Innovation in the NHS: Personalised Medicine and AI

About the Institution of Engineering and Technology (IET)

The IET is a trusted adviser of independent, impartial, evidence-based engineering and technology expertise. We are a registered charity and one of the world's leading professional societies for the engineering and technology community with over 158,000 members worldwide in 148 countries. Our strength is in working collaboratively with government, industry and academia to engineer solutions for our greatest societal challenges. We believe that professional guidance, especially in highly technological areas, is critical to good policy making.

Executive Summary

Personalised medicine and artificial intelligence (AI) have the potential to transform healthcare across the UK. The IET supports the development of a robust, evidence-led framework that ensures safe, effective, and scalable deployment of personalised medicine and AI across the UK healthcare system. Key considerations such as the role of AI, health data research, infrastructure and deployment in practice must be holistically assessed to ensure success. Further, to ensure we maintain trust and build public confidence in the use of their data, it is critical to have transparency around how the data used.

Recommendations

- **Collaboration between devolved nations**: The IET recommends continued collaboration between devolved nations in the UK, to share data and best practices on how technology and personalised medicine 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 for personalised medicine.
- **Transparency of how technology has been developed:** The Responsible Handover of AI should be included as part of ethical guidance. Transparency around the data used is critical to ensure that we maintain trust and build public confidence in the use of their data.
- **Adoption of 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.
- **Regulation and standards:** The IET recommends the adoption of the 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. We also recommend the continued development of technical standards, transparent documentation expectations, and harmonisation with other international frameworks.
- **Resilience:** The IET recommends an infrastructure plan for power stability and connectivity, alongside targeted funding to ensure resilience and safe development of

personalised medicine in healthcare. It is vital to consider the physical environments in which digital technologies and personalised medicine are deployed. This consideration extends beyond hospital settings. Articulating the infrastructure requirements, alongside the necessary financial investment, are important steps of implementing personalised medicine across prevention, diagnosis, and treatment.

- **Upskilling and reskilling:** The IET recommends that implementation of personalised medicine and AI 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.

The role of AI in personalised medicine

Improving diagnosis is a priority in the 10 Year Health Plan and personalised medicine, together with AI are a central part of achieving this. 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 for personalised medicine, transparency around how 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.

However, there is a clear gap in the ecosystem that needs to be addressed with regards to supporting best practice for development and adoption to ensure 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 for 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.

Health data research infrastructure

As new technologies and personalised treatments 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 AI and personalised medicine is used.**

The government should ensure the development of technical standards and safeguards for the use of personalised medicine and AI. 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 often 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 for personalised medicine. 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. 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 emphasises that government continues to update and clarify 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.

Deployment in practice

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 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.

Furthermore, the built environment of healthcare settings needs to be considered. Without this, technology cannot be used. The Government has already highlighted plans for 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). To facilitate the successful shift to personalised medicine, 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 Department for Health and Social Care (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.

With 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 provisions for personalised medicine and AI.

The IET recommends that implementation of personalised medicine 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 to ensure inclusive co-design as well as demonstrating the value of the products.

Conclusion

To successfully develop AI and personalised medicine, the supporting frameworks must align seamlessly with UK-wide healthcare systems. Adopting a systems approach will ensure these technologies integrate harmoniously into the broader health landscape, keeping patient experience and outcomes at the heart of their success. Crucially, the continued development and use of AI must be grounded in strong protections for patient data, supported by robust and resilient cybersecurity frameworks.

For further reading on the IET's position on the use of technology in healthcare, please see our published paper on Digital Transformation in Healthcare.

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