Digital Transformation in Healthcare

Introduction

With the publication of the 10 Year Health Plan and Life Sciences Sector Plan outlining digital transformation of the NHS, there is a significant opportunity to reshape healthcare delivery through innovation, however implementation is going to be key to success. Drawing on our expertise across sectors, we identified critical conditions for implementation of both the 10 Year Health Plan and the Life Sciences Sector Plan, focusing on a systems engineering approach to ensure integration, interoperability and resilience within the healthcare system.

The IET aims to support the development of a robust, evidence-led framework that ensures safe, effective, and scalable deployment of digital technologies across the UK healthcare system. In this paper we have outlined examples in AI (in diagnostics and clinical practice), automation, data and records.

Recommendations

- **Assessing and approving new technologies:** The IET recommends that government updates and clarifies the central adoption scheme for new technologies to ensure that as innovation happens in the NHS it is still consistent (GOV.UK, 'Innovator passports' set to accelerate cutting-edge NHS care). It is important to consider the capacity, needs and resources of the entire clinical pathway and its interaction with the rest of the system.

- **Collaboration between devolved nations**: The IET recommends continued collaboration between devolved nations in the UK, to share data and best practices on how technology is used.

- **Transparency on data sharing:** The IET recommends the continued development of technical standards, transparent documentation expectations, and harmonisation with international frameworks. This will lead to the transparency of what data has been used to develop the AI tools that are being utilised. The Responsible Handover of AI should be included as part of ethical guidance.

- **Regulation and standards:** The IET recommends the adoption of the new global standard for securing AI models and systems (ETSI EN 304 223) in order to support a structured and robust cybersecurity assurance model and the routine use of continuous monitoring tools for detecting drift, anomalies, or unsafe behaviour across the lifecycle of artificial intelligence driven systems.

- **Resilience:** The IET recommends an infrastructure plan for power stability and connectivity, alongside targeted funding to ensure resilience and safe development of (robotic) technology in healthcare. It is vital to consider the physical environments in which digital technologies are deployed. This consideration extends beyond hospital settings. Articulating the infrastructure requirements, alongside the necessary financial investment, are important steps of implementing the shifts stated in the 10 Year Health Plan.

- **Upskilling and reskilling:** The IET recommends that implementation of the 10 Year Health Plan is supported by cross sector experts to advise on upskilling workers and

patients in the NHS to safely and efficiently use the technology and products being introduced. This plan will need to be constantly reviewed in line with changing technologies and requirements. Alongside this mitigating digital poverty and promoting health equity are essential to ensure that all patients benefit from new technologies.

- **National cyber-security campaign:** Hospitals and healthcare facilities can be a target for hackers, the IET is calling on Government to run a cyber-security campaign to help patients and healthcare professionals, as well as the wider public, to protect themselves against attack.

Practicality

Digital transformation must be grounded in the practical realities of the NHS, and the wider context must be considered. Stakeholders need clear roadmaps and recommendations tailored to their infrastructure that accounts for varying levels of preparedness, capacity and infrastructure across Trusts/Health Boards.

While appropriate technologies already exist to support NHS transformation, the current data availability and quality, connectivity, and organisational structure, pose significant barriers to implementation. Data is not readily shareable across systems due to lack of common standards which reduces interoperability between systems. There are also restrictions on data sharing between companies, suppliers, and Trusts/Health Boards, which are due to the need for anonymisation to maintain trust, further compounding the issue.

Cost-effectiveness should be considered at a system level to anticipate unintended consequences of different products and technologies. For example, a slightly more expensive product may contribute to significant savings across multiple department (medical or otherwise), but this value is often overlooked in a balance between capital investment versus long term gain. According to the Parliamentary Office for Science and Technology (POST) Government departments reported that it is easier to secure funding for capital spending (e.g. to improve infrastructure) than resource expenditure, which can make it difficult to maintain services (POST, Digital Transformation in Government).

Finally, **mitigating digital poverty and promoting health equity are essential to ensure that all patients benefit from new technologies.** Community engagement and case studies involving diverse user groups can help demonstrate the value of innovation and ensure inclusive design.

Healthcare in devolved nations

As new technologies are introduced, the challenges and their mitigation should be considered prior to implementation. **The IET recommends that government updates and clarifies the central adoption scheme for new technologies to ensure that as innovation happens in the NHS it is still consistent (GOV.UK, 'Innovator passports' set to accelerate cutting-edge NHS care).** It is important to work with the innovation sector to leverage venture capitalist investment, by reducing inaccessibility and procurement complexities.

It is important to ensure strong co-operation to share best practice across the UK to improve the consistency and quality of the application of technologies. Scotland also has a distinct approach to technology and healthcare through the National Digital Platform in order to deliver technology that improves the care and wellbeing of people in Scotland. **The IET**

recommends continued collaboration between nations, to share data and best practices on how technology is used.

Data and regulation

The NHS holds large amounts of data that can be used to hone and train AI models, depending on patient consent about how their data can used in line with GDPR. However, quality and consistency vary significantly across systems and Trusts/Health Boards. Differences in technology, such as varying models of scanners, can result in incompatible data formats, making interoperability a challenge. Addressing these disparities is essential for building a cohesive digital infrastructure that works in practice. Additionally, wearable devices offer a potential source of data from healthy individuals (as opposed to a representative population), but safeguards must be in place to ensure wearables are medical grade technology. It is critical that the appropriate legal and regulatory structures are in place to allow AI's safe development and use.

As decentralised care models grow, reliance on consumer wearables raises questions about regulatory standards. Many devices may not meet the necessary thresholds for clinical use. Greater support is needed for initiatives like the Centres of Excellence for Regulatory Science and Innovation (CERSIs) and the Regulatory Innovation Office (RIO) to transfer regulatory learning across sectors. Furthermore, the ongoing and valuable work of the AI Healthcare Commission is welcomed. **The IET recommends the continued development of technical standards, transparent documentation expectations, and harmonisation with international frameworks.** This will lead to greater transparency around the training and operation of AI systems. Industry and academics must also be educated on the importance of initiating regulatory pathways early in the design phase. Developing standards, and codes and guidance for developers is critical to successful innovation.

There is also a fundamental issue with access to data, particularly for diagnostics. Ethical data sharing is going to be critical to the successful development, deployment and assessment of tools. Techniques that are advocated by big data should be incorporated, such as the use of high quality and real time data. **The IET recommends that the Responsible Handover of AI should be included as part of ethical guidance.** However, to do this there is a need for diverse data as there will naturally be a bias in the data if people are volunteering their data.

There is currently a gap between the design of the technology in the innovation / engineering stage and the development and launch of these technologies. It is important in healthcare to start with the challenge and assess what is needed for service transformation then select the correct technology to address the problem. Human centred design and transparent interfaces are essential for day-to-day clinical adoption. In order to bridge this gap, **the IET recommends that government updates and clarifies the central adoption scheme for new technologies to ensure that as innovation happens in the NHS it is still consistent as well as showing its usefulness, usability, and value to the system (GOV.UK, 'Innovator passports' set to accelerate cutting-edge NHS care).** There needs to be collaboration with local Trusts/Health Boards, within the adoption scheme in order to give a system-level view and a local perspective, when deploying new technologies.

The role of AI in diagnostics and clinical practice

Improving diagnosis is a priority in the 10 Year Health Plan. The government needs to explore how AI can be used effectively and inclusively in diagnostics. Its application would require access to real patient data, which is often difficult to obtain, but essential for properly evaluating AI tools. Government should ensure that data is shared ethically to ensure these

platforms are developed responsibly. However, there is difficulty in the reproducibility of AI technology due to limited access to high quality data sets. Training on biased populations for example can have repercussions when developing AI technology. Clear guidelines are needed to define responsibility for data management, ensure model accuracy and explainability, and confirm that tools are trained appropriately. Additionally, in order to develop AI tools, transparency around the data used is critical to ensure that we maintain trust and build public confidence in the use of their data.

Although the use of AI for diagnostics has profound potential to support the delivery of care, it is also a strong example of where systems thinking must be used to ensure that there are patient pathways and adequate workforce capacity in place to direct patients to, once they have been diagnosed. There is also a need to consider the effects of over-reliance of AI and potential for de-skilling. Research by the Lancet Gastroenterology & Hepatology journal in August 2025 found that in patients who underwent colonoscopies with and without AI-assisted systems, endoscopists introduced to an AI-assistance system had a 20% drop in detection rate after they no longer had access to the AI tools they were introduced to (The Lancet Gastroenterology & Hepatology, Endoscopist deskilling risk after exposure to artificial intelligence in colonoscopy: a multicentre, observational study).

Therefore, it is important to highlight that more diagnostics alone is not necessarily beneficial. Diagnostic tools must be developed and implemented through a systems-based approach, ensuring that the care pathways and workforce they direct patients to are in place. Additionally, the potential effects of over-reliance on AI should be considered, as it may impact the ability of medical professionals to identify anomalies independently.

There is also the opportunity to empower patients through technology. This will put patients at the centre of care. The NHS has already started allowing this for patients; however, this can be taken further by using AI to assess whether care plans are being followed appropriately, empowering patients to advocate for their health. Automated messages could be sent to GPs or patients to ensure timely follow-ups. There are existing pathways in the NHS to support clinical practice. This is an opportunity to use technology to simplify and accelerate pathways which have already been adopted in the NHS.

However, there is a clear gap in the ecosystem that needs to be addressed with regards to supporting best practice for development and adoption, ensuring that knowledge is not lost along the pipeline. **The IET recommends that the Responsible Handover of AI should be used when AI products are being developed.** This will ensure that development knowledge is passed onto product users and maintainers in a robust way. It is the role of the developer to monitor the technology after it has been deployed as there is also a need of post-market surveillance. To monitor the technology, staff using it should be trained to spot deviations in how the technology should be working, such as algorithm drifting and report it to the manufacturer.

Incorporating robotics, telehealth and drones

Robotics has the potential to positively affect hospital operations. However, for robotics to function reliably in clinical environments, standards for 6G connectivity must be established. Hospitals must also develop contingency strategies in case of Wi-Fi or network failures, ensuring that robotic systems can continue to operate safely. Improved communication infrastructure and backup systems will be critical to supporting the safe and effective use of robotics in healthcare settings.

Technologies such as drones may offer innovative ways to enhance communication. Drones could be used to transport organs, prescriptions, and medical supplies, especially in remote areas or disaster zones. However, to ensure their effectiveness, robust 6G networks must be developed to ensure effectiveness. These technologies can help build resilience in non-clinical infrastructure, reducing reliance on traditional transport and communication systems.

Telehealth platforms provide another avenue for continuous monitoring of patients' daily lives, helping clinicians detect changes over time. However, clear guidelines are needed to define responsibility for data management, confirmation that tools are trained appropriately, and ensure model accuracy and explainability. Furthermore, transparency around the data used to develop AI tools is critical. To avoid bias, diverse datasets must be prioritised, particularly if the data is offered voluntarily.

The Health Data Research Service focuses on climate and health, infectious disease, and mental health, but it is important to expand coverage to other areas of care. Digital transformation must extend beyond clinical tools to include the healthcare built environment. Technologies such as environmental sensors, monitoring air quality, temperature, and noise, can be linked with patient health data to improve outcomes. These innovations are already being explored in Smart and Digital Hospital initiatives (such as the New University Hospital Monklands) and should be considered part of a holistic approach to healthcare modernisation. Awareness of the physical environment where health technologies/clinical tools are being used not only supports their effective deployment (e.g. providing optimal conditions such as network connectivity with appropriate speed, lighting and acoustics for virtual consultations/recording), but also influences user experience and health outcomes (e.g. a quieter ward has reduced the length of patient stay as shown in Royal Cornwall Hospital silent nurse call cutting stays - trust - BBC News).

Understanding the relationship between physical environment and health, as well as how digital technologies can play a role in supporting and connecting the two, is vital when that physical environment (where users access health and care services) extends beyond traditional hospitals into community facilities and homes. **Articulating the (scale and the minimum) infrastructure requirements to realise the benefits of the digital technologies, alongside the necessary financial investment, are important steps of implementing the shifts stated in the 10 Year Health Plan.**

Telecommunications and connectivity infrastructure

In order to have successful implementation of digital technologies in the health service, such as the use of robotics in surgery, it is imperative to have a resilient telecommunication and connectivity infrastructure.

In the 10 Year Infrastructure Strategy, it states that part of the £725 billion funding towards social and economic infrastructure will cover digital connectivity by continuing investment in high-speed internet access via Project Gigabit. It also highlights government's ambition for all populated areas to have standalone 5G by 2030. (GOV.UK, UK Infrastructure: A 10 Year Strategy) However, there is no mention of work towards 6G, let alone investment for upgrading mobile connectivity in healthcare structures.

6G provides sub-millisecond latency, ultra-high reliability, and massive bandwidth, which 5G is unable to provide. While 5G technology can be suitable for surgical procedures that are not overly complex, the use of robotics or telesurgery in the future for more complex surgeries will not be possible due to the latency of 5G compared to 6G (ScienceDirect, A smart contract-based robotic surgery authentication system for healthcare using 6G-Tactile Internet). **The IET recommends an infrastructure plan for power stability and**

connectivity, alongside targeted funding to ensure resilience and safe development of robotic technology in healthcare.

Resilience

There is a risk, however, with the use of digital technologies such as robotics or AI, of cyberattacks. AI misinformation or cyber security attacks can be quite significant. With an increase in the number of devices connected by digital networks, it can expose hospital digital infrastructure to new risks. AI-driven malicious misinformation campaigns could mislead operators or automated systems, causing disruptions and outages. An AI system manipulated by false data could also open vulnerabilities that hackers could exploit, such as misleading data analysis and faulty decision making. **The IET recommends the adoption of the new global standard for securing AI models and systems (ETSI EN 304 223) in order to support a structured and robust cybersecurity assurance model** and the routine use of continuous monitoring tools for detecting drift, anomalies, or unsafe behaviour across the lifecycle of artificial intelligence driven systems. There should also be effective cybersecurity measures to protect AI systems from manipulation, the IMDRF has some practical guidance on cybersecurity in medical devices (IMDRF, Medical Device Cybersecurity Guide). Communicating the potential threats and risks around AI will increase awareness, develop competence, and create the correct cyber security culture within an organisation.

Reskilling and upskilling are critical to ensuring robust cyber resilience on a day-to-day basis. A cyber cultural change needs to be encouraged through greater learning and cyber awareness, to ensure that the NHS is protected from the increasing threat of cyber-attacks. One example where healthcare facilities are being particularly targeted is via QR phishing (Quishing) – using fake QR codes to cover over existing codes. This impacts patients and healthcare professionals, who would not normally expect to be targeted in a trusted public space when they are trying to access self-service check-in on their mobile devices, for example. According to the latest IET Skills Survey one of the most important digital skills that employers ranked highly for growth is cyber security (38%), however cyber security is also the digital skill that employers find the most difficult to recruit for (17%) (IET, 2025 UK Engineering and Technology skills survey).

The IET has called for a cybersecurity public awareness campaign, funded by the government to ensure greater awareness amongst the public of how to improve their security and become more resilient will bolster the UK's defences against attack. The widespread costs of cyberattacks far outweigh the cost of investment in prevention as research from NESTA in 2024 showed that mass campaigns can cost £5 million over a 5-year period, providing government a benefit of £300 million every year (NESTA, Fund and roll out mass media campaigns aiming to promote healthy eating).

Further, the built environment of healthcare settings needs to be considered. Without this, technology cannot be used. The Government has already highlighted plans of essential maintenance in public buildings, including hospitals in their UK Infrastructure: 10 Year Strategy, including £6 billion per year from 2025-26 to 2034-35 for maintenance and repair of the NHS estate. However, the subsequent 10 Year Health Plan does not go into detail on what maintenance, or repair would need to be undertaken to allow for hospitals to be "fully AI-enabled within the lifetime" of the plan (NHS, Fit for the future: 10 Year Health Plan for England). However, to facilitate the successful shift from Hospital to Community, the consideration of physical environment must extend beyond traditional hospital settings. For example, people's homes are becoming places where health and care services are experienced, which they were not designed for originally.

When considering resilience of infrastructure, power stability is important, especially with the increased use of robotics and AI in surgery, diagnostics and clinical practice. In the 10 Year Infrastructure Plan, it states that £70 billion of funding to be used over the next five years for targeted infrastructure replacement, maintenance, critical safety and the wider DHSC portfolio. However, due to the amount of energy needed to safely run robotics in surgery, it is imperative that funding is specifically allocated to ensure that healthcare-built environments have the power capabilities to use these technologies and mitigation strategies if these power sources were disrupted.

In regards to sustainability, there needs to be support for green technologies by building sustainability into appropriate regulation of new and expanding technologies. Achieving net-zero will require a comprehensive understanding of the most carbon efficient AI models, and the offsetting powers of technology (IET, AI and Sustainability Position Paper). The NHS NetZero45 target requires robust systems to assess the full life cycle impact of solutions (NHS, Delivering a net zero NHS), however, technology needs to be assessed for sustainability when considering the digital transformation of the NHS.

Skills needed to implement the 10 Year Health Plan

The IET recommends that implementation of the 10 Year Health Plan is supported by cross sector experts to advise on upskilling workers and patients in the NHS to safely and efficiently use the technology and products being introduced. **This plan will need to be constantly reviewed in line with changing technologies and requirements.** A recent IET survey of engineering employers found that the most important digital skills for growth over the next five years include automation (38%), cyber security (38%), data engineering (34%), and software engineering (33%) (IET, 2025 UK Engineering and Technology skills survey). However, the survey found that automation ranks highest as the area in which engineering employers feel they do not have the necessary digital skills (30%).

Mechanisms are already in place to encourage safe use of new products by patients, such as a number of digital apps and online forms. These are used to empower patients to manage their health, streamline healthcare interactions, and improve overall wellbeing and clinical decision-making. The NHS app can be updated to include these new products, with guides and tutorials included when the product is first used through the app. It is important to have community engagement involving diverse user groups in order to ensure inclusive co-design as well as demonstrating the value of the products.

Conclusion

To ensure the success of the 10 Year Health Plan, implementation is going to be key for digital infrastructure and new technologies, which is where a systems approach will enable innovations to fit seamlessly and harmoniously into the broader landscape. Understanding the scale of the implementation challenge is important and by drawing on the expertise from different sectors, while also working with organisations, such as the IET, will achieve this.