

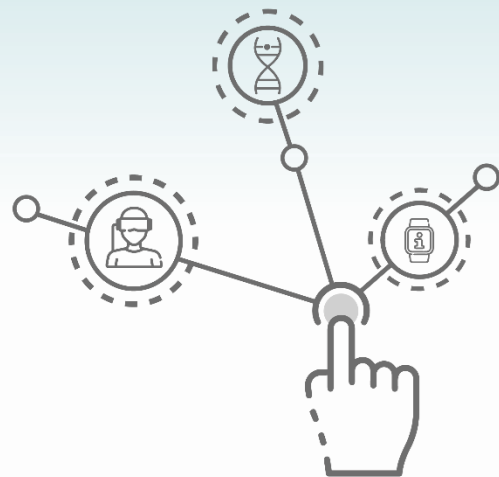


Delivering value with digital technologies
Briefing: October 2022



A model for innovation: Alder Hey Children's Hospital

Case study



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Health Education England

Delivering value with digital technologies

Digital technologies such as digital medicine, genomics, artificial intelligence and robotics have a huge potential to transform the delivery of healthcare.¹

These technologies can empower patients to participate actively in their care, with a greater focus on wellbeing and prevention. They also support the prediction of individual disease risk and personalise the management of long-term conditions.

The HFMA, supported by Health Education England, is delivering a 12-month programme of work to increase awareness amongst NHS finance staff about digital healthcare technologies, and enable finance to take an active role in supporting the use of digital technology to transform services and drive value and efficiency.²

As part of the programme, the HFMA is publishing a series of case studies. Working with organisations who have started on the digital transformation journey, we will identify examples of good practice and highlight the challenges that services face. This will include specific challenges relating to NHS finance.

This case study describes Alder Hey's model for innovation, identifying the key factors that make it a success. The case study includes an outline of two projects where the model has been applied.

Not all organisations will have the resources available to innovate at the scale of Alder Hey, but the trust's approach provides insight for organisations and systems aiming to improve services through digital innovation.

¹ HFMA, *Introduction to digital healthcare technologies*, July 2021

² HFMA, *Delivering value with digital technologies*

Introduction

Innovation is key to digital healthcare transformation. So, Alder Hey Children's Hospital NHS Foundation Trust (the trust) places it right at the heart of what it does, delivering a wide range of projects supported by the dedicated team within the Alder Hey Innovation Hub™ (the hub).

Originally set up in 2014, the hub has grown to be the largest, purpose-built, hospital-led innovation centre in the UK. It provides dedicated time and space away from day-to-day duties, where clinicians and industries can come together to create new products and technologies. This complements the trust's long history of paediatric research.

Digital technology and healthcare innovation

Healthcare innovation arises from a desire to improve health outcomes and patient experiences, enabling clinicians to focus on the needs of patients and the wider population.

It encompasses treatments, technology and processes. The expansion of digital technologies in healthcare provides the potential to offer new solutions to complex problems.

The *NHS Five Year Forward View*³ published in 2014 put healthcare innovation central to the transformation of healthcare services. It continues to be a focus in the *NHS long term plan*⁴.

Alder Hey's success factors for innovation

This section describes the elements that the trust has identified as being essential for implementing an innovative approach.

Embed innovation in strategy

The trust's *Strategic plan 2019-2024*⁵ sets out the vision, values, aims and objectives for the trust. It places innovation at the core of trust values and objectives as shown in *figure 1*.

The hub anchors innovation in their vision to build a healthier future for children and young people, using digital and medical technologies (MedTech) as a key enabler. They aim to rapidly identify real-world problems and bring the right partners together to solve problems with innovative and disruptive technology. The strategic objectives of the hub focus on tackling healthcare inequalities and finding solutions to optimise healthcare.

'Disruptive technology is one that displaces an established technology and shakes up the industry or a ground-breaking product that creates a completely new industry.'

Harvard Business Review, *Disruptive Technologies: Catching the Wave*, January–February 1995

³ NHS England, *NHS five year forward view*, 2014

⁴ NHS England, *NHS long term plan*, January 2019

⁵ Alder Hey Children's Hospital NHS Foundation Trust *Strategic plan 2019-2024*

Figure 1: Alder Hey’s strategy puts innovation at the centre⁵



‘At the heart of Alder Hey is a commitment to innovate – we dare to think differently, to focus on the needs of children and young people to deliver the biggest impact in their lives. Daring innovation drives our approach. We push the boundaries to crack the impossible – delivering on a world stage, working in partnership, to make the biggest difference and impact. Our strategy is ambitious, and we will partner with those who share our commitment to improve the lives of children and young people.’

Louise Shepherd CBE, chief executive, Alder Hey Children’s NHS Foundation Trust

Identify key implementation principles

The hub is very clear about how it implements innovation. Innovation within the hub is problem driven not technology driven, seeking to find the most appropriate solution to real world problems.

Co-creation is core to the success of innovation at Alder Hey. The hub’s open innovation portal⁶ welcomes submissions from staff, patients, service users, carers and other stakeholders where they have encountered challenges that they think the innovation hub can help to solve.

Stakeholders who have submitted a challenge are encouraged to participate in the problem solving. They are supported by hub staff and given freedom to be curious and experiment without fear of failure. This has an added benefit of identifying and unleashing hidden talent across the organisation and wider community.

Depending on the success of an innovation and any commercial outcome, stakeholders may be incentivised and rewarded for their efforts.

⁶ The *Alder Hey Innovation challenge hub* webpage ensures that anybody can raise challenges for the hub to consider.

Allocate appropriate resources

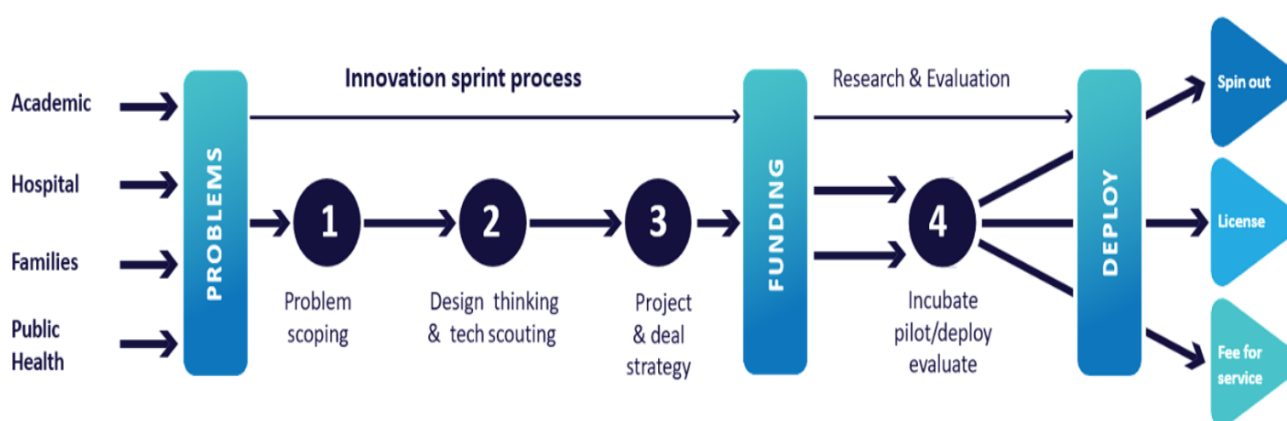
Staff need to dedicated time to focus on innovation. The hub is managed as a business separate from the day-to-day running of the hospital. A managing director and two clinical directors provide senior leadership supported by an in-house team of over 30 staff. The team incorporates experience in a wide range of disciplines including clinical, consultancy, business management and intellectual property, software design and prototyping.

In addition to the in-house team, the hub's co-creation approach identifies partners from local and international industry and academia to ensure that the most innovative technology and solutions are considered. This gives access to established and emerging technologies including artificial intelligence, wearable sensors for remote monitoring and virtual and augmented reality⁷.

Follow a structured process

All problems considered by the hub follow the same structured process, as shown in *figure 2*. At any one time, there will be around 100 projects live at various stages of the process.

Figure 2: Alder Hey innovation process



Alder Hey NHS foundation trust innovation centre ©

As soon as problems enter the pipeline, the project team will focus on both the current and future stages of the process. Identifying seed funding⁸ for the initial project and prototyping stages is essential. If a project is successful after initial development and prototyping, the hub will make a case for investment. This is covered in the next section.

Throughout a project the team will be focused on identifying and measuring the potential benefits of the innovation. The HFMA briefing *Making a difference with digital technologies: identifying and evaluating benefits* (April 2022) provides further details of how to define and evaluate the benefits of digital transformation.

Not all projects will reach deployment phase. This reflects the principle of having the freedom to be curious and experiment without fear of failure. Where a project is halted, the hub team will focus on capturing the learning that can be taken into future projects.

⁷ Virtual reality (VR) is a technology that allows a user to simulate a situation or experience, using a VR headset, within an interactive computer-generated environment. Augmented reality (AR) allows you to superimpose digital content (images, sounds, text) over a real-world environment. Further details on these and other digital healthcare technologies are included in the HFMA *Introduction to digital healthcare technologies*, July 2021.

⁸ Seed funding is the initial investment required to test out a concept. It may come from reinvestment of surpluses from previous projects or by funding received from internal or external partners and stakeholders. Seed funding carries a risk as there is no guarantee of a return on the investment.

Ensure financial sustainability

The hub's aim is for as many projects as possible to reach full deployment. Financial sustainability of the developed product or process will be considered throughout the project lifecycle but comes into full focus only after the initial problem scoping, design thinking and technology scouting has occurred.

The hub seeks to commercialise as many successful innovations as possible and aims for a 2:1 investment return on deployed solutions. Revenues generated from commercialisation ensure that the trust's patients can benefit directly with limited or no further investment, with any remaining funds reinvested as seed funding for future projects.

Where innovation results in product development, one method of commercialisation is to licence the product, leading to an ongoing revenue stream through royalties. Spin-off products may also be developed to increase revenue streams.

Not all the hub innovations will lead to commercially viable products but they may result in solving a direct problem at the trust. To get approval for full implementation within the trust, the hub may work with the relevant services to develop a case for investment outlining the anticipated benefits.

The hub extends sustainability to the local economy where possible by working directly with local partners, creating jobs and attracting talent into the area.

The next two sections provide examples of where Alder Hey's model of innovation has been applied to address challenges in local services.

Improving access to mental health services for children and young people

The hub was approached by the coalition of organisations providing child and adolescent mental health services (CAMHS) across Liverpool and Sefton to assist with improving access to their facilities and services for children and young people.

Understanding the problem

CAMHS services in Liverpool and Sefton are provided by a number of organisations including the trust. In the past, service users were referred directly to specific services. The system relied on paper-based forms, and there was a lack of consistency in the forms and the process for individual services. Each organisation has its own electronic patient record (EPR) system with no integration between each EPR. It was difficult to keep track of referrals once they were in the system with significant time spent chasing progress.

Service users, their parents and carers found it difficult to access and navigate the services. Young adults were not empowered to access advice and support without involving parents or carers.

Process for finding a solution

13 stakeholder organisations collaborated to come up with a solution, with a single common goal of improving the mental health service for children and young people. Service users, parents and carers were involved at all stages.

The hub team determined that a digital application would be the most likely solution and worked with NHSX⁹ in partnership with FutureGov¹⁰ for the initial problem scoping phases, before commissioning software development company Mindwave¹¹ to build the solution.

⁹ NHSX was set up to lead the digital transformation of health and social care as a separate unit of the DHSC and has since been integrated with the transformation directorate at NHS England.

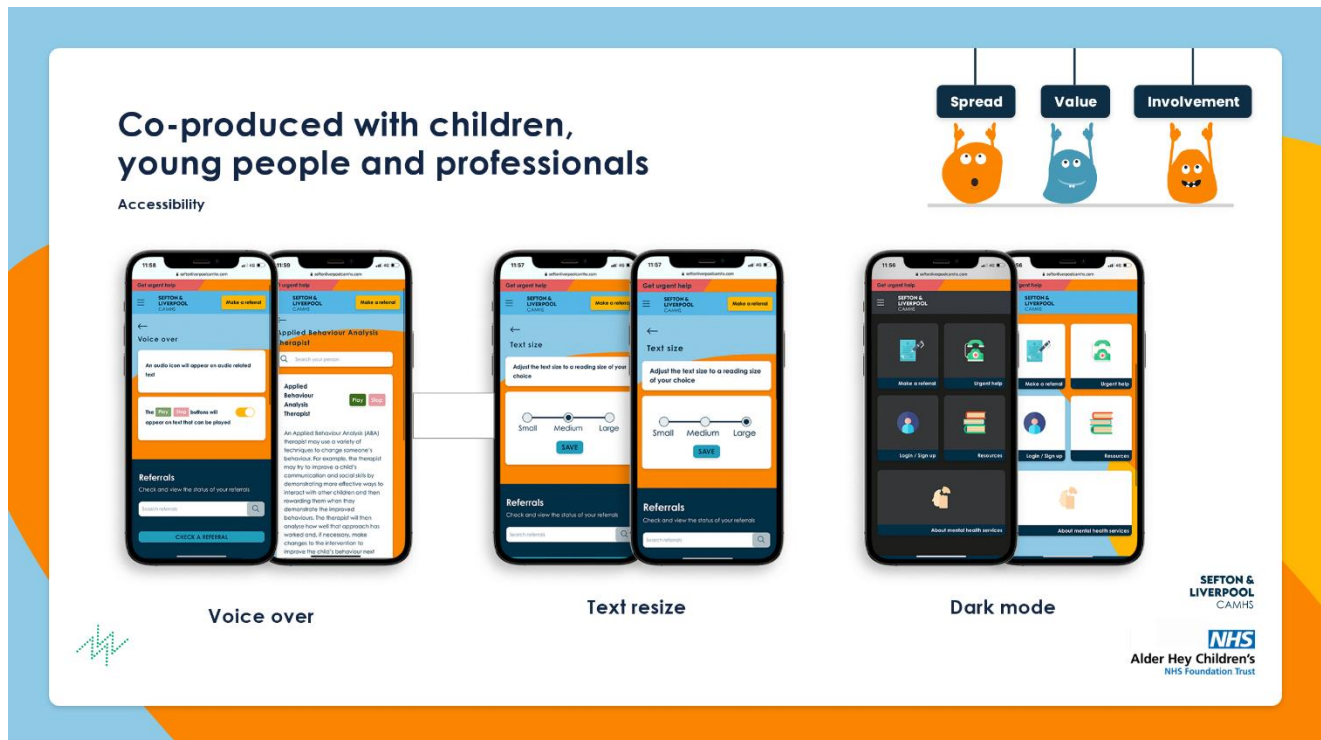
¹⁰ *FutureGov* (wearefuturegov.com) partners with public sector bodies to support digital transformation and service redesign.

¹¹ *Mindwave Ventures* develop personal health record and patient portal solutions across the UK.

Mindwave ensured that user testing and feedback was central to the development process. They engaged with 26 children and young people, 31 parents and 32 professionals (from both referring and provider organisations) over five stages of iteration before agreeing a final product specification.

Figure 3 highlights an example of the impact of co-creation. Following feedback from the service users, a vibrant colour palette for the application replaced an initial design which had been based on standard NHS colours.

Figure 3: Co-creation ensured the product was attractive for children and young people



Implementing a solution

The project resulted in a platform agnostic¹² digital application known as *CYP As One™*. The application provides a single point of access for referrals to all CAMHS services.

The application utilises robotic process automation (RPA)¹³ and interfacing¹⁴ to ensure that referrals are automatically uploaded to the appropriate individual organisation's EPR.

Educational resources can be accessed directly by children and young people to support their mental health and wellbeing via *CYP As One™*. There is also an ongoing project to scope feasibility of providing clinician approved therapeutic delivery via the platform.

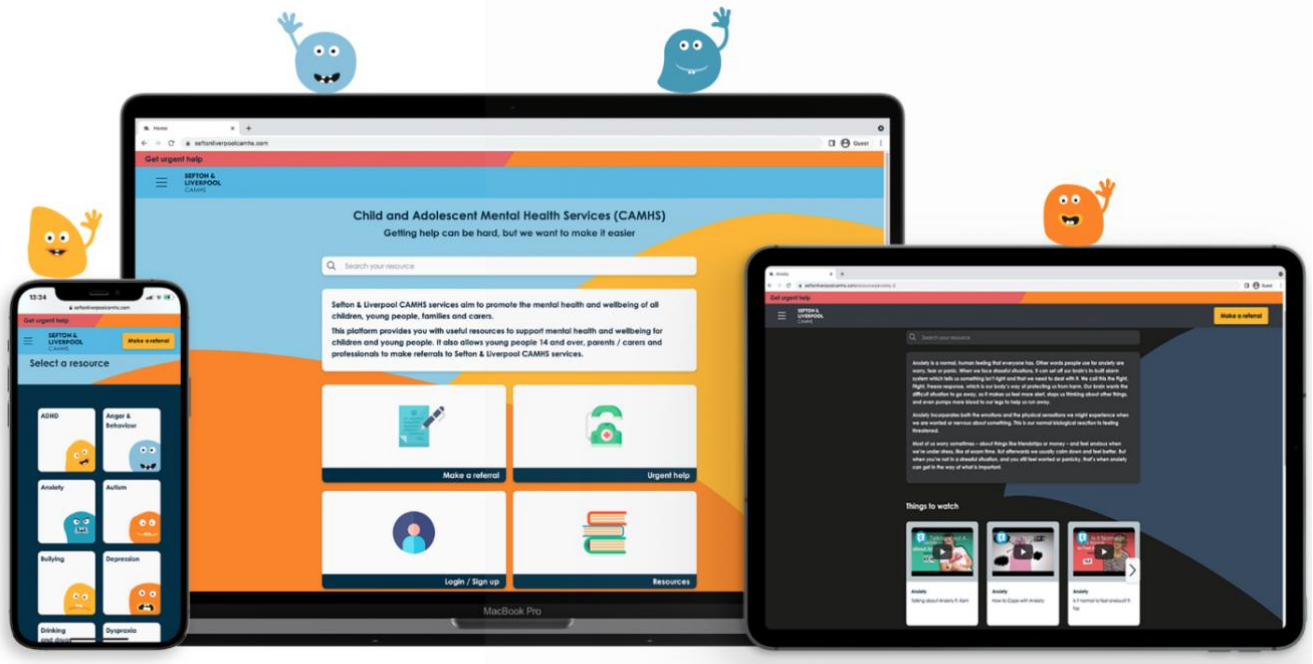
Branding is applied consistently across mobile devices, laptops and desktop computers, as highlighted in figure 4. Each layout is consistent with the user-designed colour palette.

¹² Platform agnostic is a concept that refers to the design attributes and philosophies of software products. A platform agnostic product runs equally well across more than one platform.

¹³ Robotic process automation uses automation technologies to undertake back-office tasks traditionally performed by human workers, such as extracting data, filling in forms and moving files.

¹⁴ Interfacing refers to how systems communicate with each other and how information can be shared electronically between different systems.

Figure 4: A platform agnostic digital application ensures consistency of user interfaces



Evaluating the impact

To understand if the implemented solution resolved the initial problem, the hub has identified the benefits for service users and families as well as for the CAMHS services.

Referrers, service users and families have the reassurance that all referrals are triaged within 24 hours of receipt. A unified screening service contributes to them accessing the right service and receiving the right treatment at the right time.

Clinicians can signpost service users and their families to resources available via the application. This promotes self-help and aims to reduce the need for an individual to access face-to-face services, thus helping to reduce waiting lists.

The referral process is more efficient and transparent. Previously referrers would wait up to two weeks for confirmation that the referral was in the system and would need to track progress manually with phone calls. Now referrers receive confirmation when they initially enter the details and can track progress electronically via the application.

The CAMHS service has estimated that the new electronic referral system has reduced administrative hours by 2,730 per annum. By automating data transfer processes between systems, human error is removed and data quality improved.

'I just wanted to let you know that all the parents I've heard from since the launch have all said how much easier it is to navigate and how helpful the resources are, that you have made a real difference to families lives and how much all your hard work is appreciated.'

Parent representative from stakeholder group

Looking to future expansion and sustainability

Internally, the trust plans to extend the application into other compatible services, starting with neurodiversity. This should enhance service provision for a larger patient population whilst achieving further productivity and efficiency gains for the trust.

The technology and concepts that have been developed in this project are also portable to other organisations and options are currently being considered.

Using predictive analytics to identify patients at risk of not being brought to appointments

The hub was approached by Alder Hey outpatient services to assist with reducing the volume of children who did not attend appointments. At the trust these are known as 'was not brought' (WNB) patients.

Understanding the problem

Despite various attempts to tackle the problem of WNB patients, it continues to be a challenge for the trust. When patients don't attend clinical appointments, diagnosis and treatment for the individual is delayed. High rates of non-attendance impact on efficiency and drive increases in waiting times for all patients.

The outpatient teams wanted to identify ways of proactively encouraging families to bring children to their appointments but it was not feasible to do this for a large patient cohort so they first needed to identify the children who were most at risk of missing appointments.

Identifying a solution

The hub developed an artificial intelligence (AI) model, using predictive analytics, to identify children who are likely to miss their appointment.

What are artificial intelligence and predictive analytics?

Artificial intelligence refers to systems or machines that mimic human intelligence to perform tasks and can iteratively improve themselves based on the information they collect.

Predictive analytics is a branch of advanced analytics that makes predictions about future outcomes using historical data combined with statistical modelling, data mining techniques¹⁵ and machine learning¹⁶. To gain insights from large volumes of data, data scientists use predictive analytics to find patterns and make predictions about future events.

As predictive analytics requires historical data to predict future outcomes, the in-house team needed to implement AI techniques to initially analyse electronic health records relating to orthopaedic appointments over a three-year period (May 2018 to May 2021).

This analysis revealed that the following three factors gave the highest risk of non-attendance:

- distance from healthcare provider
- history of previous non-attendance
- the elapsed time since booking the appointment.

¹⁵ Data mining is the process of uncovering patterns and other valuable information from large data sets.

¹⁶ Machine learning is a subset of AI that focuses on learning, reasoning, and decision-making. The technologies use statistical models to make predictions (or decisions) without being explicitly programmed to perform the task. The computer 'learns' as it increases its data reference points.

In parallel with this analysis, clinical and operational leads also engaged with parents, carers and young people to understand their reasons for not attending. Empirical findings correlated with the results generated by artificial intelligence.

Based on this analysis an initial prototype tool for predicting WNB patients was developed and tested on a retrospective set of appointments scheduled over a two-month period. The tool predicted WNB patients with an accuracy of 80%.

Implementing and evaluating the tool

Testing on retrospective data gave the team assurance that the tool was sufficiently accurate to move to an operational pilot. The next step was to undertake this pilot in orthopaedics, using the tool to alert the clinical teams as to which patients were at risk of not being brought to their appointments.

Once alerted, the teams could adopt different approaches to ensure these children received the healthcare they needed. One method was for outpatient staff to contact parents and carers to proactively encourage attendance. By doing so they were also able to offer an alternative convenient appointment if required.

The pilot in orthopaedics delivered a WNB reduction of 50% in 6 months. It also highlighted that the increased communication improved both patient and staff experience with feedback about the tool and approaches being very positive.

For the trust, this reduction in non-attendance rates can drive improvement in orthopaedic outpatient utilisation, increasing productivity and efficiency.

Looking to future expansion and sustainability

The positive results from the pilot means that this tool is being rolled out across all Alder Hey outpatient services. A core benefit of AI and predictive analytics is that the tool continues to learn as more data is made available therefore further improvements are expected as a direct result of rollout. The tool is being taught to identify additional risk factors for non-attendance and is expected to be able to refine predictions and increase accuracy rates as further services come on board.

As the solution is scaled across the trust, this may lead to cash-releasing savings within outpatient services. There is also the potential for cost avoidance if it removes the need for additional out-of-hours clinics.

Types of efficiency savings

Cash releasing benefits reduce the cost of the care model so that the resources can be completely re-allocated elsewhere, or the cost can be removed from a budget, for example reduced number of healthcare staff required.

Non-cash releasing benefits provide economic value through savings from increased efficiency and effectiveness, but they do not release cash, for example reallocation of staff time.

Non-financial and wider population health benefits are also expected. At Alder Hey, 40% of booked outpatient appointments relate to families living in the top 10% of most deprived locations according to the index of multiple deprivation¹⁷, with 50% of all missed appointments relating to this group of patients. People living in areas of high deprivation are more likely to experience challenges in accessing care. Reducing WNB rates for these patients is essential to ensure that they get the care they need.

¹⁷ Indices of multiple deprivation (IMD) are widely-used datasets within the UK to classify the relative deprivation (essentially a measure of poverty) of small areas. Multiple components of deprivation are weighted with different strengths and compiled into a single score of deprivation.

Next steps for the innovation hub

'The innovation hub at Alder Hey and the systematic approach we have deployed has become a core part of how 'we tackle and solve problems' here at Alder Hey Children's. Through the harnessing of technology, working in partnership we can accelerate new solutions into the real world that have impact. As our focus always starts with a real world problem, it is fantastic to see the measurable impact and value we create; we have lots of case studies that demonstrate both benefit for patients and service users and economic benefits that can drive sustainability.

Our programme of innovation is now fully integrated with the trust's strategy and operational planning priorities and is accessible to all staff who would like to be involved, next we plan to spread our innovations and collaborate with ICS, partners and national networks.'

Claire Liddy, Managing director of innovation, Alder Hey NHS Foundation Trust
Innovation Hub

How to find out more

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This case study is part of the *Delivering value with digital technologies* programme that the HFMA is undertaking, supported by Health Education England. The programme aims to increase awareness amongst NHS finance staff about digital healthcare technologies, and enable finance to take an active role in supporting the use of digital technology to transform services and drive value and efficiency. For more information click [here](#).

About Health Education England

Health Education England (HEE) is part of the NHS, and we work with partners to plan, recruit, educate and train the health workforce. HEE exists for one reason only: to support the delivery of excellent healthcare and health improvement to the patients and public of England by ensuring that the workforce of today and tomorrow has the right numbers, skills, values, and behaviours, at the right time and in the right place.

HEE's Digital Readiness Education Programme aims to create an uplift of digital skills, knowledge, understanding and awareness across the whole multi-disciplinary health and care workforce to support new ways of working. It is developing, delivering and maintaining – through the NHS Digital Academy service - a range of learning and development products and offerings for both the future/incoming workforce and for the current workforce, including senior leaders, digital (DDAT) experts and the wider workforce. Increasing workforce digital adaptability supports improved health and care services. It is for everyone, at all stages of their career journey.

This includes learning products that are person-based (e.g. the Digital Self-Assessment Toolkit, or the PGDip for Digital Health Leadership with Imperial College, or online learning modules for the finance profession); team based (e.g. Digital Boards and ICB development offers in collaboration with NHS Providers, or the Digital Futures programme with Yale); or technology based (e.g. our DART-Ed programme delivering training around Machine Learning and AI). All this is supported notably through the Informatics Skills Development Networks we have now helped establish across all regions.

For more information visit the [Digital Readiness Programme website](#) or follow the programme on Twitter [@HEE_DigiReady](#).

About the HFMA

The Healthcare Financial Management Association (HFMA) is the professional body for finance staff in healthcare. For over 70 years, it has provided independent and objective advice to its members and the wider healthcare community. It is a charitable organisation that promotes best practice and innovation in financial management and governance across the UK health economy through its local and national networks.

The association also analyses and responds to national policy and aims to exert influence in shaping the wider healthcare agenda. It has particular interest in promoting the highest professional standards in financial management and governance and is keen to work with other organisations to promote approaches that really are 'fit for purpose' and effective.

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