early.[10] This area of AI application is significant given the acute shortage of radiologists in UK hospitals.

AI as a clinical decision support tool holds huge potential for the NHS. AI can use electronic patient records and clinical research to provide clinicians with useful insights that enable them to make more informed decisions around diagnosis, testing, and treatment. There has been increased focus on training AI tools to assist prognosis.[11] Professor Jeremy Wyatt, new technologies clinical lead at the Royal College of Practitioners, believes that the NHS should "prioritise prognosis, using tools to identify the risk of a complication, or the probability that a drug will be effective, or which test the patient should take".

A major project backed by HPE, which uses memory-driven computing, aims to offer this type of tailored treatment by analysing data related to genes, lifestyle, and treatment history from thousands of patient cases similar to the individual being treated. When used in this way, AI could reduce unwarranted variation across the care system, reduce over-investigation and unnecessary testing, and potentially speed up treatment pathways, and improve health outcomes for patients. It would also align with the aim of the NHS stated in the Long Term Plan to deliver more personalised care.

All the tools mentioned above should work to alleviate pressure on the NHS by allowing clinicians to focus on patient care, treat more patients, and for those interactions to be more person-centred. If mundane tasks can be made easier or automated, this should also serve to make clinicians' jobs more enjoyable, decreasing burnout and increasing staff retention.

AI as clinical decision support

In the UK, sepsis kills up to 50,000 people per year.

It can develop rapidly and, if left untreated, can lead to organ failure and septic shock, so early identification is vital.

Sepsis can, however, present in many different ways and is difficult to identify.

Working with HPE, Cerner is helping to tackle sepsis through the development of the St John algorithm. The technology captures patient vitals at the bedside and transmits these to an electronic medical system. The St John algorithm is able to notify the clinician if the patient is at risk of sepsis, assisting them to quickly and accurately diagnose the condition and determine the right course of action.

In 2018, it identified 1.8 million patients at risk of sepsis and helped save over 35,000 lives.

Read more:
Saving lives with early sepsis detection

Patients

The internet has given us greater access to information about our health – a 2017 study by FutureYou found that, in the UK, seven in 10 of us will self-diagnose by searching symptoms online rather than consulting a physician.[12] People have been empowered by the availability of health information and AI can further this, says Dr Fenech: "Healthcare knowledge is more available than it has been previously and patients want more information. AI tools can support this democratisation and help people understand more about their health."

Tools have already been developed that could transform access to care advice. Chatbots can provide patients with 24/7 access to basic medical knowledge and advice that means they would no longer rely on primary or emergency care for every health concern. With 20% of GP appointments and 19% of A&E attendances for minor medical problems that could be treated at home, this means a huge portion of cases could be diverted from these services by a conversation with a chatbot.[13]

Chatbots could also change the way that patients are triaged into the health system, eliciting information from patients to determine whether they need medical attention. Professor Wyatt believes chatbots will become "much more widespread". "It's quite likely that in the future a patient's first point of contact with the NHS will be a chatbot carrying out a triage process."

Empowering patients with information will be vital if the NHS is to cope with increasing numbers of chronic conditions. Dr Fenech believes the prevalence of these long-term conditions necessitates solutions that enable people to take control of their health.

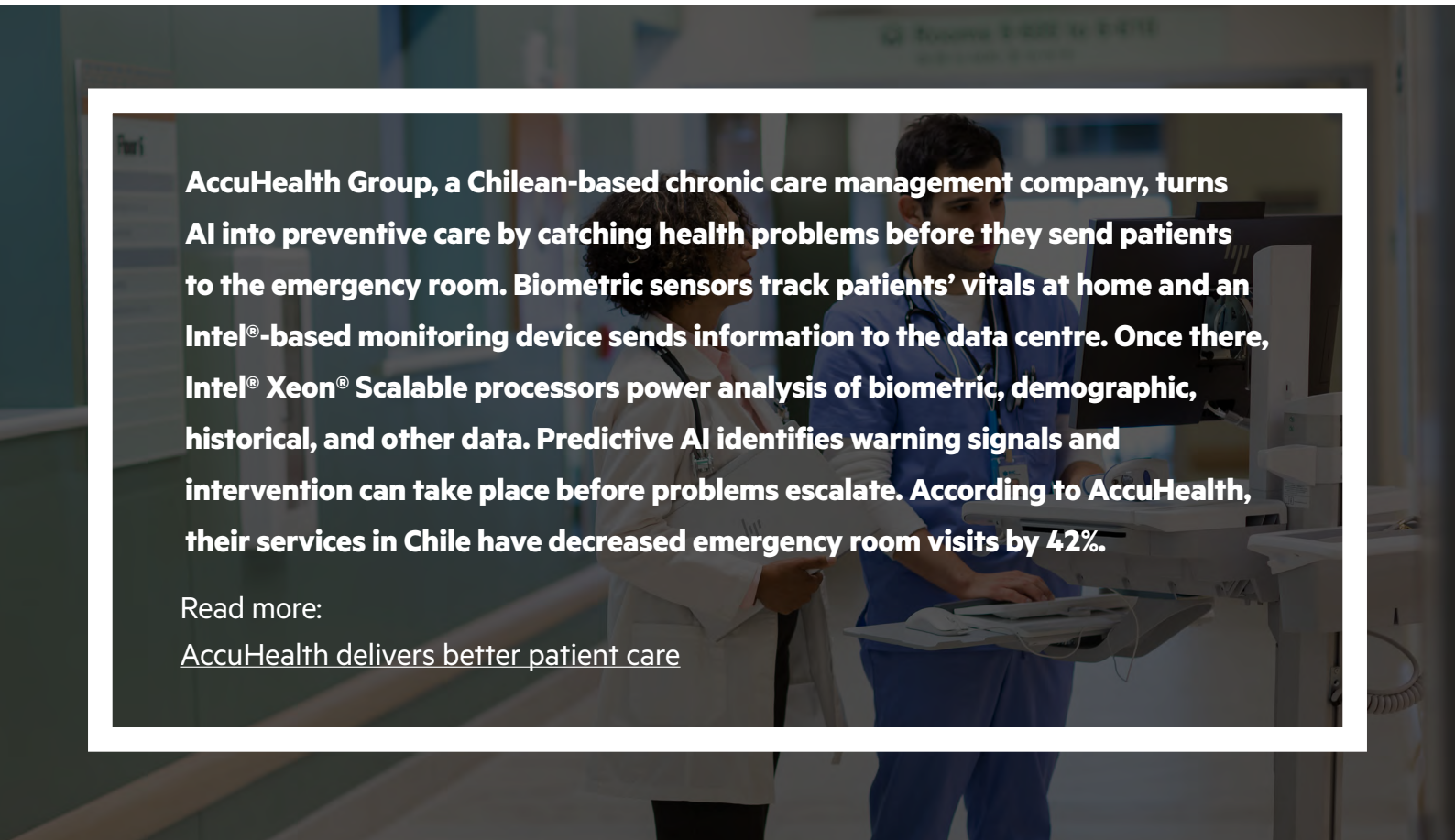
Wearable devices that allow patients to manage long-term conditions, such as diabetes, at home are already in use and likely to see wider take-up. These devices can track patients and send them alerts – reminding someone with diabetes when they need more insulin or providing daily task prompts for those with dementia – or alert care services if needed.

Research by innovation foundation Nesta last year found that "AI is also becoming capable of extracting signals from real-time data and giving early warning that a health problem is getting worse" and the AHSN Network survey found that the majority of respondents expected AI to be used "in a more predictive way, facilitating the shift from reactive care to a more preventative health model".[14] An example of this is Wellwatch, developed by Care UK with the support of HPE, which uses a wearable device to send data to a monitoring and analytics platform where algorithms match

> "People need to be the managers of their conditions, because they won't have access to a doctor 24/7. Any tool or technology that helps them to better manage their conditions can only be a good thing."
>
> **Dr Fenech**

against predefined and emerging patterns. In doing so, Wellwatch aims to predict ill health and initiate an earlier intervention, enabling vulnerable or frail people to remain safely at home for longer.

These wearable and smart home devices could enable patients to be discharged from hospital earlier and help prevent readmissions, relieving pressure on NHS emergency departments and improving patient flow in hospitals.



AccuHealth Group, a Chilean-based chronic care management company, turns AI into preventive care by catching health problems before they send patients to the emergency room. Biometric sensors track patients' vitals at home and an Intel®-based monitoring device sends information to the data centre. Once there, Intel® Xeon® Scalable processors power analysis of biometric, demographic, historical, and other data. Predictive AI identifies warning signals and intervention can take place before problems escalate. According to AccuHealth, their services in Chile have decreased emergency room visits by 42%.

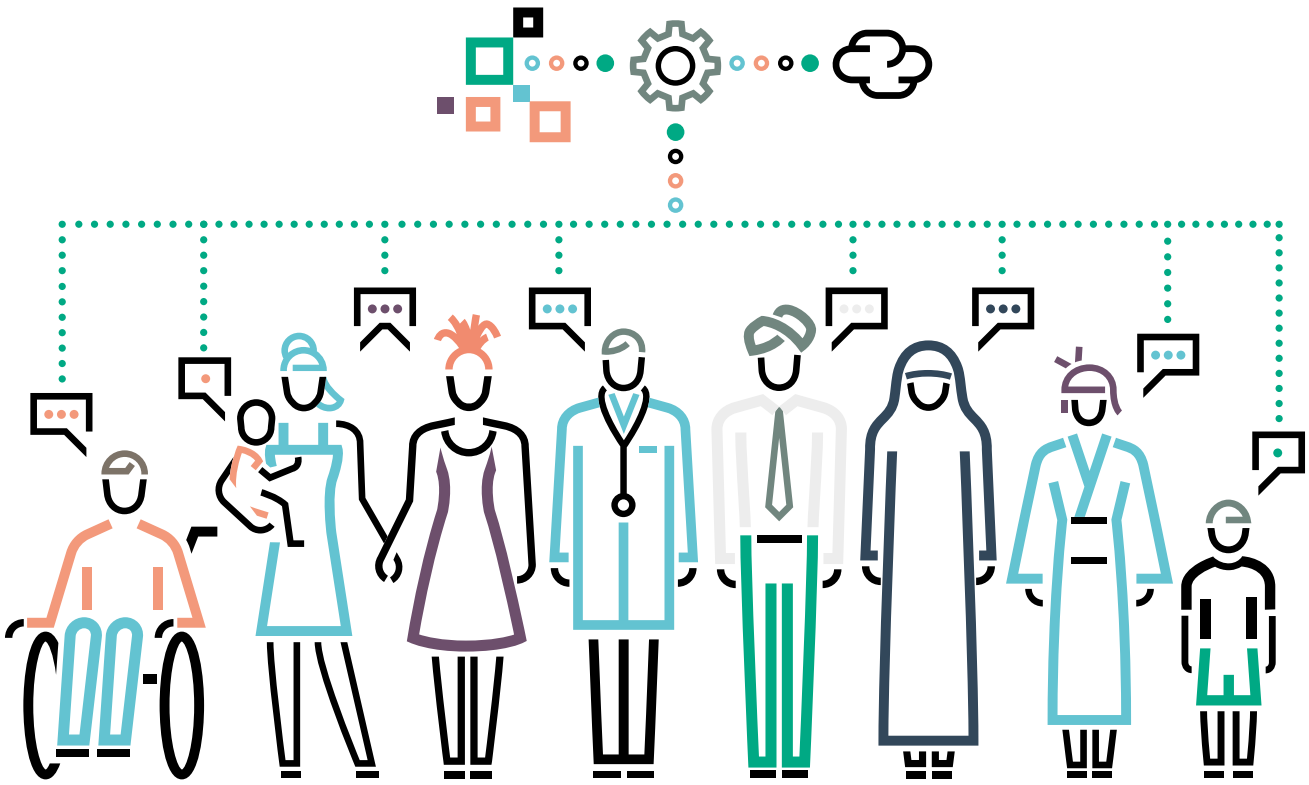
Read more:
AccuHealth delivers better patient care

Communities

If harnessed correctly, data will be a powerful strategy tool for local Integrated Care Systems, enabling them to better plan for the health needs of their communities. The Long Term Plan states that, over the next 10 years, "local NHS organisations will increasingly focus on population health" and predictive techniques will support ICSs to "optimise care for their populations".

Population-level applications were one of the five main uses of AI in healthcare identified by Future Advocacy.[15] Socioeconomics plays a hugely influential part in health outcomes, and AI could strengthen understanding of other factors influencing health. Professor Mike Trenell, director at NHS National Institute for Health Research Innovation Observatory, explains: "The real driver for AI in population health will be its potential to take us beyond the clinical care record and into understanding behaviour. That might be through other types of data such as weather or air exposure – things that we don't typically link together in data sets today."

AI can use data from multiple sources to form a full picture of population health that can be used to detect epidemics, inform resource allocation, and enable more targeted interventions.



What are the main barriers to AI implementation in the NHS?

There is a widely held view that AI tools for healthcare have so far not been as problem-driven as they need to be to generate lasting change. Eleonora Harwich, director of research and head of digital and tech innovation at think tank Reform, says that organisations "need to think about what they want to achieve and then see if technology can be an enabler for that, rather than the other way around".

One way of ensuring AI supports clinical need is by involving clinicians and patients from the very outset of development. Dr Tom Foley, clinical lead for data at NHS Digital, says involving clinicians is a "no-brainer". "It's not just about getting the technology right – it's also about understanding the organisation into which the technology is going to be deployed, understanding the impact of the technology on working lives, and on professional identities.

"History has shown that as well as having huge potential to improve working lives for clinicians, technology also has the potential to make things worse. Applications need to be produced with them to ensure it is what they need."

It is evident that the scar tissue left by the previous failures of large-scale IT programmes in the NHS needs to be taken into account when planning the deployment and integration of future technologies, as clinician buy-in will be vital to their successful use.

Another issue that needs to be taken into consideration is the inclination for clinicians to be questioning, says Dr Fenech. "As doctors and nurses, we are trained from the very beginning of medical school to be sceptical, so if we want to use a new intervention, we have to ask: 'how is this better than what I am already doing?'. For a lot of these digital tools there is no evidence because the studies haven't been done yet."

Harwich believes lower priority functions are a good place to start. "We can see quite interesting results in the back office without the need for too much upfront investment, and where solutions might be easier to scale. These solutions could free up clinician time that will create a pathway for further change – the process will be gradual, but it needs to start where immediate benefits can be reaped, so clinicians understand there are benefits. If they can see that technology is an enabler, they might be more amenable to other applications."

Professor Wyatt agrees that an evidence base for AI tools will be crucial if they are to be taken up, as "the culture of medicine is focused on evidence". He says, because of this, decision support tools should be able to demonstrate to clinicians how they reach a conclusion. "Clinicians would be unwise to use the output from a black box deep learning system because they don't know where that result came from. AI tools may be more accurate, but they will actually be less clinically useful if they are not explicit."

While these cultural challenges will clearly need significant attention, the core barrier to widespread AI take-up is arguably a logistical one. Using AI to analyse large data sets requires huge computational power and the data sets need to be high-quality. The vision set out in the Long Term Plan is at odds with the current functionality of the system and what this is able to achieve.

A document published by Intel detailing infrastructure considerations for IT leaders across all sectors identifies that, for deep learning inference to be carried out at scale, the architecture requires a "brand new approach, including creating flexible data centres capable of pooling huge resources of on-demand compute" as well as storage, connectivity, and high-speed networks.[16]

A King's Fund report exploring what new technology means for the NHS highlighted the "fragmented nature of the healthcare system" with "electronic data repositories that are not able to interface with one another".[17] Harwich says the lack of interoperability within the NHS system is a tangible limitation to progress. "The technical infrastructure and data architecture needed to harness the value and power isn't there – data isn't held or standardised in a way that is fully machine readable. Trusts have problems sharing data between departments, let alone across the system."

Having all patient records fully digitised across the system is a clear requirement for AI algorithms to work. This is supported by the expectation, detailed in the Long Term Plan, for all providers "to advance to a core level of digitisation by 2024". The introduction of a single terminology, SNOMED CT, will go a long way in improving the integrity of data and the NHS has set a target of 2020 for electronic health records across all clinical settings to move to SNOMED CT.[18]

Interoperability is clearly a key focus of digital transformation within the NHS – it was named as a top priority by 82% of respondents in the 2018 NHS Leadership Survey. The survey also found that the use of cloud services is rising across the NHS, with just 8% of respondents saying their organisation did not use cloud-based services for any part of their IT operation, down from 21% in the previous year.[19]

> The NHS is sitting on a potential goldmine of cradle-to-grave data but, in practice, the data is stored in different places that don't communicate with each other, and a large amount is still on paper. These big data sets require a joined-up approach.
>
> **Dr Fenech**

The migration to cloud services is an important step in enabling data to be accessed quickly and easily. The Long Term Plan acknowledges that without access to timely and accurate data, the NHS "cannot maximise the opportunities to improve care for all patients". Dr Foley says making data more quickly available must be a priority. "Often it can take six weeks from being submitted for patient data to be made available for research. For some applications, like decision support tools or predictive analytics, that might be too long. We put a lot of effort into collecting data – we need to allow clinicians to make better use of that data."

Health Data Research UK found that only a fraction of NHS and research data is accessible and being used for research and innovation, and the UK government has committed to tackling this by funding a national Digital Innovation Hub Programme, which aims to "increase the access and use of health data in a trustworthy and ethical way in order to develop improvements in the UK's health technology".[20]

There are other ethical concerns around AI that the healthcare sector generally will need to consider and mitigate. Regulation is a major issue, as Professor Trenell explains: "At the moment, frameworks for the approval of AI-based solutions don't exist in the UK, so even if there was a great tool, it would be difficult to roll out at scale". The recently formed NHSX has plans to create a policy toolkit "designed to ensure that artificial intelligence is used responsibly in the delivery of healthcare".[21]

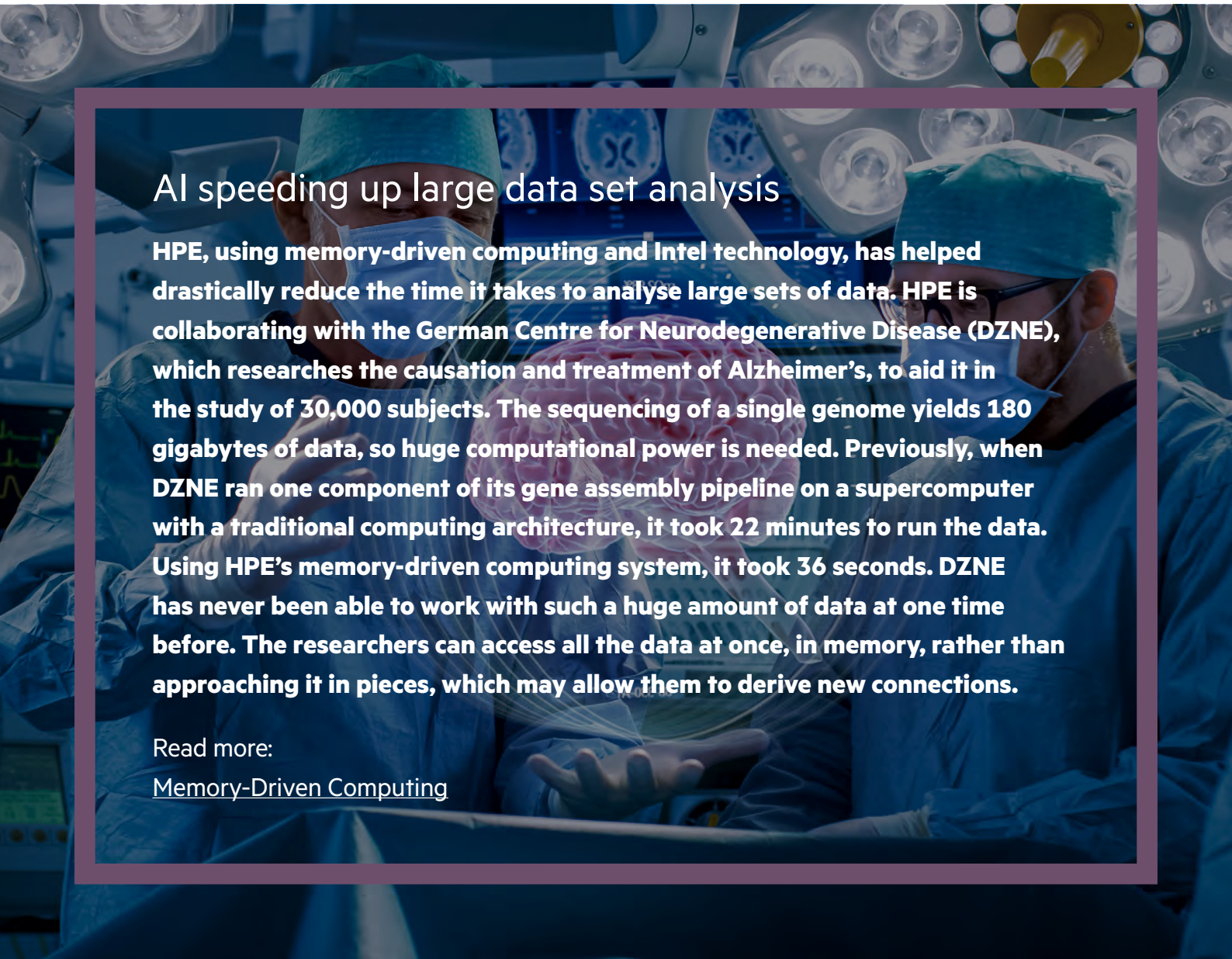
Data diversity is another major concern, and a particularly big issue for the NHS. Data sets will need to be broad in order to be fully representative of the populations they hope to serve but, especially since GDPR legislation came into force, complete data sets look to be increasingly harder to assemble.

A poll commissioned by the Health Foundation found that understanding of the use of data by both the NHS and commercial research organisations was fairly poor amongst the public. Clear, detailed communication around the use of patient data will be needed to mitigate public fears over data

security and privacy. Patients would perhaps be happier for their personal information to be used by the NHS if they understood that it is needed for research and development of new technologies and to ensure that AI algorithms are fair, and that, ultimately, sharing their data could help increase the quality of the healthcare they receive.

Professor Trenell agrees: “The consultations that have gone on so far with the public are quite clear that the public are happy to share their data as long as it provides benefit for the population. The barrier around data sharing is our historic view that the data is owned by care teams, but actually it’s owned by the patients, so the pivotal switch will be to look at how we can have meaningful engagement with citizens of the UK to change this. AI in the NHS shouldn’t be driven by just care teams, politicians, policymakers, and the IT industry but by the citizens themselves.”

It is imperative to get the data architecture right now to lay the groundwork for a truly data-driven healthcare service in the future, says Dr Foley. “The ultimate objective has to be a health service that learns from every patient who is treated – that’s something that hasn’t been possible in the past, but it is now becoming possible. Data can help to transform the way the NHS operates at every level.”



AI speeding up large data set analysis

HPE, using memory-driven computing and Intel technology, has helped drastically reduce the time it takes to analyse large sets of data. HPE is collaborating with the German Centre for Neurodegenerative Disease (DZNE), which researches the causation and treatment of Alzheimer’s, to aid it in the study of 30,000 subjects. The sequencing of a single genome yields 180 gigabytes of data, so huge computational power is needed. Previously, when DZNE ran one component of its gene assembly pipeline on a supercomputer with a traditional computing architecture, it took 22 minutes to run the data. Using HPE’s memory-driven computing system, it took 36 seconds. DZNE has never been able to work with such a huge amount of data at one time before. The researchers can access all the data at once, in memory, rather than approaching it in pieces, which may allow them to derive new connections.

Read more:
Memory-Driven Computing

What can senior decision makers do today in order to facilitate greater adoption of AI in the NHS?

While the scale of the challenge is daunting and progress will be incremental, there are steps that can be taken to build an AI-ready NHS.

Culturally, leaders need to garner trust around new technologies and align teams in a common vision, which can be done in several ways. Clinicians and patients should be engaged with at the earliest stages of development to find out where needs are, and engineers must develop an understanding of

> "The changing political landscape brings immense opportunity. Regulatory frameworks are being reset, views on how we do things are being challenged, and that all creates an opportunity to look at bringing in innovation."

clinician workflow in order to identify how these tools will be used in real clinical settings. AI trials in clinical settings would provide valuable evidence demonstrating the effectiveness of tools that can help to foster clinician buy-in. Wider health economics research would also demonstrate to key stakeholders that tools can and will be beneficial.

The technical infrastructure presents a great challenge but is critical to get right in order to cultivate sustainable AI usage, as tools will not be taken up if they are unreliable. The degree of AI readiness varies greatly from trust to trust so, while the creation of an interoperable system may be a long way off, trust leaders and CIOs can work to ensure that they are generating high-quality, consistent data, that this is stored in an easily retrievable format, and that they invest in the hardware and processing power needed to host AI applications.

Trusts each face a specific set of challenges that vary depending on resources and population. Trust leaders should, therefore, approach AI implementation on a needs-driven basis. Successful AI requires collaboration, so trust leaders need to make a choice to either work towards building their own ecosystem of partners or to work with an organisation that already has an ecosystem in place.

Recommendations for leaders

1. Make a choice to either work towards building an ecosystem of partners, or to work with a partner that already has an ecosystem to support AI in place
2. When choosing technologies, facilitate lasting change by thinking first about the needs of specific services and the reality of clinical settings and workflow
3. Encourage buy-in from clinicians and patients by engaging with them to find out what they want from AI
4. Invest in the digital infrastructure needed for AI and focus on creating an interoperable system that will enable data sharing
5. Build trust and support for AI and data sharing by educating the public on why their personal information is needed to advance healthcare technologies and how it will be used
6. Work on making data sets more available for research and testing to build up an evidence base for AI tools

AI Centre of Excellence

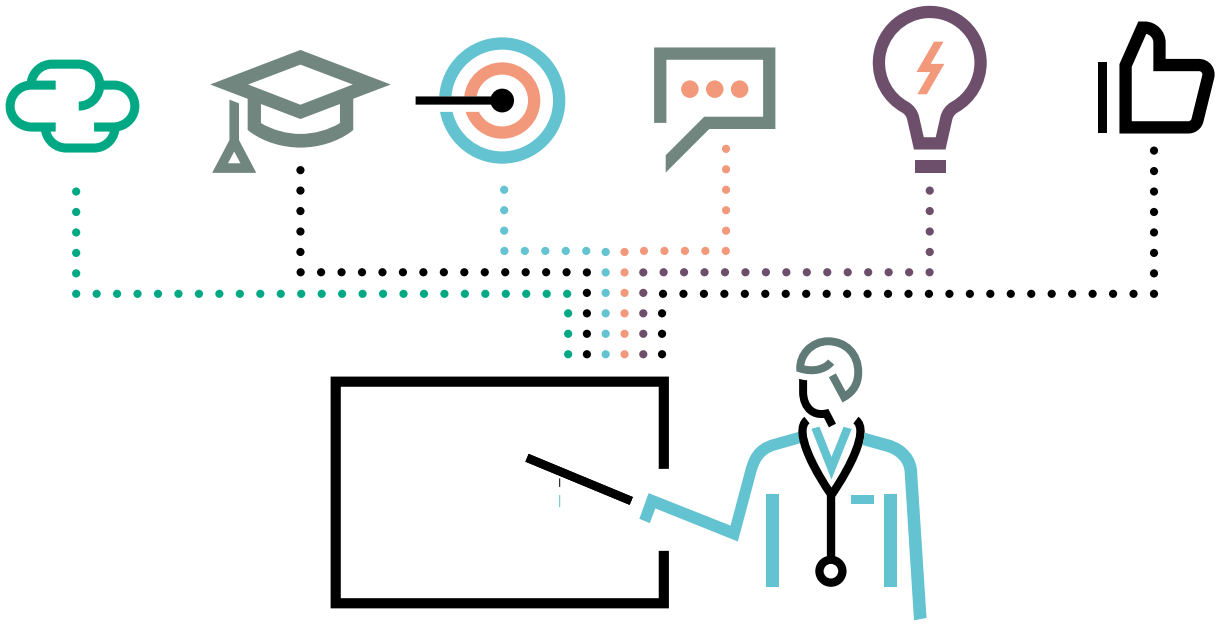
Through a strategic partnership, HPE and Intel are committed to helping advance customer innovation and help expand accessibility of High Performance Compute and AI to organisations and enterprises of all sizes. Our AI Centre of Excellence, based in Grenoble, brings together a community of experts from both companies to support customers in planning, developing, deploying and managing solutions, helping accelerate ideas into tangible business outcomes.

Conclusion

It is clear that AI has a significant role to play in the future of healthcare and could bring substantial benefits across organisations and, in light of the pressures it faces, particularly for the NHS. The ability of AI to drive efficiencies in clinical care means it could be extremely valuable and help deliver on many of the ambitions laid out in the Long Term Plan. It is also clear, however, that the wide-scale adoption of AI in the NHS is not without complications and barriers.

This report highlights that there are certainly a host of wins achievable in the next few years, in areas such as medical imaging, triage, and administration. AI can also be hugely beneficial in supporting patients to manage their own health at home, which could have positive effects on other parts of the service. Trust leaders and CIOs have the power to install solutions that can help their workforce meet the demands of the local population. For AI to have a real impact on patient treatment, however, policymakers will need to address the quality of NHS data sets and the capacity for data sharing across the system.

Investments made in the next few years could define the health service going forward. HPE and Intel are already forging partnerships that are accelerating the adoption of high-performance computing, and they are looking to create technologies that can help the NHS position itself as a leader in AI. Action must be taken now if the Long Term Plan vision of a health service that works for patients, clinicians and communities is to become a reality.



Interviewees

Dr Tom Foley, Clinical lead for data at NHS Digital
Professor Jeremy Wyatt, New technologies clinical lead at Royal College Practitioners
Eleonora Harwich, Director of Research and Head of Digital & Tech Innovation at Reform
Professor Mike Trenell, Director at NHS National Institute for Health Research Innovation Observatory
Dr Matthew Fenech, artificial intelligence consultant

References

If you are looking for additional resources then please see below a selection of links to help you.

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2 longtermplan.nhs.uk/
3 assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/767549/Annual_report_of_the_Chief_Medical_Officer_2018_-_health_2040_-_better_health_within_reach.pdf
4 forbes.com/sites/danielaraya/2019/01/22/3-things-you-need-to-know-about-augmented-intelligence/#c7757153fdc0
5 ahsnnetwork.com/wp-content/uploads/2014/12/AHSN-Network-AI-Report.pdf
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11 futureadvocacy.com/wp-content/uploads/2018/04/1804_26_FA_ETHICS_08-DIGITAL.pdf
12 healthmatters.org.uk/history/seven-ten-brits-now-use-google-self-diagnose-treat-minor-health-issues/
13 pagb.co.uk/content/uploads/2016/06/PAGB_AE_Executive_Summary_June-2015.pdf
14 media.nesta.org.uk/documents/confronting_dr_robot.pdf
15 futureadvocacy.com/wp-content/uploads/2018/04/1804_26_FA_ETHICS_08-DIGITAL.pdf
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18 Build1/Downloads/AI%20in%20Healthcare%20report_WEB.pdf
19 digitalhealth.net/2018/07/interoperability-now-the-top-priority-for-nhs-it-leaders/
20 hdruk.ac.uk/wp-content/uploads/2019/03/190311-Digital-Innovation-Hubs-Discussion-Paper-March-2019-1.pdf
21 publictechnology.net/articles/news/nhsx-create-policy-guide-use-ai-healthcare
22 kingsfund.org.uk/sites/default/files/2018-06/NHS_at_70_what_will_new_technology_mean_for_the_NHS_0.pdf

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