

Large-Scale System-Level Digitalisation Initiatives in the NHS in England: Insights from Three National Evaluations

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SUMMARY OF KEY RESEARCH FINDINGS

The English NHS provides a unique setting in which to study large-scale digital transformation. As a nationally coordinated health system serving a population of approximately 58 million, it has made substantial investments in successive national programmes for digitalisation, while also funding independent evaluations of these initiatives. This created a rare opportunity to examine how approaches to digital transformation have evolved over time and, importantly, whether lessons recur across successive programmes.

The authors' study synthesised evidence from three independent national evaluations: the National Programme for IT/NHS Care Records Service, the Global Digital Exemplar Programme, and the NHS Artificial Intelligence Lab. Together, these programmes represented approximately 13 billion GBP of investment. Drawing on

1,079 interviews, 819 observations, and 2,219 documents collected over 15 years, the authors were able to generate unique longitudinal insights into the conditions shaping large-scale digital transformation.¹

Despite major differences in the technologies, ambitions, and policy contexts of the three programmes, the authors observed similar lessons. New technologies were constrained by legacy infrastructure, interoperability, and data-quality problems. However, the most important challenges were sociotechnical: unstable governance, competing national and local priorities, inflated expectations, short programme timescales, and limited retention of learning between initiatives. Building on these recurring lessons, the authors propose the Innovation, Learning, and Infrastructure for Advancing Systemic Digitalisation (ILIAD) model, which conceptualises sustainable system-level digitalisation as requiring long-term and balanced investment in three interconnected areas.¹

WHAT CHALLENGE DOES THIS ADDRESS?

The central challenge is how health systems can get the most out of digitalisation at scale. Health systems are making substantial investments in electronic health records, data platforms, AI, and other digital capabilities, often with expectations of improvements in quality, efficiency, and productivity.² Yet, there is no simple recipe for successful large-scale digital transformation. Rather, the authors' findings suggest that health systems need to recognise and explicitly manage a series of persistent tensions that arise when digital change is pursued across multiple organisations and settings.¹

One such tension is between central coordination and local involvement in decision-making.³ System-level leadership, common standards, and coordination can

support interoperability, consistency, and scale, but overly centralised approaches may undermine local ownership and acceptance and impair adaptability and innovation. Conversely, highly decentralised approaches can result in costly fragmentation, duplication, and poor interoperability.

A second tension is between investing in new digital technologies and maintaining the broader capabilities.⁴ Advanced capabilities such as AI depend on robust digital infrastructure, high-quality data, interoperable systems, and organisational capability. Focusing resources and attention on the latest innovations while neglecting these foundations can therefore constrain their eventual value.

Finally, coordination is needed not only for implementing change, but also for learning from it.⁵ Large-scale programmes generate considerable knowledge about implementation, adaptation, and optimisation, yet the authors' study showed that this learning was not consistently retained or transferred between provider organisations or successive programmes. Realising the benefits of digitalisation at scale therefore requires mechanisms for coordinating learning and knowledge exchange across settings.¹

RELEVANCE TO EUROPEAN CLINICAL PRACTICE

The English experience is likely to be directly relevant to many European health systems. Most EU countries have predominantly publicly financed healthcare systems, including national or regional health services in countries such as Spain and the Nordic countries. However, there are substantial differences in their structure, financing and reimbursement, governance, and the distribution of responsibilities between national, regional, and local levels. Countries and regions also differ considerably in population size and organisational scale. However, the underlying challenges of coordinating infrastructure, learning, and innovation are relevant across these different system configurations.

The findings may be particularly applicable to national or regional digitalisation programmes where strategy and investment can be coordinated across multiple healthcare organisations. In more decentralised systems, the same principles may need to be operationalised at regional or network levels, with national authorities providing strategic direction, standards, and mechanisms for coordination. Scale is also important: approaches that are feasible within smaller national health systems may be considerably more challenging in larger countries or systems in which responsibility is distributed across multiple regions. Across these different configurations, the central challenge is to combine system-level direction with sufficient local involvement and adaptability, while maintaining a long-term approach that extends beyond individual technologies, programmes, and political cycles.

The European context also creates important opportunities for learning beyond individual health systems. Member States, regions, and healthcare organisations are at different stages of digital maturity and have accumulated substantial experience in implementing electronic health records, interoperability infrastructures, and other digital innovations. Rather than this learning remaining within individual organisations, regions, or countries, there is potential to develop wider European learning ecosystems through which implementation knowledge, capabilities, and lessons can be shared across national boundaries.

This is increasingly relevant as EU initiatives such as the European Health Data Space create common frameworks for interoperability and cross-border health-data exchange.⁶ Such initiatives provide an opportunity to strengthen mechanisms for shared learning about how digital transformation is implemented, adapted, and sustained. Digitally advanced organisations, regions, and countries could contribute to wider European learning networks, supporting less digitally mature settings and reducing duplication of effort across Member States.

The principles underlying ILIAD could therefore be relevant at multiple levels: locally, to inform organisational digital strategies; regionally and nationally, to coordinate infrastructure, learning, and innovation; and at an EU level, to facilitate cross-border knowledge exchange and collective learning. Differences in system structure, scale, and digital maturity create opportunities to learn from contrasting approaches and experiences. Harnessing this diversity could help reduce variation in digital capability and enable the benefits of digital innovation to be shared more widely across European populations.¹

WHAT ARE THE NEXT STEPS FOR THE RESEARCH?

The next step is to move from using the ILIAD model to understand past digitalisation programmes towards using it proactively to inform future digitalisation strategies. The key challenge will be operationalising infrastructure, learning, and innovation in ways that can inform strategic decision-making, both in England and in other health-system contexts. This includes understanding how the model can support national and regional strategy while also providing a useful framework for individual healthcare organisations making decisions about their own digital development.

A particularly important area for further research is the longitudinal evolution of these dimensions. Infrastructure, organisational learning, and capacity for innovation develop and interact over time as technologies, organisations, and healthcare systems change. The authors are currently embarking on a national study of electronic patient record optimisation in England, tracking the longitudinal trajectories through which hospitals implement, adapt, and optimise their electronic patient records over time. This work will provide an opportunity to explore these dynamic processes in greater depth and examine how changing infrastructure, organisational capabilities, learning, and innovation shape longer-term digital development.

Further research should therefore examine not only the individual dimensions of ILIAD, but how relationships between them evolve within organisations and across healthcare systems. This will be important for determining how the model can be operationalised at different levels: nationally, to inform long-term investment priorities, coordination, and mechanisms for system-wide learning; and locally, to help organisations assess their digital trajectories, identify gaps in foundational capability, learn from others, and make strategic choices about when and how to pursue further innovation.

Ultimately, longitudinal research will be essential. Digital transformation unfolds over many years and across successive generations of technology, while policy and funding programmes are often considerably shorter. Following organisations and systems over time should provide a stronger understanding of how digital capability accumulates, how learning is retained or lost, and how health systems can create the conditions for sustainable innovation and improvements in care.¹

References

1. Cresswell K, Williams R. Large-scale system-level digitalisation initiatives in the National Health Service in England: insights from three national evaluations. *NPJ Digit Med*. 2026;9(1):301.
2. Angus DC et al.; JAMA Summit on AI. AI, health, and health care today and tomorrow: the JAMA summit report on artificial intelligence. *JAMA*. 2025;334(18):1650-64.
3. Sheikh A et al. Electronic prescribing systems in hospitals to improve medication safety: a multimethods research programme. *Prog Grants Appl Res*. 2022;DOI: 10.3310/KSRS2009.
4. Cresswell K et al. A mixed methods formative evaluation of the United Kingdom National Health Service Artificial Intelligence Lab. *NPJ Digit Med*. 2025;8(1):448.
5. Cresswell K et al. Interorganizational knowledge sharing to establish digital health learning ecosystems: qualitative evaluation of a national digital health transformation program in England. *J Med Internet Res*. 2021;23(8):e23372.
6. Raab R et al. Federated electronic health records for the European Health Data Space. *Lancet Digit Health*. 2023;5(11):e840-7.