The Academy of Medical Sciences

Opportunities for quantum sensing technologies in health and care pathways: executive summary

Wednesday 7 May 2025

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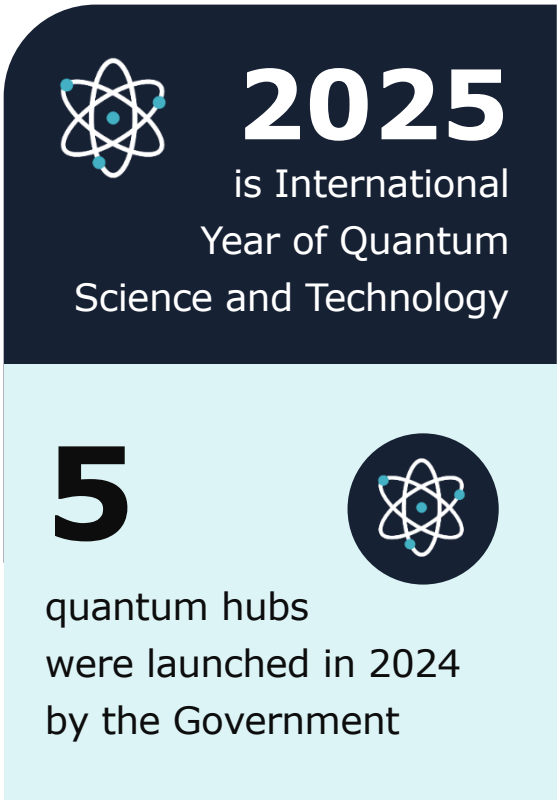
Executive summary

Background

2025 has been designated the International Year of Quantum Science and Technology by the UN. Quantum technologies such as quantum computing, quantum sensing, quantum imaging and quantum cryptography all have the potential to improve healthcare.

The National Quantum Strategy,[1] published in March 2023, set out the UK Government's ambition that: by 2030, every NHS Trust will benefit from quantum sensing-enabled solutions, helping those with chronic illness live healthier, longer lives through early diagnosis and treatment (National Quantum Strategy Mission 3).[2]

In 2024, the Government launched five new quantum hubs,[3] including a healthcare-focused hub Q-BIOMED, and QuSIT, focused on sensing, imaging and timing with relevant healthcare applications of quantum sensing and applications of quantum computing for modelling. These hubs will support the development of innovations that can transform health and care pathways in the future.



On 7 May 2025, the Academy of Medical Sciences hosted a workshop titled 'Opportunities for quantum sensing technologies in health and care pathways'. The workshop brought together many sectors with an interest in the application of quantum sensing technologies to healthcare, including clinicians, patients, developers of quantum technology, government, regulators, funders and academic researchers. All participants on the day are listed in Annex 1.

The workshop and its outputs have informed the development of a roadmap on quantum sensing technologies, commissioned by the Office for Quantum at the Department for Science, Innovation and Technology in support of the National Quantum Strategy.[4]

[1] Department for Science, Innovation and Technology (2023). *National Quantum Strategy*. https://assets.publishing.service.gov.uk/media/6411a602e90e0776996a4ade/national_quantum_strategy.pdf
[2] Department for Science Innovation and Technology (2023). *National Quantum Strategy Missions*. https://www.gov.uk/government/publications/national-quantum-strategy/national-quantum-strategy-missions
[3] UK Government (2024). *Over £100 million boost to quantum hubs to develop life-saving blood tests and resilient security systems*. https://www.gov.uk/government/news/over-100-million-boost-to-quantum-hubs-to-develop-life-saving-blood-tests-and-resilient-security-systems
[4] Department for Science, Innovation and Technology (2023). *National Quantum Strategy*. https://assets.publishing.service.gov.uk/media/6411a602e90e0776996a4ade/national_quantum_strategy.pdf

Workshop aims

- Understand the capabilities of quantum sensing technologies in a healthcare context.
- Identify the needs and challenges faced by health and care pathways that could be addressed through the application of quantum sensing technologies.
- Look to the next 5–10 years, and identify which quantum sensing technologies could address these needs and challenges.
- Consider the benefits to patients, clinicians and the NHS that would be made possible by adopting quantum sensing technologies in health and care pathways.
- Discuss guiding principles for the development and application of new quantum sensing technologies to the health and care context, and how this can be supported by effective interaction between clinicians, patients and quantum technology developers.

Workshop themes

The workshop consisted of scene setting talks, followed by a series of breakout sessions. Presentations from external speakers covered the capabilities of quantum sensing technologies in a healthcare setting to deliver improvements in disease detection and diagnosis for patients.

Participants discussed the opportunities that quantum sensing could present for health and care systems in facilitating improved treatment options and understanding of conditions that could not previously be diagnosed, particularly in underserved areas, and in addressing health inequalities. In addition, opportunities for the development of non-invasive or less-invasive alternatives to current diagnostic tests, and the potential to move care into different settings such as non-specialist centres or into the community were key discussion points within the day.

Participants noted that although quantum sensing technologies show great promise, they are not the solution to all health care challenges. However, their potential may be further enhanced by their convergence and alignment with other technological advances such as artificial intelligence. Reflections also centred around the hope that new quantum sensing technologies may lead to reduced workload for NHS staff and improved efficiencies in the delivery of care.

Principles

The workshop brought a focus to cardiovascular and neurological diseases as these had been identified as areas where quantum sensing technologies could be particularly impactful or have earlier application. However, the event also aimed to identify wider areas of application and general principles for the development of quantum sensing technology in all areas of healthcare. The following were generated from discussions at the workshop as a guide for those seeking to develop or support the development of quantum sensing technologies in a healthcare context. These principles are also of value more broadly and are widely applicable to the development of other emerging technologies.

1. **Developers should work hand in hand with clinicians and patients as end users of quantum sensing technologies**
   Developers should be aware of the problems that end users face, and use this to drive development, rather than prioritising according to what is technologically possible alone. Quantum sensing technologies must be carefully targeted to challenges that they are well suited to address, and through their application, deliver transformative improvements in patient care. End user engagement should be incorporated from the beginning, and continue through co-development. Organisations such as the Academy can have a role in broadening and strengthening the connectivity between technology developers, clinicians and patients.

   - **Development of quantum sensing technologies that are non-invasive or less-invasive should be a goal.** This was particularly identified within our workshop by both clinician and patient voices, as something that would have a significant positive impact on the patient experience.

2. **Public engagement should be undertaken alongside technology development**
   This should form part of a responsible innovation approach to help reduce the barriers to technology adoption, through increasing public understanding and awareness of quantum sensing.

3. **Innovations should be developed with early and proactive consideration of regulatory requirements, healthcare system integration and health economic impact**
   In particular, evidence generation requirements for regulatory submission should be factored in from the start of the technology development process. Regulators and funders should also ensure that pathways contain relevant expertise on quantum sensing technologies in order to support their assessment.

4. **Collaboration opportunities with large companies and across other sectors should be considered to enable scale up of technologies**
   Collaborations can provide support in the data generation required for regulatory approval through increased capacity for testing, and provide capabilities, funding and established commercialisation channels. They can also help drive the development of cost-efficient technologies, with the potential to manufacture cheaply and at scale.

5. **Training and upskilling of healthcare staff must be done in parallel to innovation ambitions for quantum sensing technologies**
   This would support smoother adoption of new technologies through staff being equipped with the knowledge needed for their application. Clinician time for research, including testing of new technologies, must also be protected to enable this.

Future work

In addition to the principles outlined above, the workshop generated significant interest amongst innovators, patients and clinicians. This enthusiasm presents a valuable opportunity to build on this network and support the further development of quantum sensing technologies in health and care settings.

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