NHS and Social Care
Innovation and Diffusion Challenges

Produced by mHabitat

Contents

Foreword
Introduction
Section 1
Mapping support available to digital health innovators
Programmes supporting digital and data health innovation
Analysing the data
Section 2
Opportunities for the system
Understanding the digital innovation pathway from an innovator’s perspective
Harnessing system assets to support innovation
Simulation labs for digital health
Section 3
Opportunities for wider system collaboration
National digital health innovation route map – “System navigation”
System leadership for emerging technologies
A classification system for digital health
Section 4
Conclusions
Foreword

Innovation and its dissemination in healthcare has been a preoccupation of the NHS for over a decade. Most discussion of innovation – and its diffusion – has focused on a wide range of developments including pharmaceuticals, surgical tools, techniques and implants, guidance and protocols, diagnostics and occasionally health IT and telehealth.

The explicit inclusion of digital health within innovation is more recent; the Accelerated Access Review (2016) was the first concerted effort to include the innovation and diffusion of digital technologies alongside medical technologies and pharmaceuticals in England.

There is wide belief that digital technologies can contribute to the effectiveness and efficiency of health and social care services. There is determination across the system to transform the way in which digital innovation can be realised much more quickly, so that patients and citizens can access improved services. However, no one entity has overall responsibility for the end-to-end realisation of the digital pathway, and that is why collaboration across system players is key.

mHabitat, as NHS-hosted specialists in the application of digital to health and social care, was keen to understand what more can be done to support innovation and entrepreneurship.

This document summarises the work we undertook in the latter half of 2017-18 to better understand the innovator’s journey.

Contributors
Alison Braithwaite
Julie Fidler
Lenore Ogilvy

Tracey Watson
Director of Innovation & Partnerships
NHS Digital

Dr Victoria Betton
Managing Director
mHabitat

NHS and Social Care Innovation and Diffusion Challenges
Introduction

Nearly three years ago, the Five Year Forward View was published, cataloguing the three challenges of quality, effectiveness and efficiency that need to be met in order to ensure that the NHS can continue to support citizens and families. As the NHS celebrated 70 years, the role of digital tools and services in supporting the delivery of health and care is gaining increasing attention.

The Office for Life Sciences (OLS) initiated the Accelerated Access Review (AAR) in 2015, with the aim of finding new ways to get drugs, devices and diagnostics – including digital services – to patients faster; the final report was published in October 2016. This was followed by a Life Sciences Industrial Strategy in August 2017 which sets out a vision to drive economic growth more rapidly and develop new technologies for patients. The Accelerated Access Review describes the digital pathway, that sets out the process innovators go through from identifying an idea to developing and implementing it.

Taking an idea for a digital innovation through to a product or service that can be used widely across the NHS and other health care systems is challenging, and most innovators or aspiring digital health entrepreneurs need support with related regulatory, technical and logistical issues.

The Accelerated Access Collaborative, which was formed following the AAR, is focused on accelerating the pathway for a limited number of high-impact innovations each year. In addition, multiple parties in the system are driving forward streams of work aiming to address system barriers.

The barriers to innovation and diffusion are well-understood and well-documented. They include, but are not limited to:

- **culture and capacity**: staff have limited capability and capacity to adopt new models of working
- **buying capabilities**: the capability and capacity of health organisations to buy all categories of purchasing is varied, and has been recognised as needing improvement by central government
- **fragmentation of the market**: Far from being a single body, the NHS is made up of hundreds of organisations, with varying policies and practices. This makes for a complex selling process and diversity of buying points
- **financial constraints**: an annual budgetary cycle encourages short term planning and inhibits multi-year benefits realisation
- **financial disincentives**: the commissioner / provider split, and the competition it drives between providers often means that the investor is not always the organisation who realises the benefits, thereby making the investment case more complex

Digital health innovations face additional, particular challenges:

- **evidence**: there is no common evidence pathway, little in the way of evidence criteria or thresholds, and digital doesn’t lend itself to traditional evidence-generating models such as randomised control trials
- **service redesign**: innovation doesn’t provide incremental improvement or replacement. While digital can supplement or improve a patient pathway, it may often completely disrupt it and that increases the complexity of collecting evidence, buying and successful implementation

In order to understand the gaps that remain following the AAR and the Industrial Strategy, mHabitat embarked in this research in the autumn of 2017, with the aim of understanding the existing support available to digital health innovators and to identify gaps that require further attention. This publication summarises the research and development we undertook.

Since this work was completed, NHS England has initiated a review of the innovation landscape. NHS England is also leading a piece of work that involves MedCity, the National Institute for Health and Care Excellence (NICE) and others to clarify the evidence pathway and collate existing resources. The results of their work are due to be published later this year.
The innovation pathway

There are a number of conceptual pathways in existence that attempt to set out a typical pathway for innovation, some with specific reference to digital technologies, from initial idea through to adoption and diffusion. The pathway is often presented as a linear process for ease of understanding, although a typical journey is unlikely to be so straightforward. Below are three different representations of the pathway, which demonstrate a different emphasis based on the perspective of the author.

What is the innovation pathway?

The pathway is often presented as a linear process for ease of understanding, although a typical journey is unlikely to be so straightforward. Below are three different representations of the pathway, which demonstrate a different emphasis based on the perspective of the author.

Digital Health Innovation Pathway - Key Stages

<table>
<thead>
<tr>
<th>Pathway stage</th>
<th>Key activities</th>
<th>Evidence generated</th>
<th>Goal</th>
</tr>
</thead>
</table>
| 1 Exploring opportunities and challenges | • Early-stage discovery  
• Horizon scanning and market review  
• NHS systems mapping  
• Establish relationships with key partners  
• Protect intellectual property | • Existing market and evidence  
• NHS context - assets, opportunities and constraints | • A well understood and clearly defined problem or opportunity |
| 2 Generating ideas | • Crowdsourcing ideas  
• Human-centered design activities (such as personas and patient journeys) with stakeholders  
• Map clinical workflow and care pathways  
• Assess clinical safety, privacy and regulatory requirements (for example, EU marking) | • A deep account of change supported by evidence  
• Alpha prototypes | • An idea or set of ideas to develop and test |
| 3 Developing and testing | • Feasibility  
• Prototyping  
• Trial  
• Light-touch evidence generation  
• Address clinical safety, privacy and regulatory requirements | • Beta prototypes  
• A stronger case with cost and benefit projections developed through practical trials and experiments, involving potential users | • Demonstrate that the idea works, or evidence to support a reworking of the idea |
| 4 Making the case | • Business case development  
• Identify benefits and savings  
• Scope and size the market  
• Identify sustainability/commercial models and consider procurement  
• Find initial clients and customers for evidence generation  
• Establish implementation models and service support capability and capacity | • Even stronger case with cost and benefit projections developed through practical trials involving end users  
• Clarity about what warrants implementation and funding | |
| 5 Delivering and implementing | • End initial clients and customers for evidence generation  
• Establish implementation models and service support capability and capacity  
• A robust and detailed case delivered through formal evaluation and evidence gathering - case of a control group to isolate impact | • Evidence derived from evaluations in multiple sites, independently run  
• Impact at scale | |
| 6 Growing, scaling and spreading | • Scale customer base and extend adoption  
• Improve evidence base and iterate  
• Refine implementation models and support | | |

Based on the NESTA Innovation Flow Chart
The objective of the first phase of the project was to map existing programmes that provide support to digital health innovators in England.

The aim was to understand the help and support available to innovators, and then analyse gaps against the digital pathway. It was hypothesised that there would be less support for the later stages of the innovation pathway, given these are the stages where there are the greatest number of challenges that are not resolved.

A snowball methodology was employed to identify programmes: the research team drew on existing knowledge and networks, along with interviews with key stakeholders and Internet searches. As the map developed, a set of key criteria was developed in order to categorise digital innovation in respect of type, location, innovation stage and host type. Once the map was created, a workshop was held involving key stakeholders in order to test and validate emerging themes.

The workshop comprised representatives from NHS Digital, Academic Health Science Networks (AHSNs), Test Beds, DigitalHealth.London, Innovate UK, a digital health SME, and a local authority.

The map, which appears on page 12 and 13 is a snapshot in time as of late autumn 2017 and it is a representation of activity in the field. It is acknowledged that given the fast pace of change in the field of digital in health, the map will not have captured every initiative.

Some **87 initiatives** potentially supporting digital health innovation were identified, evidencing that there is significant activity in the sector.

These were all programmes aimed at health or digital health innovation; generic programmes that did not have an explicit connection to health and data were excluded, as were internal research and development departments of larger organisations.
Programmes supporting digital and data health innovation

- Third Sector
- Medical Research Council
- Public Sector
- NHS and AHSN Network
- Department of Health & Social Care
- Private
- University

**Programmes supporting digital and data health innovation**

**Third Sector**
- Health Data Research UK
- Fan Institute

**Public Sector**
- MRC

**Private**
- Digital Innovation

**NHS and AHSN Network**
- AHSN
- NHS England

**Department of Health & Social Care**
- Innovation Programme
- Meridian
- People Drive Digital

**Third Sector**
- Health Enterprise East
- Medipex
- NHS Innovation South East
- TrusTech
- Midtech
- NHS Innovation South West

**Public Sector**
- DHSC
- HIE
- NHS Innovation Network (South)
- Innovation Exchange
- Innovation Accelerator Programme
- NHS Innovation Programmes

**Private**
- Innovation Accelerator Programme
- Innovation Exchange
- Innovation Accelerator Programme
- NHS Innovation Programmes

**University**
- University of Nottingham
- Digital Innovations in Healthcare

**Hospital**
- NHS Providers
- NHS Digital

**Third Sector**
- NHS and Social Care Innovation and Diffusion Challenges
- Third Sector
- Medical Research Council
- Public Sector
- NHS and AHSN Network

**Private**
- Department of Health & Social Care
- NHS Innovation Programmes

**University**
- University

**Programmes supporting digital and data health innovation**

- NHS and Social Care Innovation and Diffusion Challenges
- Third Sector
- Medical Research Council
- Public Sector
- NHS and AHSN Network
- Department of Health & Social Care
- Private
- University

**Programmes supporting digital and data health innovation**

- NHS and Social Care Innovation and Diffusion Challenges
- Third Sector
- Medical Research Council
- Public Sector
- NHS and AHSN Network
- Department of Health & Social Care
- Private
- University

**Programmes supporting digital and data health innovation**

- NHS and Social Care Innovation and Diffusion Challenges
- Third Sector
- Medical Research Council
- Public Sector
- NHS and AHSN Network
- Department of Health & Social Care
- Private
- University
Once the programmes supporting digital health innovation were catalogued, a number of categorisations were developed. As the programmes were identified and reviewed through desk research, categorisations acted as simple but useful indicators.

In figure 1, on the next page, the following categories are:

1) Extent of focus on digital health and data:
   - wholly digital health: entirely dedicated to digital health
   - partial digital health: dedicated to health with a broad focus that stated the inclusion of digital
   - health only: dedicated to health but with no stated capabilities relating to digital
   - data: wholly dedicated to health and data

Note that there are hundreds of general innovation support programmes that are not specifically designed for health and these were excluded.

2) Funding sources

3) The type of programme, ranging from incubators and accelerators to portals and consultancy.

Analysing the data

Digital Health Innovation Pathway - Keys

<table>
<thead>
<tr>
<th>Category</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wholly digital health</td>
<td>The initiative is solely aimed at digital health in England.</td>
</tr>
<tr>
<td>Partially digital health</td>
<td>Digital health is a specifically identified sector but not the only sector in scope. Geography limited to UK.</td>
</tr>
<tr>
<td>Health only</td>
<td>The initiative supports health innovation in the UK but it does not include a digital focus.</td>
</tr>
<tr>
<td>Data</td>
<td>The initiative is solely aimed at data &amp; health in England and or the UK.</td>
</tr>
</tbody>
</table>

Funding Sources:

- Public
- Academia / Research
- Private
- Third
- Collaboration with private
- Collaboration without private

Type / Category | Criteria
--- | ---
Incubator / accelerator + funding | Programme of structured support for early stage innovation (stages 1-3). May include workspace, mentors, training, networking. Includes a cash injection. Will usually involve competition and have limited entry points.
Incubator / accelerator (No funding) | Programme of structured support for early stage innovation (stages 1-3). May include workspace, mentors, training, networking, but no cash injection. Will usually involve competition and have limited entry points.
Portal | An online-only service that provides access to information and or a mechanism for the innovator to promote themselves and their products.
Community (free) | A physical or virtual place where there is support for innovators ranging from information and signposting, networking events, workshops, etc. No membership fees. No entry requirements or access controls (e.g. selection process).
Community (membership fee) | A physical or virtual place where there is support for innovators ranging from information and signposting, networking events, workshops, etc. Involves a membership fee (usually nominal but not always). No entry requirements (e.g. selection process) and access controls.
Fund | Cash injection provided following a call for proposals. Always involves competition and will have limited access points.
Advice & brokerage | A service that provides general advice and guidance, including signposting and introductions. No fees. No competition, limited access controls (selection criteria or entry point).
Evidence mechanism | A programme involving NHS organisations and a significant time commitment to assist innovators to generate real world evidence. Usually competed. Will usually involve competition and have limited entry points.
Paid consultancy / support | Offers that can assist innovators in various aspects of their journey that are sponsored by the public or third sectors (e.g. does not include businesses providing support).
Course / training | Provision of structured learning that does not include formal ongoing support such as community / mentoring / funding (e.g. less than an incubator or accelerator).
Innovators require clear conditions, that help them navigate NHS terrain. ...we call this the **Innovation Pathway**.
Each programme was reviewed to ascertain roughly which stage(s) of the innovation pathway were supported. Given the light-touch desktop nature of this stage of the work, the assignment of stages of the pathway to any programme are approximate, based on interpretation of available materials in the public domain.

**Figure 2** demonstrates a count of the initiatives supporting each stage on the innovation pathway. This shows there are fewer programmes at the beginning and the latter stages of the pathway, particularly those associated with adoption and diffusion.

**Figure 3** demonstrates the count of each type of programme, broken down by whether it is wholly digital or data, partially digital or a general health innovation support programme.

<table>
<thead>
<tr>
<th>Pathway stage</th>
<th>Digital Health Innovation Pathway - Number of initiatives addressing each stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Exploring opportunities and challenges</td>
<td>35</td>
</tr>
<tr>
<td>2 Generating ideas</td>
<td>62</td>
</tr>
<tr>
<td>3 Developing and testing</td>
<td>62</td>
</tr>
<tr>
<td>4 Making the case</td>
<td>48</td>
</tr>
<tr>
<td>5 Delivering and implementing</td>
<td>37</td>
</tr>
<tr>
<td>6 Growing, scaling and spreading</td>
<td>12</td>
</tr>
</tbody>
</table>

---

**Figure 2**

**Figure 3**
The map and analysis demonstrates that there is a significant amount of support available to innovators from a wide range of sources. Our hypothesis that there would be less support for the later stages of innovation – particularly diffusion – appears to be valid. The lesser support during the first stage of innovation in which ideas are identified and generated was, however, not anticipated.

As a result of our analysis and conversations with stakeholders, the gaps in support for innovators can be summarised as follows:

• there is no agreed classification system in place which could support risk assessment, evidence requirements and implementation. There is little in the way of shared dialogue about emerging digital technologies across the health and social care economy and the opportunities and challenges they may bring

• while there are a wide range of policies, guidance, regulatory standards, information and support available to digital health innovators, these are dispersed across the internet, not always easy to find, and often not easy to understand

• many of the initiatives supporting innovators have been designed from a policy perspective and don’t always take account of the innovator’s perspective as a user

• the AAR recommends that the ‘route for digital products should build on the Paperless 2020 simplified app assessment process’. It is unclear how aspects of digital other than apps - telehealth, infrastructure and analytics to name a few - could build on this process and who in the system will be responsible

• the mapping exercise revealed an apparent gap in support for very early stage digital innovation aligned to NHS requirements. A more consistent knowledge base and support for this early stage of innovation may be helpful. The successful health navigator role, developed by DigitalHealth.London, which supports NHS organisations to engage with digital innovators and undertake horizon scanning, appears to be promising. Improvement and innovation teams in NHS organisations are pivotal and it may be helpful to build their digital capability

• digital innovation is not always driven by or makes good use of data and access to good quality data is often difficult for innovators. While the lack of data driven digital innovation and innovation involving data are not the same thing, the issue suggests there may be a market skills and knowledge gap.

Given that the survey mainly involved desktop research and did not include detailed engagement with all 87 programmes, this research does not offer insights into the relative impact or return on investment of the different initiatives supporting digital health innovators. However further analysis of impact and return on investment might prove valuable when determining which mechanisms offer the greatest benefit not only to innovators, but also to health and social care.
NHS and Social Care Innovation and Diffusion Challenges

Opportunities for the system

Following phase 1, further research and development was undertaken focusing on specific areas. This can be summarised as:

• understanding the digital innovation pathway from an innovator’s perspective – this comprised interviews with innovators to understand enablers and barriers to their journey along the innovation pathway

• harnessing existing assets to support the innovation pathway – this comprised considering the system’s assets and improving access to them

• opportunities for wider system collaboration – this comprised exploring areas for wider system consideration

The above three topic areas are described in more detail over the next few pages.

An innovator’s perspective

During phase 1 our discussions demonstrated that innovators make use of multiple support mechanisms. However, much of the evidence about non-adoption of digital technology focuses on the NHS and system constraints rather than the innovator’s experience.

A number of innovators were interviewed to ensure that their perspective on the innovation journey informed the work.

The following overarching themes emerged consistently from our interviews. They are described here as enablers that are critical for successful design, development and implementation of digital health innovation. The enablers are a blend of human factors, infrastructure, expertise and a permissive context in which innovation can flourish.

Common themes in respect of preconditions for successful digital health innovations are:

• capacity (time and resources) and capability (knowledge and expertise) within partner NHS organisations to collaborate with digital health innovators

• service improvement capability from within partner NHS organisations so that clinical teams can redesign clinical workflows and care pathways to incorporate a digital product or service

• the infrastructure in place (for example: WiFi and smartphones) within the NHS as well as expertise in information governance, regulation and interoperability for digital products and services

• nationally endorsed programmes and accelerators (for example the NHS England Test Beds programme) which provide space and cover for digital innovation to thrive and which help partners manage risk at a local level

• guidance in order to make a clear case for return on investment and to demonstrate the impact of digital products and services is important and should be designed in at the earliest stages of development

• guidance regarding sustainability and commercial models for digital products and services. It should be noted that such models are still emerging and simply having a good idea is not sufficient for implementation and adoption

The interviews all demonstrated in one form or another that forming trusted and reciprocal relationships between multiple stakeholders over time is pivotal to the successful implementation and adoption of digital products and services.

It was clear if the enablers are not present they become barriers to innovation and that knowledge and expertise about digital health innovation is not distributed around the system.

Innovators describe access to enablers, knowledge and expertise as haphazard and they often do not know what they need to know, finding out too late.
Harnessing system assets to support innovation

Our research demonstrated how many organisations support digital health innovation, and this includes assets which provide innovators with resources that contribute towards progression through the digital innovation pathway. However, innovators felt some assets or capabilities are not always easy to find or to access.

The system has already begun its journey to improve its relationship with industry and access to its resources, for example, through the NHS Digital partnership with techUK and the re-licensing of AHSNs which includes a focus on digital health innovation.

The research found that there is an opportunity for the system to organise and present its assets in a more coherent and accessible way. There are three potential delivery options which require increasing investment and have related potential benefits:

• a guidance and standards toolkit that curates information and assets in a way that meets the user needs of innovators, which is published for innovators and innovation support organisations to use, but not with formal support or ties
• an innovation service that provides a level of support and assurance to users of the toolkit, possibly with informal relationships with existing support agencies
• an integrated model of guidance and standards, support and integrated relationships with existing support agencies, including NHS Trusts which offer simulation facilities

Innovators often need support to identify what is relevant to them and how to make best use of them. Recognising that many organisations produce resources and guidance (for example, a number of Academic Health Science Networks have produced guides for digital health innovators), it is important that the system:

• clearly articulates its offer
• develops an approach that enables any organisation that provides support to innovators to use the full spectrum of resources available, regardless of their source

Simulation labs for digital health

In order to explore how the system might make its resources more accessible, particularly at the later stages of the innovation pathway, the concept of living labs, simulation labs, and model offices were evaluated through case studies. Such labs enable the imitation of the operation of a real-world process or system in a safe environment before being tested in a live context. The case studies were drawn from health and other industries.

Most if not all of these approaches involve the opportunity for potential users to use and test the product, often in an environment that simulates real experiences. The value of many of these environments is the physicality of seeing and experiencing the product or service in a way that helps the viewer / evaluator translate that experience more readily into their own work or life experience. The challenge for simulation environments in the health sector is that no two health organisations use the same combination of digital systems, configurations or patient pathways.

The system may want to consider bringing together a catalogue of existing and future resources into a coherent guidance package. This could be extended through the creation of a virtual plug and play environment. It could be extended further to create physical simulation environments without the need to invest in new and expensive physical spaces by combining virtual resources with existing physical simulation lab facilities hosted by teaching hospitals and others.

The creation of a virtual environment that can also be used in physical simulation spaces would provide a flexible and powerful resource that would leverage the significant investment already made by the NHS. This would support the innovation pathway at later stages:

• stage 3: workflows and usability
• stage 4: interoperability testing, designing trials or pilots to support new innovations to develop an appropriate evidence base
• stages 5 and 6: enable live demonstrations and the development of training resources, case studies and integration guidance for products and services ready to enter the market

This approach could assist national bodies and other organisations supporting innovation to collaborate with the NHS provider and academic sector in a visible and constructive way.
Section 3

Opportunities for wider system collaboration

Despite innovators facing what some might describe as a protracted, complex journey compared to other fields of health innovation, there is still no shortage of great ideas that have real potential to improve delivery and patient care. As we move towards community driven, place-based care, there is no better time to consider how the wider system needs to work more effectively together and offer a joined up pathway for the realisation of new digital solutions and their adoption.

Proposals for wider system collaboration are set out below.

National digital health innovation route map – “System navigation”

At the end of phase 1 it was clear that there are many resources available to innovators across the system, but that these are widely distributed and can be difficult to find and understand in relation to each other. Making assets more accessible contributes to only a small part of the digital innovation pathway. The mapping exercise during phase 1 identified a plethora of different kinds of activities and programmes that support innovation and diffusion of digital health and care tools and services, but there is no single place to find these enablers, and no mechanism for curating them so that they make sense in relation to each other.

Therefore, there is an opportunity for system partners to collaborate to create a national repository of assets and capabilities that is managed and curated to be a one-stop location for up-to-date information. It is absolutely clear that the ecosystem needs a landing point that can offer coherent, consistent signposting to information, guidance and resources.

The Academic Health Science Networks are the most natural host for such a virtual environment, and could act as curators of content provided by all the other system partners.

This would be in addition to or could build upon the national Innovation Exchange that the Office for Life Sciences has recently commissioned the AHSN Network to build, which will provide a platform for stakeholders across the healthcare sector to share ideas, innovative solutions, projects and products to improve patient care.

We are also aware of a working group led by NHS England, and including MedCity, National Institute for Health and Care Excellence (NICE), Public Health England, and DigitalHealth. London are developing guidance and standards to address and streamline support on the specific issue of therapeutic digital health tools being clinically effective and offering economic value. See MedCity’s evidence for effectiveness: www.medcityhq.com/evidence-for-effectiveness
System leadership for emerging technologies

There is also a need for system leadership in horizon scanning for emerging technologies and convening system partners to appraise their application in the NHS. The aim would be to support a national dialogue about emerging technologies and the opportunities and challenges they might bring.

A facilitator could provide the resources and authority to convene a wide range of stakeholders (including commissioners and providers, subject matter experts from health and other industries, as well as the other arms length bodies) and facilitate a system-wide dialogue that would offer benefits for all system partners, including innovators.

If there is an appetite to pursue a classification system for digital health products and services, Health Education England (HEE) has undertaken work to develop an ontology to organise and categorise learning, and the National Institute for Health and Care Excellence (NICE) is also working on a risk-based classification for digital health to support existing work to clarify evidence requirements, and both these activities are likely to have synergies with this proposal.

The benefits of a classification system would be a common language that makes it easier to collaborate between disciplines and to compare, replicate and synthesise evidence.

Examples of the significant potential benefits to developing a classification system include:

- within research a classification would allow faster evidence generation due to, for example, aid in funding applications, comparing and synthesizing of evidence and interdisciplinary collaborations
- in terms of policy classification could help shape best practise guidelines regulations and professional standards, and inform funding and reimbursement decisions
- innovators may gain insight into current market gaps or better understand what is expected for different classes of digital health innovations
- for patients and citizens the dialogue might improve through organisation of evidence and learning about different types of interventions and what they mean for users
- commissioners and health and care providers would find it easier to access evidence of benefits and understand service and system re-design implications, informing purchasing and implementation decisions

Based on the work undertaken, the type of classification system that appears to have the greatest potential for usefulness is an ontology: a system that can contain multiple classification dimensions, including relationships other than ‘parent-child’.

This means that the system can be created starting small, for example with one dimension such as risk stratification, and expanded over time to include other dimensions such as stakeholders or evidence. Within an ontology different stakeholders can have their own lens, for example, a patient may use different words or be interested in different dimensions than a regulator. An important benefit of ontologies is that they offer the possibility for artificial intelligence applications, including natural language processing and the semantic web.
The enthusiasm for digital health innovation is evidenced by the number of innovators engaging in this sector, the programmes offered by a plethora of organisations, and policy commitments and investments.

The Accelerated Access Collaborative has been established, the National Information Board continues its work, NHS England and the Office for Life Science is currently reviewing the digital innovation landscape and have commissioned work to clarify and strengthen guidance around evidence generation. The Topol Review is also underway, which addresses workforce issues in relation to use of digital technologies in the NHS. All of these initiatives are likely to feature in the NHS Long Term Plan which will be published towards the end of 2018.

It is in the interests of everyone – patients, commissioners, providers and innovators – that innovators develop products and services that can be implemented, adopted and diffused across the NHS. Whilst the Accelerated Access Collaborative will focus on the most promising innovations, the number of these will be limited each year and will not necessarily be digital. The 15 Academic Health Science Networks have a pivotal role in the adoption and diffusion of developed digital products and services, the breadth and reach of what they can do will depend on support from other bodies and collaboration with other supporters of innovators.

Our research shows that there is already a significant amount of activity in the system that focuses on supporting or enabling innovators. The vast majority are funded by the public purse; however there is no helicopter view of what is happening across the spectrum, and little evidence of impact or value in terms of uptake.

There is an opportunity for system partners to increase and/or calibrate the co-ordination of their efforts.

Innovators are routinely unfamiliar with regulatory standards, safety, commercial and commissioning requirements. Wider system assets (for example, standards and guidance) and capabilities (for example, expertise) are not always easy to find or are consumed much later in development, therefore leading to solutions having to be re-engineered or abandoned because they can’t be scaled, integrated or adopted. As digital starts to converge with med-tech, these issues will be exacerbated.

Innovative digital solutions should always begin with understanding need and working closely with relevant bodies and individuals to support development. This could manifest in the creation of innovation communities, established to co-produce digital solutions and help advise on design and technology decisions. Following this approach many of the barriers to adoption, scalability and sustainability could be addressed when exploring opportunities, generating ideas, testing and proto-typing and making the investment case, very early in the design process. This approach would potentially give innovators access to academics, healthcare professionals, patient groups, policy makers, delivery agents, technology experts, third sector and industry all with a vested interest in successful uptake.

Finally industry, specifically those companies that host and run their own innovation support programmes should be factored into wider system discussions concerning future initiatives. During our research we have acknowledged they too have a vested interest in the realisation of digital innovation across our health and care service and are looking at ways in which they can support efforts to optimise the pathway for innovators.

Conclusions

There is a real opportunity for system partners and policy makers, when considering the current landscape or investing in future support initiatives, to ensure these issues are addressed.

At a minimum, based on the study undertaken with innovators and known barriers to uptake, scalability and spread, focus should be directed at:

1. Ensuring solutions are demand driven, understanding the place-based clinical or commissioning needs of the NHS.
2. Providing innovators access to assets and capabilities which can help them mitigate the barriers to adoption of digital technologies in the NHS at each appropriate point in the digital innovation pathway.

Innovative digital solutions should always begin with understanding need and working closely with relevant bodies and individuals to support development. This could manifest in the creation of innovation communities, established to co-produce digital solutions and help advise on design and technology decisions. Following this approach many of the barriers to adoption, scalability and sustainability could be addressed when exploring opportunities, generating ideas, testing and proto-typing and making the investment case, very early in the design process. This approach would potentially give innovators access to academics, healthcare professionals, patient groups, policy makers, delivery agents, technology experts, third sector and industry all with a vested interest in successful uptake.

Conclusions

There is a real opportunity for system partners and policy makers, when considering the current landscape or investing in future support initiatives, to ensure these issues are addressed.

At a minimum, based on the study undertaken with innovators and known barriers to uptake, scalability and spread, focus should be directed at:

1. Ensuring solutions are demand driven, understanding the place-based clinical or commissioning needs of the NHS.
2. Providing innovators access to assets and capabilities which can help them mitigate the barriers to adoption of digital technologies in the NHS at each appropriate point in the digital innovation pathway.

Innovative digital solutions should always begin with understanding need and working closely with relevant bodies and individuals to support development. This could manifest in the creation of innovation communities, established to co-produce digital solutions and help advise on design and technology decisions. Following this approach many of the barriers to adoption, scalability and sustainability could be addressed when exploring opportunities, generating ideas, testing and proto-typing and making the investment case, very early in the design process. This approach would potentially give innovators access to academics, healthcare professionals, patient groups, policy makers, delivery agents, technology experts, third sector and industry all with a vested interest in successful uptake.