

# AI: Opportunities, Capabilities and Limits

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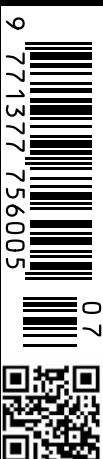
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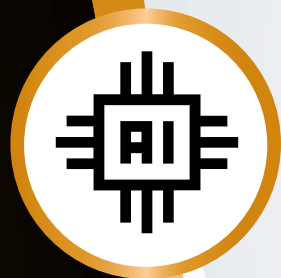
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# AI: Opportunities Capabilities & Limits



# Digital Twin Technologies - Shortening Waiting Lists and Reducing Inefficiencies

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Digital twin technologies and the use of artificial intelligence and data science to revolutionise the provision, delivery and sustainability of healthcare.



## Key Points

- The NHS needs to look to different approaches to achieve sustainable, high-quality healthcare that meets both patient need and expectations.
- Using a combination of retrospective, real-time and prospective analytics in day-to-day decision making is the key to unlocking sustainable solutions which improve healthcare outcomes.
- Digital twin technologies use AI and data science to accurately forecast what could happen in the future using a virtual replica of a hospital environment.
- Developing, implementing, and embracing these technologies will unlock the transformation that healthcare needs to deliver sustainable high quality cost-effective healthcare.

The challenges to providing healthcare at this period in history are numerous - workforce shortages, the [longest waiting list in NHS history](#) and increasingly complex conditions are just some of the obstacles that hospitals face today. Tried and tested productivity and efficiency programmes are struggling to meet demand, and it is clear that the NHS needs to look to different approaches to achieve sustainable, high-quality healthcare that meets both patient need and expectations.

### An Effective Response Needs Intuitive, Live and Insightful Predictive Analytics

In order for NHS Trusts or ICSs to respond to the challenges ahead, it is critical that the NHS and contributing partners, organisations, collaboratives, networks, neighbourhoods, places and systems, develop their use of data to embrace the full breadth of analytical capability. Using a combination of retrospective, real-time and prospective analytics in day-to-day decision making is the key to unlocking sustainable solutions which improve healthcare outcomes while maximising financial and operational efficiency.

Whilst NHS use of retrospective and real-time data is increasingly widespread, analytics that looks forward and predicts the

future is in its embryonic stage with limited investment and largely locally led implementation. And where it is used is often only during times of immediate crisis. Examples being major incidents or when ambulances are queuing outside ED and nursing teams are asked to predict what patients are due to go home in the next 24-48 hours. Not only is this data time consuming to collect and synthesise, it goes out of date almost immediately and doesn't elicit sustainable solutions.

### Transforming Decision Making

Imagine being able to accurately predict what bed capacity you are likely to need to a level of detail that enables you to identify potential over occupancy of inpatient beds several weeks in advance of it happening. Then imagine doing so with such detail that you can adjust your nursing ratios to accommodate for example, an increase in elderly admissions requiring interventions from the fragility team. Or having analytics that identifies patients who are likely to be complex discharges before they have even arrived at hospital. These insights would redefine healthcare models of service provision, giving local health providers advance notice and, therefore, time to work proactively together to create and agree a discharge pathway



that meets the needs of the patient, their families and the clinical teams.

Digital twin technologies use AI and data science to accurately forecast what could happen in the future using a virtual

opportunities for improving overall productivity.

**Pathway optimisation:** Being able to forecast the likely treatment pathway for a patient such as their need for radiology,

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## By using forward-looking metrics as opposed to retrospective metrics, hospital teams can work together to identify opportunities for improving overall productivity

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replica of a hospital environment, pulling data from multiple IT systems to simulate likely patient pathways and outcomes. Developing, implementing, and embracing these technologies will unlock the transformation that healthcare needs to deliver sustainable high quality cost-effective healthcare – and will have huge benefits across a number of areas, including:

**Workforce optimisation:** Workforce shortages across core clinical professions make it increasingly difficult to recruit, motivate and retain staff – and develop/train them to meet the requirements of 21st century healthcare. Therefore, efficient use of resources is critical. Consider the planning of elective surgery. Aligning the structure and skill mix of theatre teams to match the case-mix is a simple but effective way to positively improve productivity to benefit both the service provider and the patient. Data that provides information in advance of the theatre list as to whether staffing is optimum would inform teams on whether, for example, an anaesthetist is required or whether an additional theatre nurse is required to support due to case complexity.

**Bed optimisation:** At Nottingham University Hospitals NHS Trust, we use data collected routinely on hospital IT systems to predict length of stay for all patients at the point of their admission, accurately forecasting bed usage weeks in advance. Predicting both the number of hospital beds due to be used and the utilisation of those beds directly drives proactive use of these expensive resources, gives the patient a better experience and, ultimately, a better outcome. For example, teams booking patients to theatre lists can do so with increased confidence that the operation will not be cancelled due to non-clinical reasons, as currently [20,000 operations are cancelled year on year](#) for reasons such as bed capacity. Medical teams can then work proactively with community and social care to ensure that, once the patient is ready for discharge, any care package is optimised and ready to start immediately. By using forward-looking metrics such as how many beds do we need to use, as opposed to retrospective metrics, meaning how many beds did we use, hospital teams can work together to identify

pathology or pharmacy input would be invaluable in reducing waiting times and effective utilisation of resources. Not only would this revolutionise the management of capacity and demand across the NHS, it would also improve the patients' experience by giving visibility of what scans or appointments they may potentially have and increase their ability to 'own' their care pathway.

**Outcome optimisation:** Most importantly, maximising the potential of technologies to accurately predict and forecast will improve the quality of care, speed of intervention and overall outcome for patients. Predicting length of stay will transform discharging practices, leading to fewer "failed discharges" and a reduction in hospital re-admissions. Elective patient pathways can be condensed, reducing time spent organising appointments and maximising the time spent by key clinical teams and departments on direct patient care. As patient care and treatment increases in complexity, the decisions about the optimal care pathway will be enhanced through accurate and evidence digital tools that help guide, prioritise and inform evidence-based decisions. That would be truly patient-centric treatment that is individualised, efficient and effective.

### Digital Twin Technology Offers Opportunities to Unlock Real-Time Sustainable Efficiencies

Hospitals are increasingly complicated, interconnected and variable. Operating at close to maximum capacity most of the time whilst trying to balance increasing demand and funding gaps means that having access to a variety of analytical tools is less of a luxury and more of a necessity. Across the NHS, knowing what is going to happen before it actually happens is going to be a vital component in providing safe, efficient and effective healthcare. Technologies such as digital twins are going to revolutionise the provision, delivery and sustainability of healthcare – not just in the NHS, but worldwide.

### Conflict of Interest

None. ■