NIIN
National Industry Innovation Network

Health x Digital Transformation Report 2024-2025

A practical guide for action, on the trends that matter

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RMIT UNIVERSITY

CISCO

Health <Transformation> Lab

The role of the NIIN

The NIIN is a dynamic network that brings together industry, university and government partners to drive digital technology advancements in economy and society. With its ready-to-access capability and existing infrastructure, the NIIN's Health Alliance provides a low-risk avenue for health agencies and hospital operators to engage in innovation activities. The NIIN's six innovation centres, eight Research Chairs, two health-focused labs, and specialised technology centres serve as a collaborative hub for industry, health agencies, hospital operators, researchers, and students tackling critical healthcare challenges, collectively using digital innovation.

Establishment of the NIIN Health Alliance

The importance of scaling healthcare innovation is evident in today's dynamic and intricate healthcare landscape. To fully leverage the potential of the NIIN healthcare ecosystem, it is essential to establish a network of carefully selected partners with relevant capabilities, projects, contributions, and platforms. The NIIN Health Alliance aims to achieve three major outcomes:
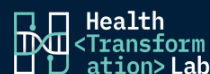
Leverage collective health innovation capacity

Build critical mass activity around health priorities

Create a forum for idea exchange in the health ecosystem.

Executive Summary

Health x Technology: from provocation to action, by way of impact

> "
> …let us stride into a brighter health future the only way possible – together."

Purpose

In an era marked by rapid technological advancements, the intersection of health and digital innovation presents an unprecedented opportunity to revolutionise healthcare. Leaps in computational power and network connectivity are driving digital innovation, and a wide collection of technologies are rapidly moving from 'might have future potential' into 'can be usefully deployed today'. Artificial Intelligence, extended reality, digital twins, 3D-printing, autonomous robots, and more are all finally moving to the point where their long-promised potential can be realised.

The *Health x Digital Transformation Report 2024-2025*, spearheaded by the National Industry Innovation Network (NIIN) Health Alliance, boldly addresses this transformative potential. Focusing on the most significant technological trends, the report considers the potential for each to redefine health systems, describes proven applications in health, and offers a clear roadmap for actionable change in the next 12 months.

The digital opportunity in health

Digital transformation in healthcare is not just a future aspiration—it is an urgent and immediate necessity. For example, the sensible, clear-eyed adoption of AI *will* change the way health systems operate. But all of its potential hinges on underlying digital infrastructure, secure data collection, and having the right skills available.

Healthcare systems worldwide are grappling with escalating demands and unprecedented challenges, and the potential for digital technologies to enhance patient care, streamline operations, and foster innovation are entirely dependent on creating the right conditions for their success. Failure to do so may yet result in a health transformation, but it will not be in the direction of more efficient, personalised, and accessible health systems. The path to success is genuinely open, realising it requires that all those involved with the health system make the right decisions today.

Articulating the potential, and the decisions required to achieve it, is the central aim of this report.

Our approach

In preparing this report, we scoured thousands of journal articles, using natural language processing to identify the most popular topics of research. Supplementing our survey of research literature, we read through every trends report we could find. From international organisations considering global health systems to national think tanks focusing on country-specific challenges, we have distilled 2024's hottest properties – the trends that everyone is talking about.
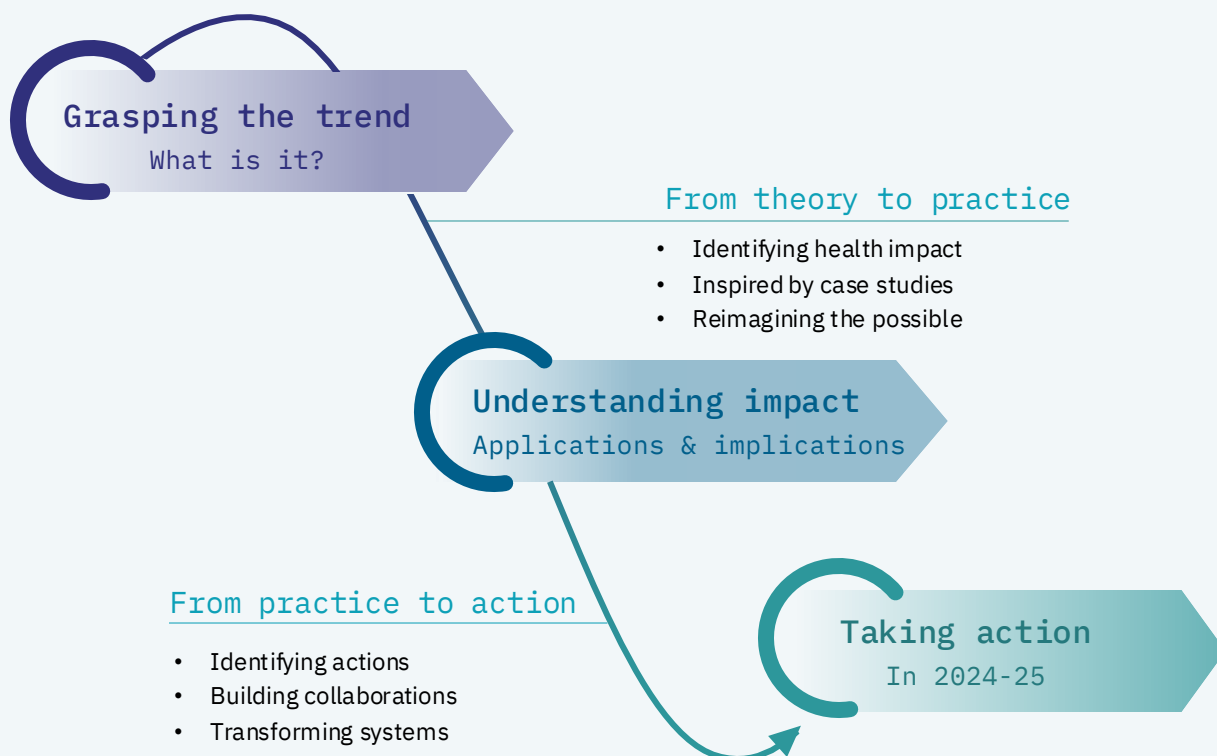
Five Transformation Dimensions of future digital-driven health emerged, representing a variety of technologies across different levels of activity. These are:

1. **Augmented intelligences:** the deployment artificial intelligence and machine learning to make healthcare genuinely smart

2. **Simulation and simulacra:** using digital replicas and simulation technologies to hack the real world

3. **Remote patient care:** leveraging digital means to provide care meets the patient where they need it

4. **Health system adaptability and dynamism**: technologies that foster system resilience in times of rapid change

5. **Harnessing biotechnology breakthroughs:** building the digital foundations of future healthcare.

The first – artificial intelligence – is an individual technological field and undoubtedly the most talked about current technology trend. The second and third dimensions are, in contrast, fields of application in which multiple different individual technologies can be harnessed towards a purpose. Thus, we consider the use of simulations in our second dimension, where different technologies like extended reality and digital twins bring digital tools to bear on the physical world. Similarly, in dimension three, with the overarching aim of creating genuine remote patient care, we see communication technologies, the Internet-of-Things and AI deployed together for a single purpose.

As we worked through these three dimensions, two other fields emerged as being particularly important. First is the need for constant adaptation in our health infrastructure and systems. The world is changing rapidly, creating ever new challenges for health systems. Building dynamism and adaptation into the health system – in its policies, along with physical and digital infrastructure – is the only way for health systems to efficiently cater to changing populations and conditions.

Finally, so much of the literature reveals genuine excitement about the possibilities of breakthroughs in biotechnology: from gene editing to nanotech to fulfilling long-held dreams of personalised medicine. The question for this report in respect of this last category has been: what role must digital play in harnessing these breakthroughs?

Grasping the trend
  What is it?

From theory to practice

- Identifying health impact
- Inspired by case studies
- Reimagining the possible

Understanding impact
  Applications & implications

From practice to action

- Identifying actions
- Building collaborations
- Transforming systems

Taking action
  In 2024-25

How to use this report to pursue transformative impact

The intention behind this report is to provide a clear line from the nature of each Transformation Dimension, through how it will impact health, and ultimately to the actions you can take today to realise and maximise that impact, depending on where you sit in or around the health system. Thus, the discussion of each Dimension is split into three parts.

Grasping the trend

For each Transformation Dimension, the first section considers the relevant technology trends in detail, providing depth beyond the buzzwords. We break down the field, highlighting facets that are most promising or well-developed, and identify aspects that are over-hyped.

Each of these sections aims to be a self-contained primer on the nature of the technology trend or dimension under examination.

Understanding impact

At the risk of tautology, health technologies must – whether realised or potential – have an impact on health. Therefore, second section in respect of each Transformation Dimension applies an impact framework to the Dimension in question, explaining the ways in which the technologies can impact patient care and wellbeing, and system infrastructure.

Wherever necessary, we highlight proclaimed technologies for which evidence of impact is scant or likely to be implausible. Such examples are, however, rare. The creation of good health and wellbeing is influenced by a wide variety of factors. Technologies that directly act on individual health – such as artificial titanium[1] hearts have the most obvious impact, but the maintenance of population health are equally based on robust administration, high-quality data, and clinical skills development.

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[1] Groch, S. (2024). "His dad was dying. So Daniel built a world-first artificial heart – with pipes and magnets." from https://www.smh.com.au/healthcare/his-dad-was-dying-so-daniel-built-a-world-first-artificial-heart-with-pipes-and-magnets-20240215-p5f54u.html.
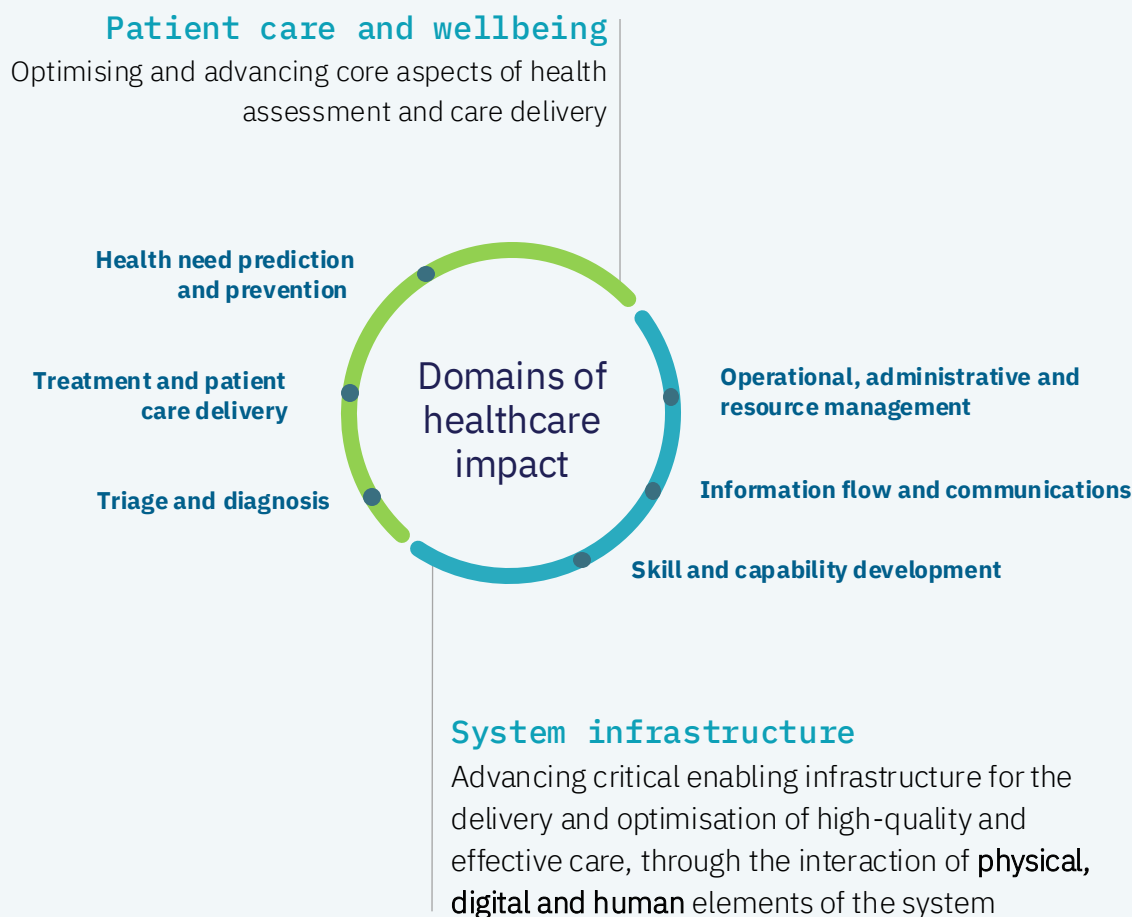
Our Impact Framework (please see below) categorises applications of health technologies according to their impact on patient care and wellbeing, and health system infrastructure. As depicted in the figure below, these domains of impact are broken down into further sub-categories to help specify the precise nature of impact.

Overall, the Impact Framework provides a heuristic for organising the different types of impact that a technology might deliver, simplifying decision-making and making clearer how maximised impact requires input from the many types of health professionals.

We then further illustrate and make granular that impact through the use of case studies – examples of where the technologies in question *are* having an impact already. Some of these case studies are drawn from NIIN universities and from our ecosystem – while we also include those from around the world.

These case studies aim to illustrate, to inspire and to act as a provocation for readers to identify interventions that they might like to pursue in their own services, contexts and domains.

Patient care and wellbeing
Optimising and advancing core aspects of health assessment and care delivery

Health need prediction and prevention

Treatment and patient care delivery

Triage and diagnosis

Domains of healthcare impact

Operational, administrative and resource management

Information flow and communications

Skill and capability development

System infrastructure
Advancing critical enabling infrastructure for the delivery and optimisation of high-quality and effective care, through the interaction of **physical, digital and human** elements of the system

Taking action

Where there is the promise of health impact, the next question is, "What actions must be taken?"

In the final section we move from practice to action, focusing on the steps that can – and we recommend, should – be taken across 2024-2025. These range from ways to implement new technologies immediately, through to outlining the preparatory steps required to implement them in the future. This section considers action across a broad scale, including tasks for regulators, health services, researchers, and clinicians.

Our Action Framework (below) identifies and maps the actions that health ecosystem actors can take across 2024-2025, across three key phases of technology readiness:

- **Foundations:** Where technologies are nascent and/or still developing, actions across the health system can only be foundational, establishing the right regulatory settings, preparing the requisite infrastructure, and exploring the technology's potential.
- **Activate:** For more established technologies, the imperative is activation, building capabilities and developing pilot studies. At this stage promising technologies are applied directly to health problems.
- **Transform:** For the most well-established technologies – with clear impact already being demonstrated - the task is to deploy and then scale. It is at this point that we start to see our health system transform, providing ever better health outcomes for patients and populations.
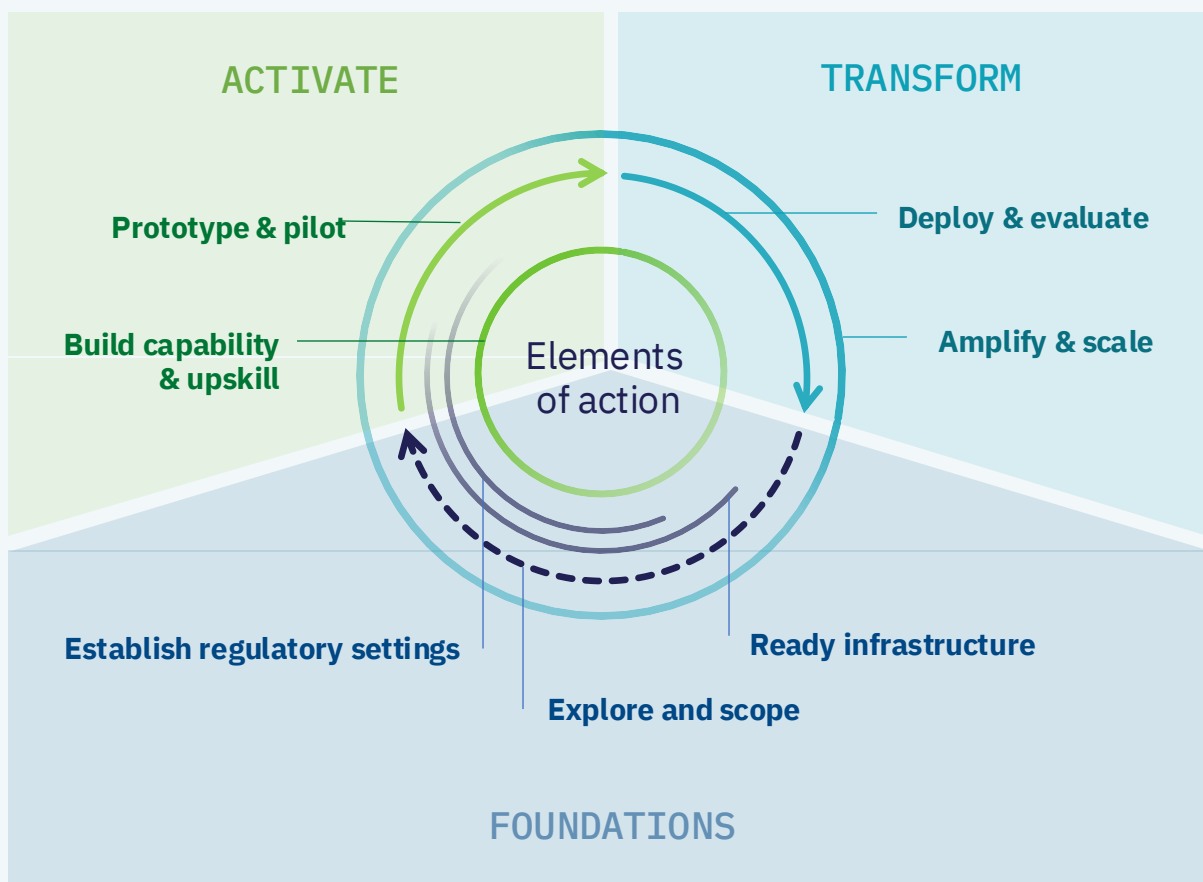
An integrated approach to strategic action

Put another way, across each of the five Transformation Dimensions, the three organising sections move from theory to impact and on to action, offering a detailed picture of what the dimension is, what it will do, and how you can make it happen.

The table below contains a distillation of this approach, highlighting core insights and recommendations for each of the five Transformation Dimensions.

Grasping the Trend What is it?	Understanding impact Applications and implications	Taking action Actions for 2024-25
Augmented intelligences		
Artificial intelligence is 2024's most hyped trend. Powered by neural networks and the ingestion of enormous quantities of data, AI identifies statistical trends in the data that can be applied to new contexts.	Potentially revolutionary across almost every major element of the health system, from diagnostics and care, to operational decision making and resource management. However, impact is dependent on the sophistication of digital infrastructure, data collection and management, and cybersecurity.	• Build robust data pipelines for high-quality data for AI training and operation. • Invest in skills around AI and potential uses. • Establish partnerships to explore prerequisites to implementation.
Simulation and simulacra		
Simulation technologies allow testing, prototyping and experimenting without the costs or consequences associated with the physical world. Includes Extended Reality, digital twins and 3D Printing.	Extensive potential impact, touching elements of the system across both patient care and system infrastructure. However, most technologies are still broadly in early stages of deployment, in even the most advanced health systems and providers.	• Build the technology foundations that simulation technologies need to work. • Collaboratively scope, prototype, and pilot these technologies to learn and plan for more fulsome deployment.
Remote patient care		
Involves utilisation of an array of communication technologies and network-connected sensors to provide care to an individual in circumstances where the carer and patient are not in the same physical space.	Potential for significant transformation, especially at the patient level, and with implications for the infrastructural and operational elements of the system. While the pandemic has driven exponential growth in RPC deployment, realising impact at scale will require more sophisticated data processing and cybersecurity.	• Scope and collaborate on the most strategic technologies for prototyping, deployment and iteration. • Building the technology infrastructure for scale. • Incentivise and enable hybrid healthcare at scale via policy and regulatory settings.
Health system adaptability and dynamism		
Involves creating systems that are flexible by default, designed with the anticipation of the need for future adjustment, and with a range of features that can achieve the required shifts – across physical and digital infrastructure, and organisational structures and processes.	Adaptation is not a choice. As the world changes, health systems can decide to build dynamism into their structures or be forced to change in periodic ruptures. Crafting flexible policy and building dynamic structures allows health systems to keep pace with the rest of society and respond to challenges confidently as they arise.	• Build the technology infrastructure of dynamism, calibrating to strategic goals and key areas across organisations and the health system more broadly. • Embed a focus on collaboratively prototyping and learning.
Harnessing biotechnology breakthroughs		
The great breakthroughs in health have come from breakthroughs in biotechnology deep scientific research. Today, the implementation of such breakthroughs is enhanced by appropriate digital infrastructure - or hampered by its absence.	Biotech research into gene editing, personalised genomics and regenerative medicine appear set to transform medical practice. Each is powered by AI and data analytics and will require robust digital systems for implementation.	• Build partnerships across health, biotech and research institutions to prepare for new technologies as they become available. • Build redundant capacity into data management systems to handle influxes of biological and patient data.

Call to action: join the transformation

Throughout this report we highlight case studies of real action across each of the five Transformation Dimensions. We have collected more than 100 such examples (see the Appendix for the full complement), each demonstrating what is possible today along with the pitfalls and challenges to navigate.

From this we have crafted a list of actions that anyone in the health system can look to implement today. These actions are summarised in the right-most column of the table above and presented in full throughout the report. These 'action tables' appear at the end of each section and together provide a comprehensive overview of measures that are not simply possible today, but that have been tested, tried and implemented somewhere in the world already. Each action is real, validated, and demonstrably achievable.

The NIIN Health Alliance stands at the forefront of this digital revolution. By uniting government, industry, and academic partners, the NIIN has created a dynamic ecosystem designed to drive advancements in digital health technology. With six innovation centres, eight Research Chairs, two health-focused labs, and specialised technology hubs, NIIN is uniquely positioned to address critical healthcare challenges through collaborative digital innovation.

The NIIN Health Alliance is not, however, merely a collective of researchers or technology vendors; it is a catalyst for transformative impact in healthcare. This report aims to be a clarion call to action, urging stakeholders to move beyond the theoretical and into practical implementation. By joining forces with the NIIN Health Alliance, healthcare providers, policymakers, and technologists can collectively drive innovation and create a collaborative, future-ready healthcare ecosystem.

The NIIN Health Alliance stands ready to catalyse innovation efforts across our health systems. Join us – and let us stride into this new era of healthcare together, leveraging the power of digital transformation to achieve unprecedented advancements in patient care and operational excellence.

The future of healthcare is now—engage with the NIIN Health Alliance and be part of the revolution.