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Policy paper

The future of healthcare: our vision for digital, data and technology in health and care

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Introduction

All around us, a new generation of technology is changing our lives, from the everyday use of satnavs and smartphones through to the profound ability of genomics to help us develop personalised medicines for individuals

(https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/464088/BIS-15-543-genomics-in-the-UK.pdf).

Yet the state of online services, basic IT and clinical tools in health and care is far behind where it needs to be. Despite much good practice and some pockets of excellence, for many people – patients, service users, carers and staff – we still need to sort the basics.

Technology systems used daily across hospitals, GP surgeries, care homes, pharmacies and community care facilities don't talk to each other, fail frequently and do not follow modern cyber security practices. As a result, some people are getting suboptimal care,^{1,2} staff are frustrated (<http://www.nhsstaffsurveys.com/Page/1064/Latest-Results/2017-Results/>) and money could be saved (<https://www.england.nhs.uk/five-year-forward-view/next-steps-on-the-nhs-five-year-forward-view/funding-and-efficiency/>) and released for the front line.

Just being able to make the best use of mainstream products and services would transform health and social care in this country.

But it's not just about getting the current systems to work better – our ambition should be for the use of the best technology available for the NHS and social care sector. The potential of cutting-edge technologies to support preventative, predictive and personalised care is huge.

For example, we could use more data-driven technologies such as artificial intelligence (AI) to help diagnose diseases or conditions and to gain better insights into treatments and preventions that could benefit all of society (https://www.kingsfund.org.uk/sites/default/files/2018-06/NHS_at_70_what_will_new_technology_mean_for_the_NHS_0.pdf). Or we could use robotics and voice assistants to support people and their carers in rehabilitation, dementia support or medication management. And appropriate use of NHS data could radically reduce the cost and time needed to generate new evidence on the effectiveness of interventions.

To reach this potential we need to focus on getting the basics right: the digital architecture of the health and care system – the building blocks. Open standards, secure identity and interoperability (<https://en.wikipedia.org/wiki/Interoperability>) are critical to the safe and successful use of technology, ensuring that systems talk to each other and that the right data gets to the right place at the right time.

We need modular IT systems, where any module can be easily switched out, to create a market where providers compete on – and are rewarded for – quality. We also need to make sure patients and people who use care services have confidence that their data is held securely and used appropriately.

But the gap between where we are and where we want to be is only getting bigger.

We need to take a radical new approach to technology across the system and stop the narrative that it's too difficult to do it right in health and care.

The UK has the chance to lead the world on healthtech. We already have some of the world's leading healthtech companies bringing new innovations and advancing the international reputation of our excellent science and research base. And, in the NHS, we have the world's biggest health institution (<https://www.bbc.co.uk/news/magazine-17429786>). We have the opportunity to build an ecosystem that continually creates the best healthtech – technology that can be exported, alongside new methods and insights that can contribute to health outcomes globally.

We are committed to working with partners to make that happen.

This document sets out the government's vision for the use of technology, digital and data within health and care, to meet the needs of all our users.

Our ultimate objective is the provision of better care and improved health outcomes for people in England. But this cannot be done without a clear focus on improving the technology used by the 1.4 million NHS staff,^{3,4} 1.5 million-strong social care workforce (<https://www.skillsforcare.org.uk/NMDS-SC-intelligence/Workforce-intelligence/publications/The-size-and-structure-of-the-adult-social-care-sector-and-workforce-in-England.aspx>) and those many different groups who deliver and plan health and care services for the public.

This vision sets out a new approach that we want to develop collaboratively. We've set out what we want to see and how we think we should get there. This includes setting clear standards for the use of technology in health and care.

We don't have all the answers – this should be the beginning of an open conversation about how we can iterate to best achieve what is needed and work with the many brilliant, forward-thinking people in the system to get it right.

It is clear that across the health and care system, there is a lot of good work locally and nationally to build on. We have included examples of this best practice throughout. Many truly engaged professionals are working hard to improve health and care through the implementation of national and local systems, and through the introduction of new healthtech innovations.

We must now all unite around a common vision to drive this forward together, harnessing innovation in the full spectrum from the most mundane to the most exciting, from basic IT to advanced AI.

Guiding principles

To achieve this vision, we have many real challenges to overcome:

- legacy technology and commercial arrangements
- complex organisational and delivery structures
- a risk-averse culture
- limited resources to invest
- a critical need to build and maintain public trust^{5,6,7}

At the heart of this vision are 4 guiding principles we should maintain to make this work:

- user need
- privacy and security
- interoperability and openness
- inclusion

And we need to draw on emerging thinking on designing technology safely, ethically and effectively for the values and interests of civil society.⁸

Ask what the user need is

Every service must be designed around user needs, whether the needs of the public, clinicians or other staff.

Services designed around users and their needs (<https://www.gov.uk/service-manual/user-research/start-by-learning-user-needs>):

- are more likely to be used
- help more people get the right outcome for them – and so achieve their intent
- cost less to operate by reducing time and money spent on resolving problems

Privacy and security

It is critical that we maintain public trust in how we hold, share and use data. Clear and mandated standards, guidance and frameworks for this will underpin the delivery of the best services and outcomes that meet user need and are based on the General Data Protection Regulation (GDPR) and consent where appropriate.

We need to maintain a safe and secure data infrastructure that protects health and care services, patients and the public. The digital architecture of the health and care system needs to be underpinned by clear and commonly understood data and cyber security standards, mandated across the NHS, to ensure we are secure by default and that the penalties for data breaches are effective in protecting patients' privacy.

Interoperability and openness

Our technology landscape is varied and diverse, and interoperability is poor. This:

- increases costs because we are not taking advantage of economies of scale⁹
- has patient safety implications and increases errors¹⁰
- introduces delays in the transmission of data from one system to another¹¹
- slows the digitisation of those parts of the system still very poorly served by technology

The data and technology standards we agree to will be open so that anyone can see them and anyone writing code for use in the NHS knows what the standards are before they start. But it's not just about technology – agreeing and adhering to clinical data standards will give us much better and more granular detail with which to fight disease and prevent and treat illness.

We should be using the best off-the-shelf technology where our needs are like everyone else's, and not building bespoke solutions where they are not needed.

Inclusion

Health and care services are for everyone. We need to design for, and with, people with different physical, mental health, social, cultural and learning needs, and for people with low digital literacy or those less able to access technology. Different people may need different services and some people will never use digital services themselves directly but will benefit from others using digital services and freeing resources to help them. We must acknowledge that those with the greatest health needs are also the most at risk of being left behind and build digital services with this in mind, ensuring the highest levels of accessibility wherever possible.

Architectural principles

We are putting an end to the illusion that health and care technology needs to be special. We deserve software and kit that helps us meet our goals, and we should adhere to these architectural principles to achieve this.

1. Put our tools in modern browsers

When we make all of our digital services available in the browser, according to open web standards, we:

- release all of our users – and their trusts, CCGs or any other administrative grouping – to choose any modern computers and operating systems that meet their needs

- open our ecosystem to some of the world's best user experience designers, who can help us meet our needs and reduce friction in our jobs
- do not require our users to pay a software provider or app store to use the services essential to their health and care or their jobs
- move to a mobile-first approach and make the same digital services easily accessible from mobile phones, tablets, laptops and assistive technologies like screen readers. We recognise that our users access digital services in a variety of contexts, and technology like mobile alerts and responsive design can be critical to supporting the workforce in their roles
- get the benefit of the continual security and functionality improvements that come with the 'evergreen' ecosystem of modern browsers and web technologies

2. Internet first

When we adopt internet standards and protocols for our networks and digital services:

- we maximise the amount of technologies and digital services that will work for us and for those we care for
- we maximise the number of developers and software engineers that can help us transform health and care and meet the needs of our users
- we minimise what you need to learn to build software and digital services for health and care
- we maximise the amount of distributed data we can handle

Our health and care system will never be a centralised service, because it services the citizens of an entire nation, and so too should its infrastructure not be centralised. But appropriate access to our data from any part of it – like you can access your email from anywhere, as long as you have the right passwords – is an important part of delivering care and staying healthy where we want to be

3. Public cloud first

When we start with the assumption that all our services should run in the public cloud with no more locally managed servers:

- we get the resilience and backups of some of the most cyber-aware and heavily invested companies in the world
- we can run and grow projects that work with infinite amounts of data or have unpredictable processing needs
- we can share data to increase security – and only those with appropriate access are able to see the data they need
- the commodity services we use, like word processing, should be continually upgraded and improved – without massive migration projects

This is in line with the guidance published by NHS Digital (<https://digital.nhs.uk/data-and-information/looking-after-information/data-security-and-information-governance/nhs-and-social-care-data-off-shoring-and-the-use-of-public-cloud-services>) in January 2018.

4. Build a data layer with registers and APIs

Efficient data management and discovery means that we should store data once – usually where it is created – and make it available where appropriate. When we build registers of data and make them accessible over open application programming interfaces (APIs):

- every digital service that relies on those registers is kept up to date by default

- we look at delivering and maintaining a register like delivering a service to the NHS and to our patients. A team looks after that data, maintains its uptime and accuracy, and notifies its users when changes are made. We take that responsibility seriously
- we don't need costly large databases of personal health and care data to deliver our services and meet our research aims – and smaller, dispersed datasets mean fewer large attractive targets for hackers.

5. Adopt the best cyber security standards

When we adopt the best cyber security standards of industry, including keeping our software, networks and systems up to date, we:

- maintain the confidence of our users
- are able to build and buy securely

6. Separate the layers of our patient record stack: hosting, data and digital services

When we have separate contracts and separate approaches for each of the pieces of our patient record stack, we:

- get to improve and upgrade each layer without disrupting the others
- get the benefit of the country's digital and technology specialists in the areas they know best – no longer needing a specific workforce to support bespoke systems
- can create a modular ecosystem of digital services competing on quality to meet the needs of all our staff and patients in every specialty and every part of the country
- no longer have to undergo expensive, risky and disruptive data migrations every time we want to use a different digital service
- can break those large contracts that give us little freedom into a series of smaller contracts that let us take advantage of the best approaches and features
- can ensure that our privacy and security aims for safeguarding patient data are protected with the most up-to-date architectures

Our priorities

There are 4 areas where we need to act.

1. Infrastructure

Put in place the right infrastructure so hospitals, GPs, pharmacies and community and social care providers can join up people's care, and patients don't have to repeat their medical history or care needs to different people, where systems can talk to each other safely and securely, using open standards for data and interoperability. And being open with people about how their information is used so that they have confidence that it is legal, safe and secure.

Buy the best technology – changing the way we buy broadband contracts, laptops and desktops, software licences and developer time so we break the supplier capture. We want staff who work in the health and care system to have technology that helps them to do their jobs effectively, and for NHS and social care organisations – and taxpayers – to get the best value for money.

2. Digital services

Ensure that digital services meet people's needs – understand who the users of a system, website or service are, what they need to do, the problems or frustrations they experience and what they need from a system, website or service to achieve their goal.

3. Innovation

Enable healthtech and innovation so the cutting-edge technology developed by our thriving healthtech economy can be more easily developed and used across the health and social care system, and the NHS and social care can benefit from world-leading innovation and research.

4. Skills and culture

Develop the right skills and capabilities so staff are supported and leaders are able to drive the best outcomes. The right skills are not only digital skills but the leadership and change management skills needed to iterate and improve.

Build an open culture, working with innovators, academics, industry, staff and the people who use health and care services to deliver better outcomes for everyone, welcoming feedback and seeking constant improvement.

1. Infrastructure

Right now, we have too many systems that don't talk to each other, often because the contracts we have in place do not adequately specify the standards of interoperability, usability and continual improvement that are needed.^{12, 13}

Central to our need for interoperability is the patient record – not a system or application but the patient's data itself. The ability to share records between hospitals, GPs, community pharmacies and care providers is inconsistent¹⁴ and people are frequently discharged from hospital without sufficient or accurate information about their care needs (https://www.cqc.org.uk/sites/default/files/20180702_beyond_barriers.pdf).

Our technology infrastructure should allow systems to talk to each other safely and securely, using open standards for data and interoperability so people have confidence that their data is up to date and in the right place, and health and care professionals have access to the information they need to provide care. Interoperable, connected health information in other countries has shown cost-and time-saving benefits, including enhanced care co-ordination and a reduction in unnecessary diagnostic testing¹⁵. We need to replace legacy architectural decisions to keep up with modern technology.

See case study 1: Whole Systems Integrated Care.

Data safeguarding and cyber security measures

Our ability to unlock the benefits of high-quality data available across care settings relies on the public having confidence in our appropriate and effective use of data. To strengthen public trust in how we hold, share and use data it is essential to have the right bedrock of cyber security, rules around privacy and data sharing, and strong relationships with the National Cyber Security Centre and other security bodies.

The WannaCry attack in 2017 showed how much disruption can be caused by cyber attacks and how critical it is that we do all we can to reduce the risk associated with security exposures. The National Audit Office report (<https://www.nao.org.uk/wp-content/uploads/2017/10/Investigation-WannaCry-cyber-attack-and-the-NHS.pdf>) found that WannaCry “was a relatively unsophisticated attack and could have been prevented by the NHS following basic IT security best practice”. We know that more attacks are inevitable and we need to ensure everyone is following clear and commonly understood data and cyber security standards, which we enforce to protect patients' privacy.

We need to build on the existing safeguards in legislation, security standards, toolkits and independent advisory bodies, and ensure that data is shared across the system in a safe, secure and legal way.

GDPR (<https://ico.org.uk/for-organisations/guide-to-the-general-data-protection-regulation-gdpr/>) is the basis of our legal framework for data protection and consent. In addition, the National Data Guardian for Health and Social Care (<https://www.gov.uk/government/organisations/national-data-guardian>) is an independent voice for individuals in how their data is used in the health and care system.

NHS Digital's Data Security and Protection Toolkit (<https://digital.nhs.uk/data-and-information/looking-after-information/data-security-and-information-governance/data-security-and-protection-toolkit>) describes the 10 data security standards that all organisations with access to NHS patient data and systems must adhere to. These standards are specific in nature and range from access control systems to the management of obsolescent technology and supplier management.

In September 2018, the Initial Code of Conduct for Data-Driven Health and Care Technology (<https://www.gov.uk/government/publications/code-of-conduct-for-data-driven-health-and-care-technology/initial-code-of-conduct-for-data-driven-health-and-care-technology>) was published, with the aim of creating a safe and trusted environment that encourages innovation and ensures that any benefits from partnerships between technology companies and health and care providers are shared fairly. This code of conduct will be continually iterated to keep it valid and responsive to changes and developments.

Steps like these are vital so that the NHS remains the most trusted institution in the country for using data and people have equal trust in our care system. If data is to be used effectively to support better health and care outcomes, it is essential that the public has trust and confidence in us and can see robust data governance, strong safeguards and strict penalties in place for misuse.

Open standards

Digital transformation across a large set of organisations requires clear standards to be set centrally so that organisations can make decisions that meet their own local needs. We have seen this approach applied in other parts of government (<https://www.nao.org.uk/wp-content/uploads/2017/03/Digital-transformation-in-government.pdf>), and we know that, done right, it works.

For too long we have done things nationally that get in the way of local health and care organisations using new technologies to serve their populations, and we have missed the opportunity to set the rules for interoperability.

According to the architectural principles above, we will set the minimum rules needed to guarantee data interoperability, safe use of our data and effective and efficient contracts with industry.

We will provide support as well, but we will not mistake support and guidance for hard-and-fast rules. For those areas that have the skills and are already transforming their service delivery, we don't want anything national to get in the way.

We need a clear set of standards that the NHS must adhere to in order to achieve our vision of a standards-based ecosystem.

We will set national open standards for data, interoperability, privacy and confidentiality, real-time data access, cyber security and access rules.

Open standards are not an abstract technical goal. They permit interoperability between different regions and systems but they also, crucially, permit a modular approach to IT in the NHS, where tools can be pulled and replaced with better alternatives as vendors develop better products. This, in turn, will help produce market conditions that drive innovation, in an ecosystem where developers and vendors continuously compete on quality to fill each niche, rather than capturing users.

Alongside this vision document, NHS Digital has published a new draft NHS digital, data and technology standards framework (<https://digital.nhs.uk/about-nhs-digital/our-work/nhs-digital-data-and-technology-standards>) setting out early thinking and expectations for the use of data, interoperability, design and IT commercial standards within the NHS.

And we will work with local government and the wider social care system to consider how we can develop appropriate and effective standards that support the sharing of information between providers and commissioners.

We know that these standards must be open, based on international standards and work already done with independent advisory bodies, and based on clear evidence of being useful, usable and used to address the needs of patients, people who use care services and health and care staff.

Standards will be in line with the government's Open Standards Principles (<https://www.gov.uk/government/publications/open-standards-principles/open-standards-principles>), because working in this way clears away barriers to reuse and innovation, and creates a level playing field for all commercial interests.

We will continue to work collaboratively to develop user-centred design standards and patterns and practices (<https://beta.nhs.uk/service-manual/>) for public-facing services to accelerate the delivery of safe and intuitive systems that work well together.

These standards will be mandated throughout the NHS.

We will provide guidance and support to help organisations in the NHS meet agreed standards.

Detailed specifications for each of the standards referenced in the new framework will be published over the coming weeks, starting with data standards. We will iterate the framework with your feedback, and agree the approach to mandating standards and to enforcement.

To begin this work, we will ask NHS Improvement to take account of NHS trusts' compliance with the standards as part of their oversight of providers, and NHS England to include the standards in their standard contract so that all purchasing is consistent with best practice.

We will also ask the Care Quality Commission ([CQC](https://www.cqc.gov.uk/)) how best to reflect the standards in their inspections of NHS and social care providers, and NHS Improvement and NHS Digital to work together on the use of spend controls to enforce the use of standards when procuring new systems for the NHS, looking at additional controls for spend on systems and services that are below current thresholds.

The standards will also be part of the framework for GP systems providers and Local Health and Care Records Exemplars (<https://www.england.nhs.uk/wp-content/uploads/2018/05/local-health-and-care-record-exemplars-summary.pdf>) that support the NHS and social care to join up locally.

In the information age, IT is at the core of everything an organisation does. Ensuring compliance with open standards at the point of procurement will therefore be a top priority throughout the health system, because any breaches of these principles can significantly hold back the provision of safe outstanding care, regionally and nationally, while substantially driving up costs.

Standards that meet user needs

We must be clear how these standards address the user needs of people who use health and care services, carers and families, as well as care professionals and commissioners. We intend that:

- patients, people who use care services and their carers and families should not have to repeat themselves – they should be reassured that the treatment they are given is based on their care provider having access to relevant information
- citizens who wish to personalise their use of health and care services should be able to access their care record, contribute to it and use apps that enable them to self-care, knowing that the information is secure and available to care professionals in all settings, and having a consistent and convenient user experience
- care professionals should be able to access vital information about their patients at the point at which they need it most, available across venues of care in a consistent and understandable format
- care professionals should be able to record information about the patient and trust that it will be readily available to others involved in their care
- care professionals should be able to use decision support tools to provide the best care, medicine or device for a patient based on accurate and available data
- researchers and service commissioners should be able to apply algorithms to analyse data for planning and research
- vendors with products that could support patients can, with consent, securely access and contribute information back to a patient's care record

More information about how sample standards allow us to meet these user needs is found in Annex B: sample standards and user needs.

Meeting these standards will increasingly allow us to share data across the system, analyse and drive insights from that data, and procure and redeploy technology with greater efficiency and at lower cost than has been possible before.

And there is good work to build on in local organisations. Local Health and Care Records Exemplars (<https://www.england.nhs.uk/publication/local-health-and-care-record-exemplars/>) are based on locally led delivery, joining up data from health and social care, gaining and maintaining trust by bringing along the public and care professionals with attention paid to privacy from the start.

The Global Digital Exemplars (<https://www.england.nhs.uk/digitaltechnology/connecteddigitalsystems/exemplars/>) – NHS trusts who are leading the transformation of healthcare technology in England – are also working towards becoming world-class examples of digitised health and care organisations and will lead the way for others to learn from. The blueprints they develop will make it quicker and cheaper for others to reach the same standard.

We will use digital maturity models such as the international Health Information and Management Systems Society (<https://www.himssanalytics.org/emram>) (HIMSS) to increase the efficiency and safety gains of a fully digitised healthcare service for all hospitals.

See case study 2: Great Manchester Local Health and Care Record.

Buy the best technology

We need technology that makes life easier for staff and those using health and care services and their families. Many staff are resorting to paper-based processes as workarounds because the technology they use is slow and clunky¹⁶ and others still work in paper-based¹⁶ organisations where mobile working and digital technology could increase efficiency and productivity.¹⁷

Yet others report significant improvement in working practices from the adoption of technology that works for them.¹⁸ Digitisation will save health and care providers money and free up staff time – money and time that can be better used to provide great care.

See case study 3: software for electronic rostering.

Local system leaders should ensure that the technology available to staff meets at least their basic needs, and that internal processes aren't preventing staff from making the best use of technology in their jobs. Use of IT systems should not be an additional burden they need to be extensively trained for. We need to build technical skills in the whole health and care system to help professionals and leaders to manage their technology, articulate their user needs better and buy the best tech.

The health and care technology ecosystem is constantly delivering improvements and disruptions, many of which could help our health and care system significantly. To take advantage of these, we need quick, efficient procurement processes, small and short contracts, and clear documentation of our own architecture – our datasets and systems.

For the NHS, we also want to remove the barriers to technology providers selling into the system – removing the need for innovators to travel the country selling to one trust at a time. We will support the procurement of technology through the application of procurement frameworks.

All new IT systems purchased by the NHS will be required to meet the standards we set out and existing services will need to be upgraded to meet these standards.

As customers or commissioners, we should set out the kind of user experience we expect digital, data and technology to deliver to meet sensible goals, not specify a particular system or supplier.

We will support health and social care organisations to spend money wisely on technology.

Organisations in the health and care system must have access to – or, for the larger organisations, have in-house provision of – the capacity and technical expertise to understand contracts, to be better, more informed customers. Contracts should be short and avoid lock-in, enabling teams and organisations to swap in and out of better, cheaper services as they become available. Often contracts need to be broken into smaller constituent parts. This not only lets us continue to meet our user needs in better ways – it also encourages competition in industry, which can only result in better tools for us.

Those organisations providing support and advice to organisations in the sector should embed these principles for technology contracts in their work.

We need to build in flexibility so that local organisations can buy technology and services to meet local needs, from within common standards. We will develop new frameworks, where required, to ensure a competitive marketplace and value for money.

Whenever appropriate we should use common services and build on stable and predictable platforms (<https://www.gov.uk/service-toolkit#components>) to help us save money, reduce complexity and enable innovation, acknowledging that other sectors may have already solved similar problems (<https://www2.deloitte.com/insights/us/en/industry/public-sector/gov-on-the-go.htm>).

We need to redraw the lines between what technology we create and what we buy. We should not be building our own versions of the commodity services that industry is delivering so effectively, like email clients, laptops and network routers. Instead, we should be empowered to buy the tools we need, like we do in the rest of our lives. Equally, we need tech-savvy staff in the NHS who understand that new and innovative things can be done very cheaply to address clinical needs in small niches, using low-cost bespoke software assembled by good software engineers from off-the-shelf open source modules.

Like running our own operating theatres, we must be able to manage the technologies we use and be active participants in the supply chain. We know that many of the problems of the past have come from outsourcing our decision-making about our technology. We need staff at the highest level in the health service – both locally and nationally – with the technical fluency needed to be a competent customer: to rapidly identify quick wins from technology, while rapidly dismissing digital 'snake oil'.

See case study 4: intelligent alert system for early diagnosis of sepsis.

2. Digital services

Public-facing digital services should support and empower people to stay healthy and independent for longer. This will include, among other things, secure online access to clinicians, personalised and relevant health information, and digital tools and advice that meet the growing expectations of consumers

([https://www.kingsfund.org.uk/sites/default/files/2018-](https://www.kingsfund.org.uk/sites/default/files/2018-06/NHS_at_70_what_will_new_technology_mean_for_the_NHS_0.pdf)

[06/NHS_at_70_what_will_new_technology_mean_for_the_NHS_0.pdf](https://www.kingsfund.org.uk/sites/default/files/2018-06/NHS_at_70_what_will_new_technology_mean_for_the_NHS_0.pdf)). We already provide the UK's biggest health website, NHS.UK (<https://www.nhs.uk/>), which received over 500 million visits from people seeking advice last year (<https://digital.nhs.uk/news-and-events/news-archive/2017-news-archive/12-days-of-nhs-choices>), and the NHS apps library (<https://apps.beta.nhs.uk/>) now provides access to approved tools that offer personalised advice, self-care and tools for health and wellbeing. And we are already seeing people managing their NHS experience digitally, including viewing their GP record. We are developing NHS Login and the NHS App to support this evolution.

Staff across the whole health and care sector also deserve high-quality digital services that remove time-consuming or inconvenient processes and reduce their workload, ultimately freeing up time for care. They should not have to waste vital time logging on to systems, or transcribing clinical data by hand or over the phone.

All the services we build, buy or commission should start with user needs.

This means a different way of working for many: we must talk to the people who use the services, learn about what they need, then start small, test and make changes in line with user experience and feedback. We should always keep the outcome we're trying to achieve in mind, and understand that users may not always find it easy to articulate their needs. This does not make the user need any less important.

Services should be person-centred and consider people's entire experience, including the infrastructure and processes that surround their interactions. Patients need to be able to communicate with us about appointments and administrative issues in the way they run the rest of their lives – email, text messaging and apps are a much-needed evolution from the mountain of letters we post. No service should refuse to communicate electronically about these issues with a patient where they would previously have sent a letter.

Health and care is complex, but this complexity should not be pushed onto the users of our services. These design principles are set out in the NHS Service Design Manual (<https://beta.nhs.uk/service-manual/design-principles/>) and are open to feedback.

See case study 5: empowering patients with inflammatory bowel disease.

We need to build nationally only those few services that the market can't provide and that must be done once for everyone, such as secure login and granular access to data. This may mean some programmes need to be stopped.

However, the digital revolution in health and care cannot rely solely on the innovations of industry. There is a huge role for the NHS, care providers and commissioners of health and care services to develop solutions and co-create them with industry, recognising the value and expertise that health and social care organisations bring to the table in this co-creation.

Some of our user needs are unique, like carers in a particular geographical location or patients using assistive technologies. Or sometimes we can beat something to market because we know what we need and are motivated to solve the problem first.

In those circumstances where industry won't see the economies of scale they need to invest, we must be empowered to build our own digital services, often running on our data and networks. We will do that according to the government's Digital Service Standard (<https://www.gov.uk/service-manual/service-standard>), and within the minimal rules we set for our infrastructure.

We also want to reassure those who are currently building products that we have no intention or desire to close off the market – in fact we want exactly the opposite. We want to back innovations that can improve our health and care system, wherever they can be found – and we know that some of the best innovations are being driven by clinicians and staff up and down the country.

See case study 6: supporting care delivery and the workforce.

3. Innovation

The UK has many of the world's leading healthtech companies, as well as world-class research and academic institutes and the world's biggest health institution.

Just as we have created a world-class ecosystem to make the UK the world leader in fintech (<https://home.kpmg.com/uk/en/home/media/press-releases/2018/07/uk-global-leader-for-fintech-investment-in-h1-2018-.html>) (financial technology), so we can do the same in healthtech.

Our vision is of a health service that:

- supports innovators to develop safe and effective innovations that meet user needs
- promotes the testing and iteration of these innovations so they can be used with confidence
- ensures the best innovations are used so that the health and care system, the people who depend on it and innovators can benefit

We also want to lead the world in the development of innovations to support people to live healthy and independent lives for longer, working closely with industry to develop new attractive technologies for the public as part of the Ageing Society Grand Challenge (<https://www.gov.uk/government/publications/industrial-strategy-the-grand-challenges/industrial-strategy-the-grand-challenges#ageing-society>).

See case study 7: Trialling the use of the Amazon Echo in adult social care.

We will put in place a framework that allows researchers, innovators and technology companies to thrive, quickly access support and guidance, and develop products that meet user needs. Most importantly, we need to support the uptake and adoption of the best of those services.

We will work unceasingly to curate the healthtech – and emerging carettech – ecosystem so that innovators feel supported and can see our commitment to them and their groundbreaking discoveries.

Building an ecosystem means setting standards, communicating user needs, supporting access to finance and encouraging NHS/industry collaboration. It means removing barriers to market entry for innovators and developers, including streamlining and simplifying the landscape for innovation, so that innovators and those working in health and care know how and where to find the support they need.

We want to make the rules and opportunities as clear and simple as possible to create a competitive marketplace for innovation where any tech company can compete and have an equal opportunity to deliver.

The standards we set at the centre for evidence, privacy, cyber security and access to data will promote innovation by setting clear rules for innovators and commissioners. We will work with experts and users to develop these rules. They will provide a clear signal to innovators and the health and care system on the standards that will have to be met for an innovation to be used across the system.

It is essential that we are clear about the system requirements for innovation. Health and care organisations will be supported to better communicate their priorities to industry, making it easier for healthtech innovators to develop products that meet the needs of the NHS and patients. We will support the development of high-quality solutions to genuine problems.

We will work with NHS England and the National Institute for Health and Care Excellence ([NICE](#)) to develop a way of helping time-poor NHS staff identify and use innovations that are highly effective. We will consider the role that a funding mandate might provide and whether a ‘comply or explain’ model might be appropriate for the very best healthtech products.

We will put collaboration and co-development at the heart of innovation in health and care.

And, once products have been developed in line with standards and priorities, we will make it easier for the NHS to take advantage of these innovations by improving procurement.

We will work across the system to reduce the burdens faced by small companies when trying to sell into the NHS and make it easier for NHS organisations to quickly identify and buy products, improving the accessibility and use of procurement frameworks and their supporting processes, building on the work of the government’s G-Cloud framework on the Digital Marketplace. In many cases the G-Cloud framework (<https://www.gov.uk/guidance/the-g-cloud-framework-on-the-digital-marketplace>) can be used now.

Partnerships between innovators and the NHS must be at the heart of the ecosystem. Collaboration, co-development and iteration between innovators and the NHS will become the new norm. We know that the successful adoption and spread of innovation across the sector relies on trust between the innovator and the NHS and that these relationships are key to integrating the needs of staff and patients into products. Where there is good practice and an understanding of what does and does not work, we will help people learn from each other. We will look to provide increased support for clinician innovators working inside the NHS, because we know they are well placed to develop innovations that meet the needs of patients.

We will increase opportunities for real-world testing and iteration by creating safe spaces for innovators and clinicians to develop and test products, services, business models and delivery mechanisms.

We will provide opportunities for innovators to develop and prove their ideas in clinical and ‘real world’ settings, enabling innovators to develop the evidence they need to access the NHS and giving the NHS confidence in the quality and impact of a product.

To support innovators who are challenging the rules, we will introduce a healthtech regulatory sandbox, working with the Information Commissioner’s Office, the National Data Guardian, [NICE](#) and other regulators. The healthtech sandbox will let us test, iterate and de-risk the most promising innovations – and the relevant regulation – so that when they are ready for uptake across the NHS, clinicians can use them with confidence.

We will strengthen and simplify the institutional landscape for support for healthtech, which currently comprises the Academic Health Science Networks (<http://www.ahsnnetwork.com/>), the NHS Test Bed programmes (<https://www.england.nhs.uk/ourwork/innovation/test-beds/>) and the Digital Health Technology Catalyst.

Our goal is to simplify the landscape for innovators wanting to work with the NHS and to make it significantly easier for health technology innovators to navigate the system.

This is where the most exciting developments happen, in exploratory projects to cure disease with [AI](#), to adapt how hospitals run using real-time data and analytics, and to provide clinicians with up-to-the-minute decision support tools informed by research.

We will focus on removing barriers to uptake of innovations and their spread across the system.

See case study 8: Capacity Tracker.

We will deliver the AI and Data Grand Challenge (<https://www.gov.uk/government/publications/industrial-strategy-the-grand-challenges/industrial-strategy-the-grand-challenges#artificial-intelligence-and-data>) mission to use data, AI and innovation to transform the prevention, early diagnosis and treatment of diseases.

Artificial intelligence has huge potential to improve diagnosis and care. We need to continue to develop the Initial Code of Conduct for Data-Driven Health and Care Technology (<https://www.gov.uk/government/publications/code-of-conduct-for-data-driven-health-and-care-technology/initial-code-of-conduct-for-data-driven-health-and-care-technology>) to influence and enforce the highest standards of good practice for the development of emerging technologies.

The government has also committed £98 million through the Ageing Society Grand Challenge Fund (<https://www.gov.uk/government/collections/industrial-strategy-challenge-fund-joint-research-and-innovation>) to stimulate the market to develop new healthy ageing technologies that help people live independently in their homes, tackle loneliness, and increase independence and wellbeing.

We are supportive of Dame Wendy Hall and Jérôme Pesenti's ideas on data trusts to facilitate the ethical sharing of data between organisations (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/652097/Growing_the_artificial_intelligence_industry_in_the_UK.pdf), which the government will launch as a pilot later this year.

See case study 9: Artificial Intelligence (AI) improving eyesight.

4. Skills and culture

To take advantage of this agenda, we need the right skills in the NHS, social care and across the system. We want to empower our workforce with enough technical expertise to be able to identify opportunities where technology can help meet user needs, and to implement new technology at the coalface with confidence.

We need to recruit and retain specialist non-clinical professions, such as a highly skilled and well-resourced data science and analytics workforce to make the best use of all the data we will unlock.¹⁹

We need to ensure that the many skilled professionals already working in the health and care system are supported to continuously develop. Many of the innovations that exist have been led by clinicians and staff with a passion for improving health and care. We want to make it easier for them to develop new tools, share their work and share their skills with colleagues to help build a technologically capable workforce, whichever part of the sector they are working in. Because these applied technical skills are new and currently in short supply, we will need to find ways to empower frontline staff with proven skills in this domain, and where appropriate give them the time away from clinical duties to further develop their own skills and train others.

This needs to be driven by leaders at every level. All health and care organisations should ensure board-level understanding of how data and technology drives their services and strategies, and take charge of the digital maturity of their organisations – in the same way that they manage their finances and the quality of their services.

Leaders will want to ensure that their staff are trained to use data and technology in their work and have the time to learn the skills they need. They will also need to build in-house capability to understand the technology they run, procure the right things and manage commercial arrangements. Ideally, all substantial healthcare organisations should have staff with the technical skills and healthcare knowledge to participate in productive discussions with developers and vendors to produce the bespoke tools – and implementations of consumer technology – needed to address their needs.

Dr Eric Topol is leading a review (<https://hee.nhs.uk/our-work/topol-review>) looking at what training and skills clinical staff will need to make the best use of AI, robotics, genomics and digital medicine. We should build on Health Education England's work to develop build the capabilities of staff and leaders in health and care to be

digital-ready, through initiatives such as the NHS Digital Academy (<https://www.england.nhs.uk/digitaltechnology/nhs-digital-academy/>), and work with Skills for Care to support digital skills for the adult social care workforce.

See case study 10: Health Education England's Building a Digital Ready Workforce.

Build an open culture

The culture change needed to deliver this vision requires strong management and leadership. This is not an IT project – it's about transforming ways of working. Every board and sustainability and transformation partnership (STP) leadership team must drive this and ensure this transformation happens. Every patient must have full, frictionless access to all of their health records to use in our growing ecosystem of healthtech solutions and services.

We need the right skills and capability at every level of our organisations and we need to change the culture of adoption for this digital age. In the NHS, the culture is understandably that clinical trials take time so we should adopt new ideas only once robustly and repeatedly tested. Yet a new generation of technology has arrived that can be adopted at pace and iterated. We must be careful to ensure that we follow clinical trials where the new technology is clinical but also to ensure we have appropriate assurance processes that recognise when an innovation can be adopted faster. We must learn to adopt, iterate and continuously improve innovations, and support those who are working this way.

We will take an open and collaborative approach to this work and we encourage other local and national organisations to collaborate, share and be transparent about their progress, for the benefit of others.

Dr Ben Goldacre will chair a new Healthtech Advisory Board, reporting directly to the Secretary of State for Health and Social Care, that will include technology experts, clinicians and academics. It will be an ideas hub for how we transform the NHS to improve patient outcomes and patient experience, and to make the lives of NHS staff easier.

The constant changes in the way technology can be used requires an agile, iterative culture – we can now try things at low cost without big commitment or upfront risk, for example cheaper, cloud-based hosting for web services. We need to support capabilities around governance and the cultural shift in line with the move to reusable services.

We will empower each board, each procurement team, each chief information officer and each member of staff with a revolutionary idea to take charge of their role in our healthtech ecosystem. We will equip them with clear documentation to minimise the barriers to building a software solution, a supportive and agile culture, and innovation support to help good ideas spread.

And while we can create a culture of innovation, we want to do this in a controlled and co-ordinated way using standards. This will help us avoid small, piecemeal failures and increasing our legacy IT with half-finished attempts. Standards set centrally are key to enabling this culture in the right way, but also controls on spend so we can be sure that every pound is spent wisely.

Conclusion

We have the opportunity to create the most advanced health and care system in the world, and to become the global leader in healthtech. By harnessing the power of technology and creating an environment to enable innovation, we can manage the growing demand for services and create the secure and sustainable future for the NHS and social care system that we all want to see.

When we follow the principles we have set out, we not only transform the health and care system and the healthtech economy to be the most advanced in the world – we also create organisations that can continue to evolve, improve and innovate with the best technologists and disruptors, wherever they may be.

We have strong ambitions for the technologies we want to use, and the opportunity to create a world-leading environment for spreading and supporting innovation wherever it comes from.

And we must never forget who we are building things for – those who depend on the health and care system to look after them and those who work within that system.

We have set out the guiding principles we should operate by:

- user need
- privacy and security
- interoperability and openness
- inclusion

We have also articulated our architectural principles:

- put our tools in modern browsers
- internet first
- public cloud first
- build a data layer with registers and APIs
- adopt the best cyber security standards
- separate the layers of our patient record stack: hosting, data and digital services

We have set out our priorities on infrastructure, digital services, innovation, and skills and culture, which are to:

- put in place the right infrastructure
- buy the best technology
- ensure that digital services meet people's needs
- enable healthtech and innovation
- develop the right skills and capabilities
- build an open culture

We will know we have achieved our goals when:

- a healthy person can stay healthy and active (using wearables, diet-tracking apps) and can co-ordinate with their GP or other health professional about targeted preventative care
- a person with any long-term condition can find a variety of supportive apps and technologies to meet their needs, created by the market and working seamlessly with their NHS data and care
- a developer or researcher can easily see everything they need to know to work with NHS data or build something to sell to the NHS
- a clinician or social care worker has digital tools and services that support them in doing their jobs and allow them to provide care and support for their patient with a minimum of friction and distraction
- the world-leading research we've always aimed for, from our massive body of health data, is not only possible but is producing groundbreaking new clinical treatments
- the UK is the global centre of healthtech and is exporting our expertise abroad
- a taxpayer can see how effective our care is and what needs improvement – by hospital, condition/care pathway, supplier involved
- an analyst can work out who are the largest – and smallest – suppliers to the NHS or care system and discover where there are gaps in the market to bring better innovations to our system
- someone with an idea for a new digital tool – a clinician, academic, citizen, charity, or commissioner – can easily find a huge selection of developers and researchers to help, with a wealth of experience, earned through the successful delivery of earlier working tools.
- a developer, company or researcher who has hit a barrier around access to data or users can get rapid, responsive help to keep their project moving

- a developer or researcher can rapidly collect evidence on the real-world impact of their tool, using the same efficient digital methods and datasets that allowed them to develop a digital tool in the first place
- a commissioner, clinician or person using health and care services can rapidly access evidence on the impact of the digital tools they are being offered
- a developer with an idea for a digital health tool will migrate to the UK because this is the best place to build it, get it used and assess its impact on real-world outcomes

This document is for discussion. We want to hear from you:

- Do you agree with these priorities?
- What have we missed?
- What good work should we support and build on?
- What do we need to take into account when thinking about applying these principles to different parts of the health and care system?

A questionnaire (<https://r1.surveysandforms.com/4c3zqo08-fa3ela24>) has been set up for you to provide comments and feedback on the vision.

Annex A: case studies

Case study 1: Whole Systems Integrated Care (WSIC)

The WSIC programme (<https://digitalhealth.london/casestudy/case-study-whole-systems-integrated-care-wsic-dashboards/>), in north-west London, uses analytics on top of integrated health and social care information (primary care, secondary care, community care, mental health and social care) to support both population health and direct care. Care staff can use the system to identify people who would benefit from additional support, perhaps based around frailty or risk of admissions. This could include things like identifying someone with diabetes who has missing care processes, people with asthma who have issues with their medication and have had frequent episodes requiring medical intervention, or supporting clinical multidisciplinary team meetings across health and social care looking at improving child health. It is hard to get a holistic view of a patient's history if the data remains trapped in systems that don't talk to each other.

The programme's strategy and ambition includes increasing the frequency and richness of clinical data feeds into the WSIC record, to move towards more real-time data, including wider determinants of health data and embedding the analytics in the clinical systems, giving patients access to their own data.

The WSIC programme and its learning is being incorporated as part of the wider OneLondon Local Health and Care Record Exemplar programme.

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Case study 2: Great Manchester Local Health and Care Record

The Greater Manchester vision for health and social care is to deliver the fastest and greatest improvement in health and wellbeing for its 2.8 million population. With 10 areas of Greater Manchester working together to create an integrated digital care record ([IDCR](#)) approach, they were successful (<http://www.gmhsc.org.uk/greater-manchester-awarded-7-5m-to-drive-forward-integration-of-health-and-care-records/>) in their bid to become a Local Health and Care Record Exemplar ([LHCRE](#)). The [LHCRE](#) approach will ensure information is visible across multiple care settings and specialities in Greater Manchester as people move between different parts of the NHS and social care.

Greater Manchester's Local Health and Care Records ([LHCR](#)) will allow authorised health and care professionals involved in a person's care to have immediate access to a comprehensive care record with the relevant level of information they need to inform their care decisions, when and where they need it. This is

particularly important for health and social care professionals caring for people living with dementia who will have secure access to information around dementia diagnosis and care needs.

The LHCR will also enable patients to be active participants in their care, both in access and contribution to their comprehensive care record as well as being part of a joint care planning process with their care professionals. Real-time algorithms will run on the data from the comprehensive care record to help alert and proactively intervene, as well as inform how services can be tailored locally. So, for a person with dementia, their diagnosis, care planning, management of end-of-life preferences as well as access to information would be available through the LHCR to help improve outcomes and enable appropriate use of resources via earlier intervention.

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Case study 3: software for electronic rostering

Ineffective rostering of staff is the cause of a number of significant challenges that confront the NHS, including a reliance of expensive agency staff (with costs of over £3 billion in 2014²⁰) and challenges of recruitment and retention.

In response to these challenges, the clinical pharmacy team at East Kent Hospitals University NHS Foundation Trust introduced full job planning and electronic rostering to improve workforce visibility across 3 of their sites, optimise staff deployment and increase management accountability for forward planning. Used effectively, e-rostering improves productivity and delivers cost savings, as trusts can forecast and plan staffing in advance (reducing reliance on agency staff), spend less time on administration, and manage their workforce flexibility across sites. It also allows staff to have more control over when they work.

East Kent report that implementation has improved staff recruitment and retention, and reduced sickness absence and unauthorised leave.

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Case study 4: intelligent alert system for early diagnosis of sepsis

The Nervecentre (<https://nhsaccelerator.com/innovation/nervecentre-software/>) platform, at Nottingham University Hospitals, uses vital signs, early warning score (EWS) and pathology results to inform the early diagnosis of sepsis (<https://www.nhs.uk/conditions/sepsis>). Algorithms, based on sepsis indicators and NICE guidance, are applied to local/regional clinical rules to help identify early onset. When a patient presents early indications of sepsis, the platform's intelligent alert system immediately alerts the right clinicians and nurses to ensure that care is appropriately escalated, prioritised and carried out. Moreover, the system not only alerts clinical staff, it links with experts in disease and sepsis to provide clear visibility of when results have been received or are still to be reviewed. The combination of the algorithm, automated escalation and task prioritisation helps aims to eliminate the human factors that can delay the identification and treatment of sepsis. The Nervecentre has the potential to offer improved patient care and improve efficiency of sepsis care, as well as offering further research and analysis opportunities with the data being produced.

The ambition is to go even further and create interoperability between patient records to enable any clinician to see whether a patient has been seen and treated for their infection before. As part of our antimicrobial resistance strategy, the Department of Health and Social Care's plan is to extend this to linking to further information about the patient in real time. In addition to sepsis, this could cover immunisation records, antibiotic treatment and antimicrobial resistance history to help clinicians optimise life-saving antimicrobial treatments for people with acute severe infections.

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Case study 5: empowering patients with inflammatory bowel disease

Patients Know Best (PKB) is an online platform that is empowering more than 4,000 patients across Surrey and Sussex Healthcare NHS Trust to play an active role in managing their inflammatory bowel disease (IBD) as well as offering them greater access to clinical expertise and innovative treatments.²¹

Supported by the Kent, Surrey and Sussex Academic Health Science Network (KSS AHSN), PKB is being used by patients to record their symptoms and communicate with their clinical team remotely, accelerating timely access to advice, clinical reviews for flare-ups, and escalation to disease-modifying therapy where appropriate. It also offers reassurance to those who are stable without the need for a face-to-face review.

The benefits of this patient-centred approach have been significant. As well as reducing the number of inpatient admissions and outpatient attendances, the time to access specialist care at the onset of a flare-up has reduced from 6 weeks to 1 week. At the start of the study 60% of respondents reported that their IBD had been well controlled in the preceding 2 weeks, with this figure rising to 71% after 4 months of PKB usage. Importantly, 68% said the service had a positive impact on their IBD, and 77% said it helped them feel more confident in managing their own health.

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Case study 6: supporting care delivery and the workforce

WCS Care (<https://wcs-care.co.uk/our-care/innovation-partners/>) (a care home provider) and Cera (<https://blog.ceracare.co.uk/technology-at-cera-our-focus-on-providing-safe-excellent-quality-home-care>) (which provides care at home) are 2 providers using technology to support people to live the lives they want.

As the first care home provider in the UK to install acoustic monitoring systems (systems that monitor the sleep of patients and trigger an alert when noises exceed specified levels), WCS care professionals can detect when residents may need additional care and support during the night and respond appropriately. This is helping to address the challenge of many people suffering from poor sleep or disturbances during the night. The introduction of the system has improved the quality of night time care, reduced the number of falls during the night and prevented unnecessary disturbances for residents while they sleep. As well as acoustic monitoring, WCS Care is working with partners to improve care and wellbeing for residents using digital technologies, using handheld devices for electronic care planning and to enable relatives access to their loved one's care notes, providing transparency and building trust.

Challenges with the provision of home care include a sustainable carer workforce, scheduling visits, and keeping patients and their families involved in the planning and delivery of care at home. To respond to these and improve the quality of care provided, Cera uses technology in various ways, including connecting people in need of care and support to carers that are nearby, automating back-office functions (such as scheduling and payments) and using digital care records to log information. Cera report that their innovations in home care have seen a huge difference in client satisfaction. Cera is also developing an artificial intelligence chatbot to assist carers with recommendations for home care of people with conditions such as dementia. The ambition is that it can help spot symptoms of illness and prevent medical emergencies via pre-emptive alerts.

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Case study 7: Trialling the use of the Amazon Echo in adult social care

Hampshire County Council and their partnership with PA Consulting/Argenti wanted to test the hypothesis that consumer technology could be used to support people with care needs.²²

Hampshire are trialling the use of Amazon Echo/Alexa within its technology service for 50 people with social care eligibility. They have built a 'skill' (app) that uses Alexa to record tasks and reminders for the home care provider carer to act on when they arrive for their visit, which can be created by a remote carer or family member. It will also remind the carer to prompt the service user to do certain things like take pills, or to remind

them about a visit. The Alexa device will also benefit those partially sighted, or more socially isolated individuals who may want to use it to ask for information or utilise other features such as audiobooks or the radio.

This trial focuses on using consumer technology (as opposed to telecare equipment), as this uses familiar, user-friendly devices that offer additional features, such as radio. These devices can be less stigmatising than the traditional red button and beige box and also can be used to embed care functions into connected homes and the internet of things (https://en.wikipedia.org/wiki/Internet_of_things).

The reported impact for patients has been:

- decreased feeling of social isolation as measured through pre- and post-project surveys and evaluations
- the level of assurance of family members increased as they can be alerted through the device

This approach offers Hampshire, and other councils, a move away from the old-fashioned model of care technology, where devices are made by specialised manufacturers without much input into how these work, with inflexible functions and with little cost savings.

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Case study 8: Capacity Tracker

Capacity Tracker (<https://www.necsu.nhs.uk/services/system-wide-transformation/capacity-tracker/>) is a collaboration between NHS England and NHS North of England Commissioning Support that provides live care home bed state/capacity to clinical and hospital staff. Rather than spending hours calling round to care homes to find available beds, the tracker provides available beds instantly to hospital staff. This also reduces the number of delayed transfers of care (DTOCs), where a patient is ready to leave hospital but still occupies a bed.

The tracker has improved efficiency of discharge teams by reducing the volume of phone calls to care homes, enabling hospital staff to spend more time delivering direct patient care rather than administration.

Health professionals can help patients and families quickly find care homes with available beds that are within their budget, improving patient experience once the decision has been made to discharge to a care home.

Care homes can update their bed state on the move, whenever and wherever they are, rather than having to answer high volumes of calls from discharge teams asking if they have a vacancy.

The tracker makes the most of available data. It has powerful analytical and benchmarking capabilities that take advantage of the published national DTOC data, removing the need for hospital staff to have to download spreadsheets and perform tricky functions on them.

Being web-based, Capacity Tracker is entirely scalable and is designed to be implemented at pace. The service is an example of innovation driven locally, tested and collaboratively iterated, and with the potential to successfully scale nationally.

Capacity Tracker is a customised, cost-effective and scalable web-based solution that is easy to deploy and is 100% built and owned by the NHS.

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Case study 9: AI improving eyesight

Two million people in the UK are living with sight loss

(<https://www.rnib.org.uk/sites/default/files/Eye%20health%20and%20sight%20loss%20stats%20and%20facts.pdf>), of whom around 350,000 are registered blind or partially sighted.

Ground-breaking research (<https://www.moorfields.nhs.uk/content/breakthrough-ai-technology-improve-care-patients>) by Moorfields Eye Hospital, DeepMind Health and UCL uses AI to help identify diseases that potentially lead to blindness. The AI system can recommend the correct referral decision for over 50 eye diseases with 94% accuracy, matching world-leading eye experts.

The breakthrough research, published online by Nature, describes how AI and machine learning technology has been successfully trained on thousands of historic de-identified eye scans to identify features of eye disease and recommend how patients should be referred for care.

This technology has the potential to transform the way professionals carry out eye tests, allowing them to spot conditions earlier and prioritise patients with the most serious eye diseases before irreversible damage sets in. With the right treatment at the right time, many cases are preventable. For example, it is estimated that up to 98% of sight loss resulting from diabetes can be prevented by early detection and treatment.²³

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Case study 10: Health Education England’s ‘Building a Digital Ready Workforce’ programme

Health Education England’s programme is working with Lancashire and South Cumbria sustainability and transformation partnership to trial a toolkit for board-level development. The toolkit will use the language of leadership and be aligned to the CQC/NHS Improvement Well-led framework. It will help boards set a clear future direction, gain assurance (rather than reassurance) that their digital footprint is fit for purpose, and set a culture of openness, safe experimentation and shared power.

The toolkit will be white-labelled for boards and board development providers to use.

The programme has invested in the NHS Digital Academy, the first cohort of which is underway (and the second is now open for applications), which will ensure 300 chief information officers and chief clinical information officers are trained by March 2021. There are currently approximately 60,000 informaticians or digital experts in the NHS, from clinical coders to librarians, IT helpdesk staff to clinical information officers. The Building a Digital Ready Workforce programme (<https://hee.nhs.uk/our-work/building-digital-ready-workforce>) (BDRW) has invested in the Federation of Informatics Professionals and the Faculty of Clinical Informatics. These 2 professional registration bodies will ensure all our digital staff are both good enough and able to progress to a level of excellence within a well-described career, supported by training, development, mentorship and compassionate peers.

The BDRW programme also intends to support every one of our 3.1 million staff in health and social care to be digitally ready – the unique combination of skills, knowledge, attitudes and behaviours that enable our staff to do their jobs, solve problems as they arise, and be comfortable with using data, information, knowledge and technology to do so.

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Annex B: sample standards and user needs

We know that the standards we set must meet the needs of our users. The table below shows a sample of the standards and examples of the user needs they will help us to meet.

Standard	Description	User need
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Standard	Description	User need
NHS Number	<p>The NHS Number is the established unique patient identifier for use across health and social care. It is essential to ensure safety and continuity of care. It can be confirmed quickly and accurately via the Personal Demographic Service (PDS). The NHS Number is the link to a patient's clinical history via their electronic patient record.</p> <p>Use of the NHS Number is already prevalent at the point of sharing information, but we will move to the position where the NHS Number is available at the point of care.</p>	<p>When I'm reading or writing information about a patient, I have to be sure I've got the right person's record, so that information about a patient can be accurately recorded against them and then be retrieved accurately by those involved in their care.</p> <p>As a patient, when I am accessing my care records, I need to know that I can access records about me, so I can be given the right care for me.</p> <p>As a patient, I would like care professionals to be able to retrieve key information about me, and by using a consistent identifier, this will help me not having to repeat myself.</p>
SNOMED CT	<p>SNOMED CT is an international terminology in use across 35 countries. It is a comprehensive clinical terminology which allows clinicians in direct care to describe their interactions with patients which can then be coded to ensure semantic interoperability across health settings and secondary uses.</p>	<p>When I'm caring for a patient, I need a clear, consistent and computable representation of clinical information about a patient so that I can bring together relevant information and use decision support tools to inform my own and others' delivery of safe and effective care.</p> <p>When I'm doing research, I need a clear, consistent and computable representation of clinical information about a patient so that I can develop and run algorithms to help inform me about the cases and populations I'm studying, and enable me and others to apply my discoveries more quickly in clinical care.</p>

Standard	Description	User need
dm+d (dictionary of medicines and devices)	The dm+d is a dictionary of descriptions and codes that represent medicines and devices in use across the NHS. It is used for prescribing, dispensing, and other clinical records involving medicines and medical devices.	When I'm caring for a patient, I need a clear, consistent and computable representation of clinical information about medicines and medical devices, so that I can proactively use appropriate digital tools to help me ensure that a patient gets the right medicine or device, and the right care to go with it.
ICD11	The ICD coding has long been used in the NHS predominantly for secondary uses – it is widely used in Commissioning Data Set returns and it is also key to research, public health management, and a number of trust returns. A new version of ICD has been announced by the World Health Organisation, that provides better analytical capabilities through internal hierarchies, and also offers improved integration with SNOMED CT, therefore allowing the automatic derivation of ICD-11 codes to a significant extent from SNOMED CT information captured at the point of care.	When I'm running a service or doing research, I need information about diseases and health conditions to be a consistent, computable and comparable representation, so that I can analyse and draw the right conclusions from it.

Standard	Description	User need
Fast Health Interoperability Resources (FHIR)	<p>FHIR is the latest iteration of standards within the HL7 family following v3 and v2. The standard defines a representation for a range of clinical concepts including diagnosis, allergy, procedure and medications. These resources can be combined together to build bigger constructs such as the documents and whole record structures.</p> <p>The CareConnect programme of work has developed a series of constrained profiles to represent an NHS view of the standard based on the international FHIR standard. The specifications have defined a number of <u>APIs</u> to enable access to information held in records. FHIR has also gained wide support from industry as the messaging standard of choice.</p>	<p>As a care professional, when I am sharing information across venues of care, I need this information to be shared in a consistent manner so that it can be effectively used across different systems.</p> <p>As a patient, when I am accessing my record, I need it to be able to access my records from different systems, and update information with my contributions.</p> <p>As a vendor working within the health and care system, when I have a product that contributes to and accesses health and care information in other systems for a patient's care, I need my product to be able to safely and securely connect and interoperate with those systems.</p>
Unified Codes for Units of Measure (UCUM)	<p>The UCUM is an international system of codes (and associated syntax) for unambiguously representing units of measure. It allows the unambiguous representation of units of measure (such as cm, kg), which are an essential component of some observations and results in medicine (blood tests, physical measurements and so on).</p> <p>UCUM has a long history of use within messaging specifications and is adopted by the FHIR standard.</p>	<p>When I'm looking at test results, I need to know that a consistent representation of measurement has been used, so I can make calculations automatically in the system I run.</p>

Standard	Description	User need
FIDO	<p>A set of specifications that support strong authentication to identity services using public key-based credentials. FIDO enables a professional or citizen to use an authenticator app to store the keys for organisations with which they establish a relationship. When accessing a service, a doctor or citizen is prompted to give agreement to sign on using a combination of biometric/PIN with key material.</p> <p>FIDO-based solutions comply with UK and global authentication assurance levels, including Cabinet Office Good Practice Guides 44 (Level 3), and advice from the UK National Cyber Security Centre and the US National Institute of Standards and Technology.</p>	<p>As a care professional, when I'm working in different places at short notice, I need a mobile tool for verifying my status and authenticating access to systems that does not involve undue administrative delays and is also secure so patient data is always protected.</p> <p>As a care professional, when I'm working for different employers, I need to establish relationships with employers and hold the key material for each so I can use a consistent identifier with each organisation.</p> <p>As a citizen, I need to be able to sign-on to health services in a convenient and secure way, consistent with how I access other services, so that I am empowered to self-care using familiar tools and techniques.</p>
OpenID Connect	<p>A set of specifications for an interoperable identity layer that enables single sign-on to applications using a federated identity. OpenID Connect enables the sharing of a user's identity attributes to multiple apps once they have authenticated to an identity service.</p>	<p>As a care professional, I need to access a combination of local and national services using the same federated identity and to use modern mobile apps, so I can fulfil clinical duties and work effectively.</p> <p>As a citizen, I need to sign-on to my apps and then be able to access additional apps in a seamless way so I can personalise my use of NHS services and don't have to sign-on repeatedly.</p>

Standard	Description	User need
OAuth 2.0	A set of specifications that provide an authorisation mechanism for apps and APIs to interoperate, so that once a user has signed on to an app using an identity token, that app can be authorised to access APIs, such as to read/write records.	As a care professional, I need a way for my main clinical system to obtain an access token that contains my permissions. These can then be used to obtain structured data from APIs hosted by national and local systems so I have access to relevant data and decision support to make effective clinical decisions.

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