



Perfect
Patient
Pathway



Sheffield Teaching Hospitals
NHS Foundation Trust

Perfect Patient Pathway Test Bed Overview Report



Contents

Foreword	Page 3
Introduction	Page 4
Partnerships	Page 5
Defining the need & designing the programme	Pages 6 - 7
Long Term Conditions	Pages 8 - 9
Collaboration with Public & Patient Partners	Page 10
Overview of Test Bed projects	
Asthma	Page 11
Falls Prevention	Pages 12 - 13
Digital Care Home	Pages 14 - 15
3Rings	Page 16
Diabetes Management	Page 17
Digital Health Training	Pages 18 - 19
Emergency Contact	Page 20
Predictive Analytics	Page 21
Programme Evaluation	Pages 22 - 25
Shared Learning	Pages 26 - 27



Key Programme Activity



Foreword

It's been quite a journey since NHS Chief Executive Simon Stevens announced at the World Economic Forum in Davos, Switzerland in January 2016, that the Perfect Patient Pathway Test Bed had succeeded in its bid to become one of just seven national Wave 1 NHS England Test Beds, novel NHS and industry partnerships created to test combinations of digital technology and pathway redesign in real-world settings.

By creating the Test Bed collaboration, our aim was to be more than the sum of our parts, and to enable health and social care organisations across Sheffield and the city region to work together, with patients, to co-design the best way to deliver care to people with long term conditions based on their needs and wants and using the latest technology. We created an 'ecosystem' for healthcare technology innovations to be tested and evaluated within transformed services and clinically robust ways of working, using data to drive real change and improve effectiveness.

Over two years since the programme was launched, the Perfect Patient Pathway Test Bed Overview Report has been compiled to share our collective key learning as the foundations for ongoing investment and commitment to our regional healthcare innovation infrastructure.

We've learnt about the value of co-design and the power and value of involving patients, service users, their families and carers in shaping health care and giving us their valuable insight. We've discovered how to take new approaches and think differently in order to overcome barriers to implementing technology. And we have a new, deeper understanding of the conditions required for real world testing of technology for patient benefit compared to those present for clinical research trials.

On behalf of the Perfect Patient Pathway Test Bed, I would like to extend our thanks to all the partners, patients and stakeholders who contributed their time, energy and expertise, and also say a personal thank you to the Perfect Patient Pathway Test Bed Programme Team, the Test Bed Advisory Group (TAG), and our evaluation partners SCHARR at The University of Sheffield.

Wendy Tindale

Professor Wendy Tindale OBE
Scientific & Innovation Director

Sheffield Teaching Hospitals NHS Foundation Trust



We have a
new, deeper
understanding
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world testing of
technology for
patient benefit.



Introduction

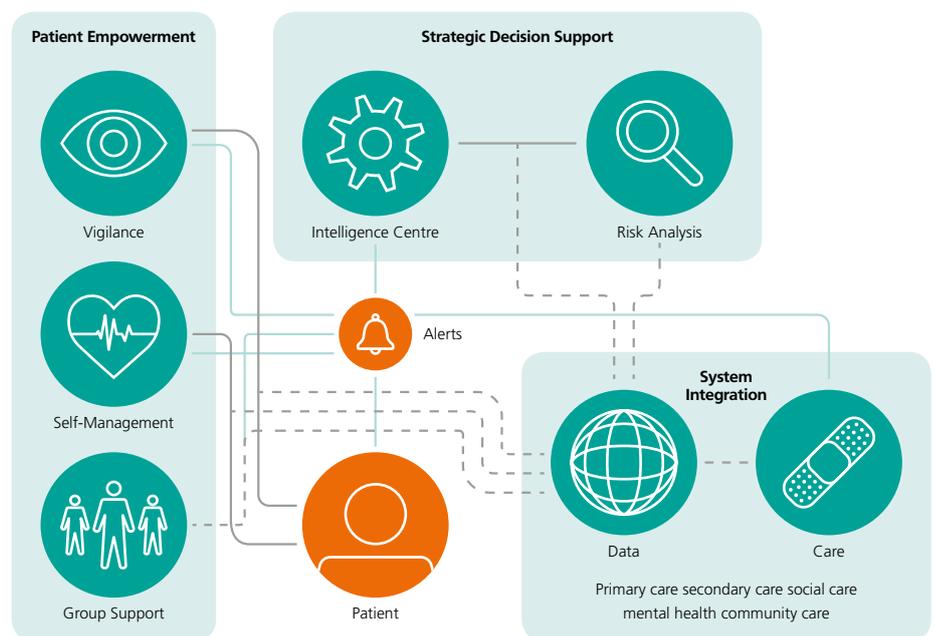


The Test Bed programme is a cross-government collaboration funded by NHS England, the Department of Health & Social Care, and the Office for Life Sciences (OLS) which originated in the Five Year Forward View (FYFV) as a response to three well established barriers to the uptake of innovation within health systems:

1. Innovations are often implemented in isolation from each other and the infrastructure in which they function.
2. There is a comparative lack of robust evidence about their real-world effects, as opposed to experimental or research settings.
3. Innovations are often introduced on top of existing working practices and infrastructure, rather than in conjunction.

Wave 1 of the Test Bed programme saw seven national locations (comprising multi-stakeholder partnerships between NHS, industry, academia, patients and the voluntary sector) established to test and evaluate the impact of combinations of digital technology and pathway redesign in real-world settings. The aims of the Test Bed programme were to create the conditions for testing **'combinatorial innovation'** and improve patient outcomes and experience of care, at the same or lower cost than current practice, whilst supporting economic growth.

Test Bed Vision



The Perfect Patient Pathway Test Bed

programme (hosted by Sheffield Teaching Hospitals NHS Foundation Trust) was launched in January 2016 with the aim of benefitting patients with multiple long-term conditions through combining and integrating innovative digital technologies and service redesign, to keep patients well, independent and avoiding crisis points which often result in hospital admission, intensive rehabilitation and a high level of social care support.

The Perfect Patient Pathway Test Bed programme also sought to build the infrastructure, and networks within the region, to test, refine and scale-up innovation; and to establish the effectiveness of this type of programme for identifying, implementing and evaluating the use of health technology in the NHS.

Programme objectives were to:

- Provide an ongoing platform for testing, refining and scaling-up innovations.
- Re-design pathways, bringing combinatorial technologies and system transformations to support holistic and personalised care.
- Support co-ordinated decision-making across health and care, informed by real-time data and predictive analytics.
- Evaluate the combination of new technologies and service re-designs producing robust and objective results that can be shared and disseminated.
- Embed the culture of transformation and improvement in NHS and other health and care organisations.

Partnerships

The Perfect Patient Pathway Test Bed was a multi-stakeholder partnership between organisations representing health and social care providers and commissioners; academia; industry; the voluntary sector and patient networks.

Health, Social Care & Academic



Innovators



Digital Care Home Partners



Working as a team is important.
The commitment of NHS staff to the
project can determine its success



Defining the need & designing the programme



To understand the unmet needs and priorities across the Sheffield region for people living with or caring for somebody with long-term conditions, and the health and care systems supporting them, the Test Bed hosted a roadshow of Engagement Workshops with members of the public, stakeholder organisations, clinicians and innovators. The projects within the programme were designed in response to the perspectives of stakeholders on their priorities for care and the use of technology using the 'Clear Ideas' method.

- Stakeholders were positive about the potential of technology to improve services and improve patient outcomes through the provision of quality data for service planning, the identification of risk, the development of preventative and patient self-care interventions, and reducing demand for services.
- Stakeholders also felt technology could assist with rehabilitation, monitoring and ongoing maintenance to sustain health and well-being.
- To be successful and sustainable, the programme would require good ongoing communication and collaboration between the Test Bed and all stakeholders and deep understanding of resources and capacity.
- Stakeholders felt that innovators need to help users and commissioners of services to understand the benefits that technology can bring to service delivery.
- Technology applications were considered to be useful for improving engagement with patients and communication between primary, secondary and community care.
- It was important to communicate service needs to innovators in order to meet gaps in service provision, rehabilitation and maintenance.
- There was potential to start using technologies with people with single conditions before multiple conditions to determine the usability and acceptability of the technology before scale up and spread.



Can technology support new care pathways and record keeping?



Trials in real world settings can feed into the thinking process of innovators and show how things could probably be improved through technology and innovation.



Can we monitor patients with long term conditions, those at high risk of exacerbation or deterioration, to identify problems early and reduce morbidity and admissions?





Focus on highly understood clinical groups with specific health needs and use these to demonstrate benefit of an intervention to other 'similar' and more diverse groups



- Understand existing regional integration and interoperability activity to create a Test Bed programme legacy.
- Important for the Test Bed team and innovators of technology to understand the variability between/within organisations in current care service pathways, information governance and data protection.
- Ongoing involvement and engagement with stakeholders was seen as essential.
- The partnership was advised to consider availability of the necessary skills and resources to support the introduction and integration of new technologies within services and organisations in high-demand.
- Enthusiasm to support the introduction & implementation of technology in general not just in the Test Bed - such agreement and consensus was a valuable facilitator of successful change management.

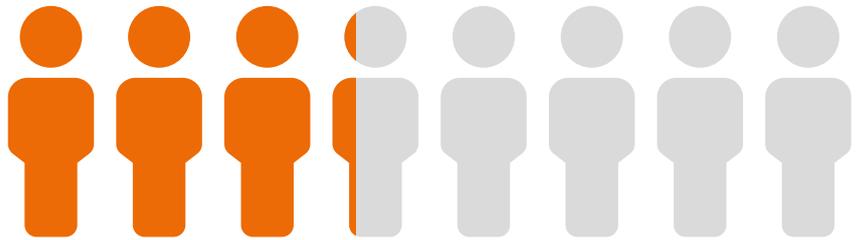


Early intervention and breaking down bureaucracy.

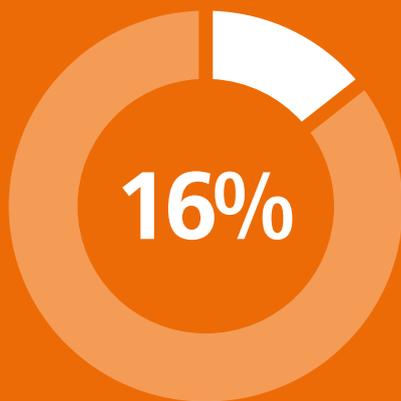


Long term conditions

Long Term Conditions (LTCs) - Impact in Sheffield



40% of all people with 2+ LTCs have depression.



16% of people in Sheffield of all ages live with at least 2 LTCs.



By the age of 40, 30% of people have 1 LTC, by 60, 60% of people have 1 LTC.



Delaying the onset of 2+ LTCs by:

1 year has estimated cost savings in secondary care of £4M.

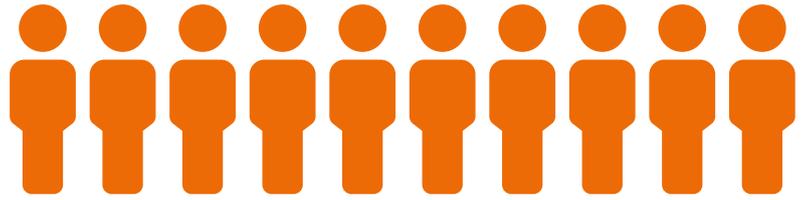
5 years has estimated cost savings in secondary care of £21M.

10 years has estimated cost savings in secondary care of £39M.

Long Term Conditions & Frailty - National

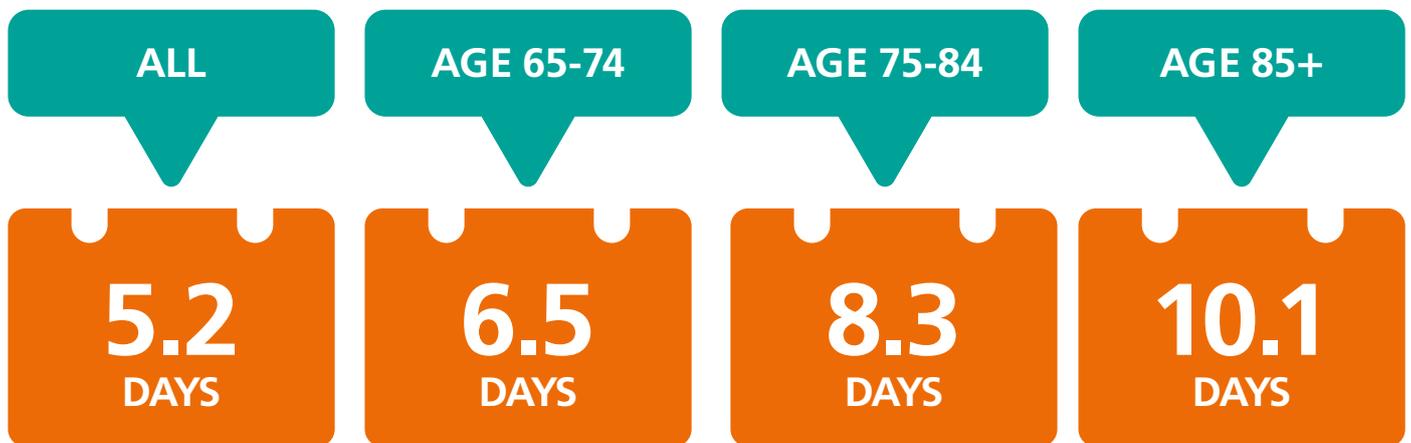
Source Age UK

16 MILLION



Number of people aged 65+ is projected to rise by 41% in the next 17 years to over 16 million.

Average length of stay for emergency hospital admissions.



Digital Inclusion



11.3 MILLION

11.3 million people in the UK don't have the basic digital skills they need to thrive in today's world.



SAVES £6.40

IN AVOIDED GP OR A&E VISITS

Good Things Foundation¹ calculated that every £1 invested in digital inclusion by the NHS would save £6.40 in avoided GP or A&E visits, and that the true saving could be considerably higher.

¹Test Bed partners page 18

Collaboration with Public & Patient Partners

Healthwatch Sheffield fulfilled a significant role in the Test Bed collaboration – supporting engagement with members of the public and ensuring that their views were heard and fully considered in the design and delivery of the projects and contributing to programme learning. A key aim of the engagement activity was improving the experience of people recruited to participate – leading to the formation of the **Test Bed Advisory Group (TAG)** to support this aim.

The Test Bed Advisory Group comprised volunteers that either had long term health conditions or were the relative or carer of someone with such conditions. The group actively identified issues that could matter from a patient, relative and carer perspective and suggested ways in which project plans could be developed to better suit individuals and encourage them to take part.



The TAG provide valuable insight by scrutinising evaluation plans, designing and amending information materials for participants and members of the public. In addition to debating and advising on issues relating to specific projects, the TAG were consulted on programme wide issues such as how patient data was handled, potential equality issues and overcoming barriers to participation.

The TAG identified that one of the strengths of the programme was that digital competence was not a barrier to participation as some projects did not require patients to have digital skills instead requiring health care professionals to use the technology with them.

Members were also involved in engaging wider stakeholders in the programme including participation in national Test Bed Quarterly Events and the Yorkshire & Humber AHSN Digital Health & Wellbeing Ecosystem event - delivering a workshop session to challenge the audience to

consider barriers to adoption of technology in healthcare.

Some TAG members took the role of 'champions' providing more in-depth support for specific projects because of their experience of a focus condition, and TAG had Programme Board representation to ensure the service user voice was heard at a strategic level. The Group and Healthwatch Sheffield also provided significant support to the evaluation process –co-designing information materials and playing an independent role in the data gathering and interview process.

Healthwatch Sheffield raised public awareness of the programme by visiting voluntary and community groups whose members have long term health conditions and Patient Participation Groups (PPGs) of the GP surgeries involved in the projects. Gathering views from these groups helped to ensure that the views of people of various ages and backgrounds were fed into the programme.



Any technology needs to be user friendly for all staff and patients especially to ensure participation.



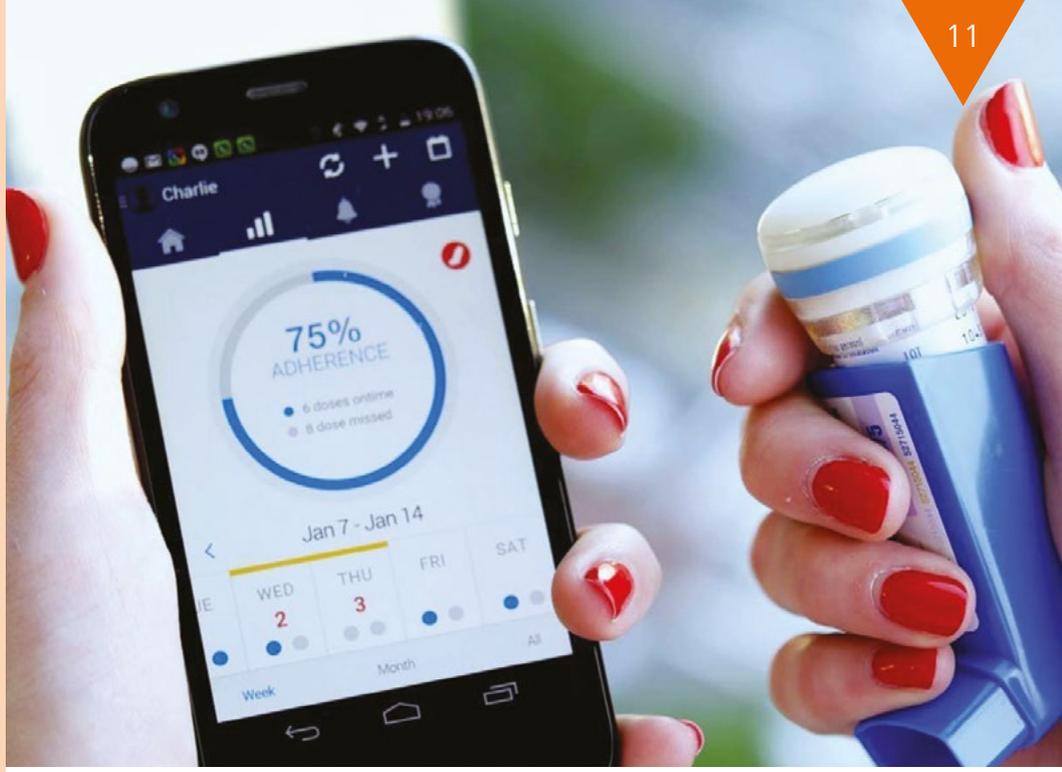
Overview of Test Bed projects

Asthma



The **CareTRx** programme sought to understand how an innovative combination of digital technology, behavioural change science and patient support services could be of benefit to patients in the self-management of their asthma condition by providing information on inhaler usage and treatment adherence and exploring how patients and clinicians responded to this new approach to asthma management using:

- CareTRx Sensor that fitted over the top of an inhaler device to record dosing events to remind the user to take medication.
- CareTRx app for smartphones to link to the sensor.
- CareTRx Clinic to familiarise users with the intervention, to help download the app, and work with individuals to understand their behaviours in terms of medication adherence.
- A data analytics dashboard and a data hosting cloud for users and clinicians to view medication history.
- And a Patient Support Programme (PSP digital coaching) comprising email, text messaging and website linked to behaviour change approaches.



132 people with asthma registered with 10 GP practices in Sheffield were invited to take part in the pilot programme and attend a CareTRx Clinic with a respiratory nurse specialist. The programme enabled patients to monitor their dosage, receive notifications, and view statistics on how often they were taking their medicine. A dedicated nurse call centre and website provided tools and advice to support patients to manage their asthma.

Partners

Dover Court Surgery, Greystones Medical Centre, Nethergreen Surgery, The Hollies Medical Centre, Woodhouse Medical Centre, Sheffield University Practice, Porterbrook Medical Centre, The White House Surgery, The Crookes Practice, Birley Medical Centre, Teva UK, Healthwatch Sheffield, ScHARR, Sheffield Teaching Hospitals NHS Foundation Trust.

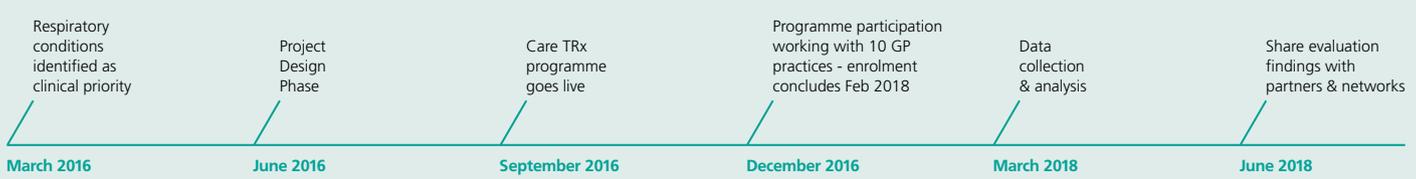
Key Learning

- The evaluation found that interpreting the current evidence on the relationship between medication adherence and exacerbations is complex. Although not

possible to attribute adherence levels to the intervention (data was received from 83 patients regarding adherence to scheduled medication dosage) the mean average of adherence remained above 50%, which some research studies define as above normal adherent level, and in addition, the results of this evaluation demonstrated a 78% adherence in 50-59 year olds.

- There is significant value for innovators engaging with the NHS to enable iterative development/ design of combinations of complex interventions
- Patient involvement can be improved by reducing time implications for participation e.g. coordinating appointments with routine care appointments; or keeping clinics short with flexible availability.
- Large amount of learning needs to take place at the early stages of testing out technology (especially combinations of innovations) in real-world settings.
- Simplify the process of collecting data for project evaluations to increase completion rates.

Asthma



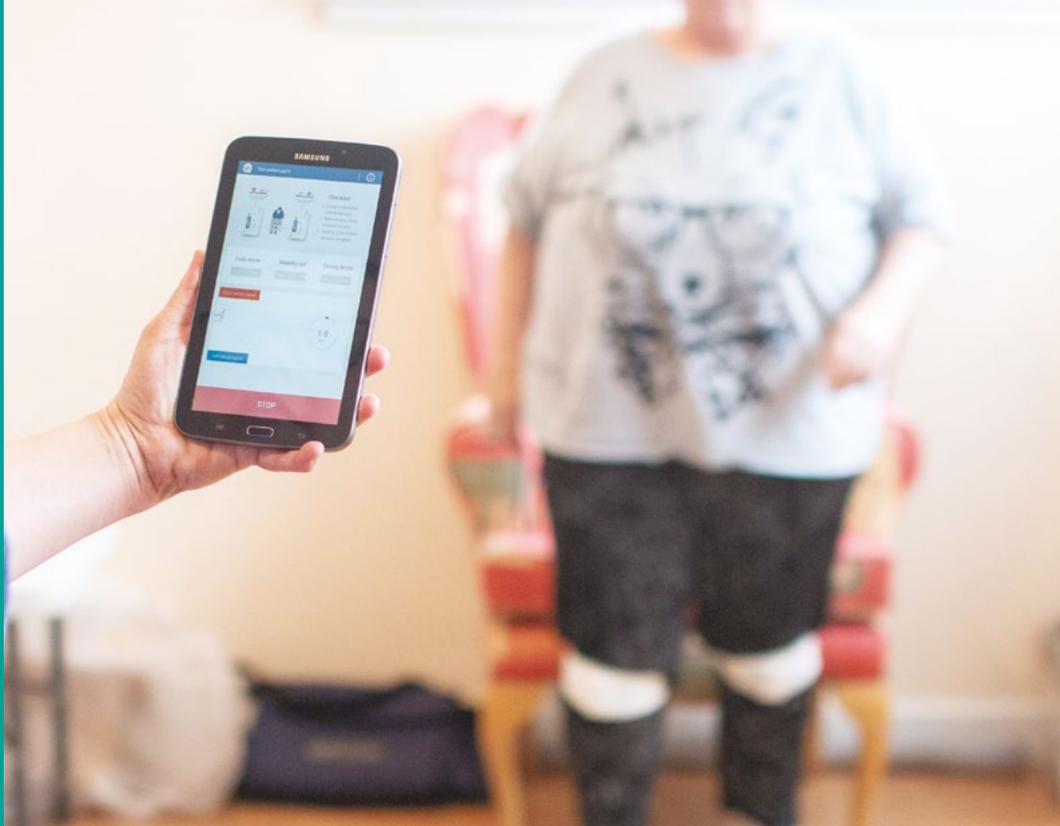
Falls Prevention



The Falls Prevention project tested and evaluated the application of the Kinesis QTUG™ (Quantitative Timed Up and Go) – a medical device for assessment of falls risk and frailty – in a range of settings including 3 GP practices; a weekly secondary care based balance clinic; and within community and voluntary sector groups and sheltered housing schemes.

The QTUG technology comprised two inertial sensors, worn by the participant, during a short timed walking exercise. During the assessment, data was streamed via Bluetooth to a tablet device and a mobile software app (including a falls risk questionnaire) to assess frailty and mobility, to give an objective assessment of falls risk based upon the 'Timed Up and Go' test. The device also provided identification of mobility impairment through automatic comparison against reference values for the participant's age and gender.

The QTUG test was introduced as part of a change to the assessment process providing an opportunity for clinicians to re-think their model of care and assess people at an earlier stage for their risk of falls rather than people being assessed and accessing falls prevention services after they had already fallen.



The Falls Prevention project was an opportunity to:

- Invite people aged 65 and over, and potentially at risk of a future fall, to have their gait assessed without requiring an 'expert' to use the device.
- Facilitate appropriate clinical decisions and referrals to falls-prevention interventions based on the information obtained.
- Improve ability for people to 'self-manage', engage in exercise, strength and balance sessions or make other home adaptations or lifestyle changes to reduce the risk of falls.
- Explore potential to reduce unplanned hospital admissions/use of A&E and use of urgent primary care through injurious falls.

Partners

Sheffield Teaching Hospitals NHS Foundation Trust Telehealth Team, University of Sheffield - SCHARR, Kinesis, Healthwatch Sheffield, Sheffield Teaching Hospitals NHS Foundation Trust - ENT Clinic, Pitsmoor Surgery, Flowers Medical Centre, Southey Green Medical Centre.

Key Learning

- Primary care - 180 patients invited for assessment and 60 patients assessed. 14% were referred to the falls prevention service.
- Secondary care - 45 out of 84 attendees were assessed and 7 of these with high falls risk scores (16%) were referred to the falls service.
- Community settings - 272 assessments and 138 (50.7%) were successfully referred to the falls prevention intervention.
- To assess cost-effectiveness, an exploratory economic model was developed by School of Health and Related Research (SCHARR) at the University of Sheffield. According to this model screening with QTUG produces more Quality Adjusted Life Years (QALYs) and cost-savings than paper-based assessments and if falls-risk screening was sought by clinicians, QTUG should be considered rather than the manual assessment for people aged 65 to 89.
- The model also suggested that a falls prevention care pathway had a higher

Falls Prevention

Fall prevention identified as clinical priority

March 2016

Project Design Phase for primary care

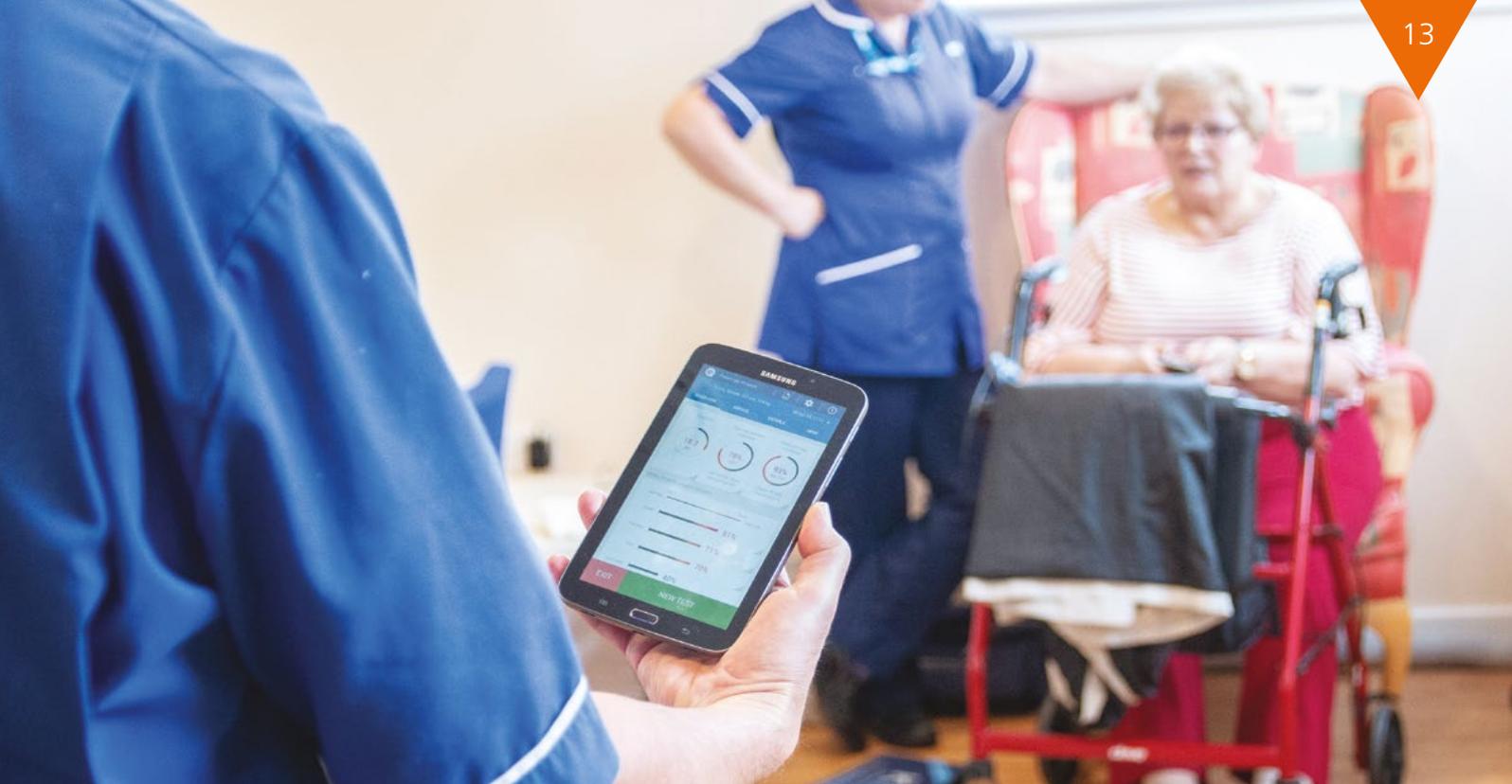
September 2016

Staff trained & first participant assessed in first GP practice

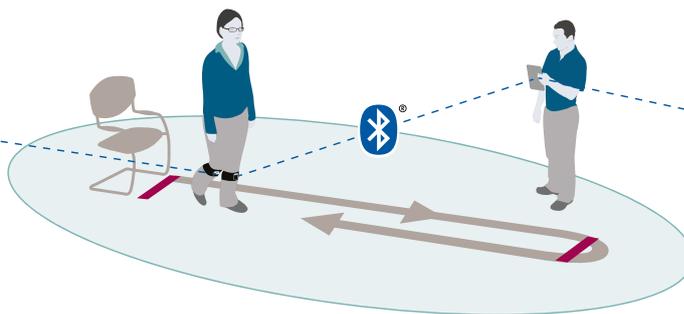
December 2016

Second GP practice starts assessments. Project design phase for Secondary Care

March 2017



body worn inertial sensors



streaming wirelessly via Bluetooth



patient's mobility assessment

probability of being cost-effective when screening and falls prevention interventions were utilised in a population aged 75 to 89.

- Feedback from the secondary care clinic indicated that the assessment process was suitable for a busy clinical setting; aided interactions with patients; provided systematic assessment and referral routes, and was well received by patients and clinicians.
- The number of assessments completed over the project duration was significantly

higher in the community settings. However, this resulted in a long waiting list for the falls prevention service following referrals. A sustainable assessment service would require improved coordination with prevention and support services and possibly increased capacity or alternative support to manage referrals.

- Staff involved in project implementation considered the high interest in the project in lunch clubs and community groups could be attributed to removing barriers to attendance such as travel or

appointment booking or how people responded to the opportunity offered by a 'Strength & Balance' programme rather than be concerned by a 'Falls Prevention' service which could impact on people's confidence.

- System approaches are important in order to consider unintended consequences of introducing technology and to explore effects across organisations, service-providers and pathways.

Third GP practice starts assessments

June 2017

Secondary care assessments from Dec 2017 to March 2018.
Project design phase for community settings Jan 2018

December 2017

Community assessments completed from Feb - Apr 2018

March 2018

Share evaluation findings with partners and networks

June 2018

Digital Care Home

inhealthcare

The Digital Care Home project tested the impact of digital technology combined with integrated working of healthcare professionals and care home teams to provide enhanced clinical interventions to care home residents and reduce potentially avoidable admissions to hospital through better access to support in the community. The service was designed as an **'early warning system'**, highlighting changes in health which could otherwise go unnoticed.

The Digital Care Home service enabled carers to monitor a resident's vital signs (National Early Warning Signs (NEWS) observations) - respiration rate, oxygen saturation, temperature, blood pressure, heart rate and level of consciousness - and record this information digitally using a tablet app instead of using paper.

This information was then able to be shared securely with a team of nurses, located at the Single Point of Access (SPA) at Sheffield Teaching Hospitals NHS Foundation Trust, for assessment and support with clinical decision making; and to access expertise from GPs and nursing teams. SPA worked in partnership with the care home teams to respond according to the needs of the individual if early deterioration of health was identified and an 'alert' was generated.



Examples of potential responses as a result of the intervention included prioritising residents for immediate attention during GP ward rounds or additional GP visits; increased resident monitoring; medication reviews; or community nurse home visits.

The service integrated directly into clinical systems including SystmOne and EMIS Web, meaning that shared information could be uploaded into patient records and accessed by NHS teams following referrals for a joined-up response between local healthcare services.

Partners

Sheffield Teaching Hospitals NHS Foundation Trust – Single Point of Access (SPA), SchARR, Healthwatch Sheffield, Inhealthcare, St Luke's Hospice, Balmoral Care Home, Moored Place Care Home, Chapel Lodge Care Home, Haythorne Place Care Home, Chatsworth Grange Care Home, Alexander Court Care Home, Loxley Court Care Home, Longley Park View Care Home, Newfield Care Home, Woodhill House Care Home. 131 residents from 10 care homes in Sheffield participated in the project.

Digital Care Home

Support for care homes identified as regional priority

March 2016

Project Design Phase (user engagement and data sharing)

September 2016

Resources co-designed with TAG

March 2017

Launch of monitoring in pilot care home - Balmoral

June 2017



Key Learning

- Co-production is essential in order to embed relationships between care home sector and local NHS services.
- It takes time to integrate new ways of working into a routine and this requires commitment and resilience from a workforce who need to be clear on the benefits that remote monitoring can bring to them, their organisation and the people they care for – take the time to engage with, understand and incentivise the care home workforce.
- The use of technology did not replace personal contact and knowledge about residents – nurses reported using the time spent taking observations to talk to residents and learn more about how they were feeling, with the data supplementing any detection of health deterioration.
- Usability of technology is particularly important in busy care home environments.
- Problems submitting information were often attributed to Wi-Fi connectivity.
- Effective implementation requires investment in education and training; engagement with care home teams, residents, and their family & friends; and resources to help teams trouble-shoot any problems they have using technology to encourage independence and increase confidence.
- Adherence to the Digital Care Home service required a team approach with strong leadership and 'buy-in' across the organisation with approaches personalised to each care home's routine such as flash meetings or huddles.
- The act of regular monitoring can increase the knowledge and understanding of care home staff, and increase vigilance and attention. Literature review evidence was corroborated by responses to alerts, where care home staff members had taken actions before contact from SPA.
- The project was generally well-received with recommendations for further investigations into the potential impact on related health and social care services and the frequency and timing of monitoring.
- There were over 200 alerts generated during the project with the majority of alerts dealt with by SPA and care home (e.g. increased monitoring).
- On a few occasions, alerts were attributed to contextual and environmental factors (e.g. high room temperature or lying positions) and resolved quickly.
- In 16 cases, care home staff reported having no concerns about the alert, indicating the benefit of understanding the baseline (or 'normal') NEWS score for that resident.
- Although there could not be any definitive conclusions inferred between the impact of the service on rate of emergency contacts during the intervention when compared with before the project, the Digital Care Home project provides a good example of the integration of innovative digital technology to create new linkages and pathways of care between existing services.

Oct 2017 - Jan 2018 - launch of monitoring at Moored Place, Chapel Lodge, Haythorne Place, Chatsworth Grange, Alexander Court and Loxley Court Care Homes

Evaluation Interviews with care home partners

Analysis of remote monitoring data and alerts
Creation of film content to raise awareness of the service nationally

Share evaluation findings with partners and networks

3Rings



The 3Rings 'Internet of Things' project investigated the use of the 3Rings™ device in daily life as a means of maintaining independence for people living alone with dementia, by enabling a family carer to recognise changes in routine behaviour.

The device consisted of a smart mains electricity plug which allowed appliances to be plugged into it. The device was designed to provide daily reassurance to families or remote carers by monitoring the routine use of the appliance (e.g. kettle) and indicating changes in behaviour that could be a cause for concern e.g. carers would be alerted if any appliance hadn't been used in order to respond if there was cause for concern.

Partners

Sheffield Hallam University (SHU) Advanced Wellbeing Research Centre (AWRC), Westfield Health, The Alzheimer's Society, and Age UK.



Key Learning

- The technology monitored daily activities in an unobtrusive way.
- Over the 5 month period of the study, most people had little change in their daily routines.
- Some people became less frail and some carers experienced less burden, but it cannot be proven that the technology was the only reason for this.
- Family Carers reported they felt reassured from knowing routine and being able to recognise when something was out of the ordinary.
- When Family Carers recognised a change in the pattern of routine behaviour, specifically drinking, they were able to put remedies in place which they hoped would prevent a "crisis" e.g. illness or hospital admission.
- Insight gained from this study in terms of usability and acceptability by target users was promising in order to further examine and test the theories behind the technology in future studies.

3Rings



Diabetes



The Diabetes project was designed to test and evaluate how technology could support improved self-management of insulin regimes by improving access for individuals with diabetes to frequent and accurate data about their insulin use to help them better manage insulin levels and avoid missed or 'double' doses. The project pilot invited people to participate who needed to inject insulin to manage their diabetes and who also required daily visits from a community nurse for administration of their injections.

The technology (Insulcheck Classic), a simple clip-on attachment, was designed to fit a standard insulin injection pen without modification of the pen or its operation. Once attached, it automatically detected when an injection was performed and displayed the elapsed time since the last injection for the user.

Partners

Insulcheck, Healthwatch Sheffield, SchARR, Sheffield Teaching Hospitals NHS Foundation Trust.

Key Learning

Feedback from the pilot project indicated that people who injected insulin and those who had family and friends with insulin pens thought the device would be useful. The focus on prevention and empowering patients to self-manage was thought to be a valuable aspect of the project, as was avoiding the potentially serious consequences of having a double dose of insulin within a short period of time.

The pilot project resulted in extensive learning for the partnership regarding the pace of change of technology development and the impact on evaluation methodologies in pilot projects as new technologies arrive in the market. User



groups were interested in future versions of the device to include reminders or 'nudges' to prompt participants to take their insulin; for the dose of insulin administered to be recorded; and for the device to be designed for people with limited dexterity in their hands.

Diabetes

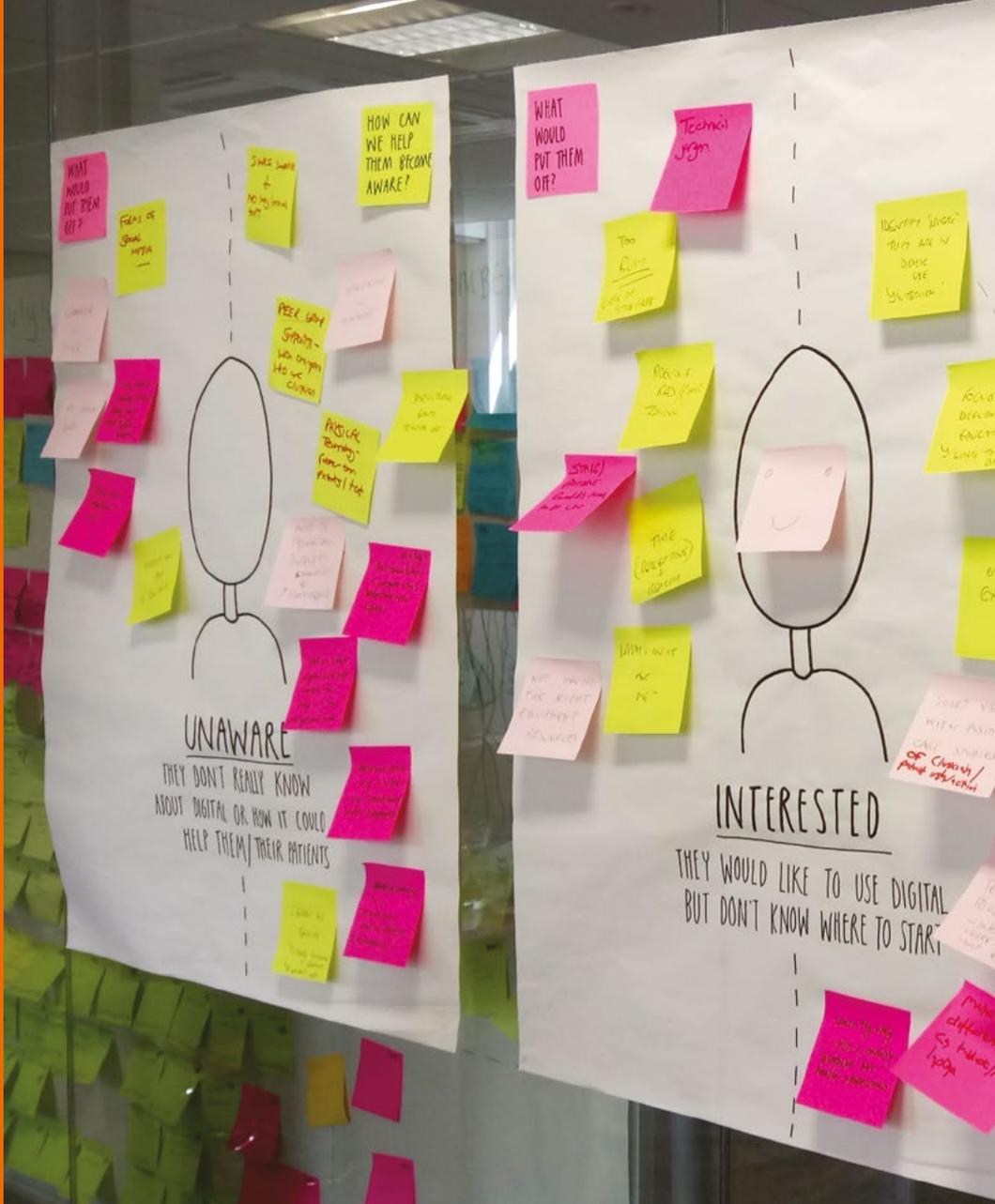


Digital Health Training



Digital Health Training was an opportunity for the Test Bed to collaborate with Good Things Foundation to co-design resources for health professionals to become **'Digital Health Champions'** – a new role to catalyse conversations, between clinicians and people with long-term conditions, to encourage and support the use of digital health for self-management alongside clinical interventions.

Good Things Foundation previously worked with NHS England to deliver Widening Digital Participation, a programme focusing on the activation and confidence of patients to self-care **using digital tools and resources** connecting primary care services with community digital inclusion support, using online and offline resources.



Studies indicate that digital inclusion activity is most effective when delivered in familiar settings by familiar people; tailored to personal interests, motivations and needs; and as part of other services or activities of which the user already understands the value.

To develop more understanding about how these approaches and resources could be used by healthcare professionals to help people with one or more long term conditions to self-manage their health, Good Things Foundation worked with the Test Bed and the Test Bed Advisory Group (TAG) to explore and challenge perceptions

of digital health literacy; conduct an initial training needs analysis; and delivered a pilot programme of workshops in response to the question.

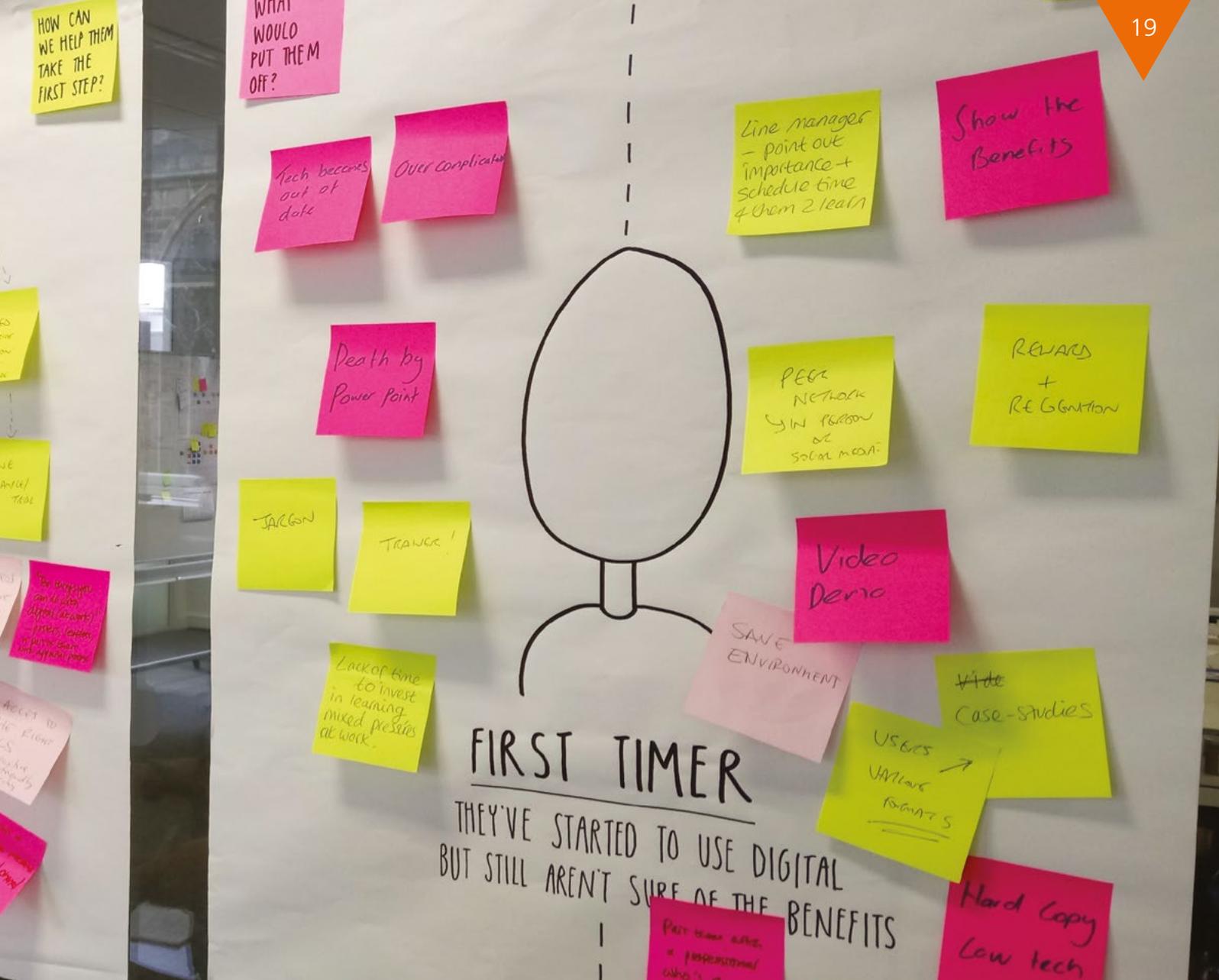


How can we develop health professionals' capacity to improve digital health skills for people living with long-term conditions?



Digital Health Training





Partners

Good Things Foundation, Sheffield Teaching Hospitals NHS Foundation Trust, Healthwatch Sheffield, Test Bed Advisory Group.

Key Learning

- There was a lack of digital skills confidence and willingness to engage amongst health professionals.
- To promote adoption by as many members of staff as possible, digital health training must be recognised and promoted by all levels of the NHS hierarchy and should be incorporated into practitioners' continuing professional development (CPD).
- Peer support amongst colleagues at all levels is key to raising awareness of digital health before it can be translated into conversations with patients.
- To engage health professionals in digital health, the benefits to patients must be clearly communicated when promoting any related training.
- Allowing time to iterate the delivery of the training throughout this pilot enabled the team to make changes that had a positive effect on health professionals' subsequent behaviour change.
- It is crucial to acknowledge the concerns of staff who are reluctant to engage with digital and to have those people as an equal part of any training.
- This pilot has shown that there is scope to embed digital health training for health professionals with a range of backgrounds and confidence when it focuses on core, baseline themes, rather than specific technologies. The workshops delivered have been well received and there is benefit to scaling this approach across the Trust and beyond.
- Including patients or people with lived experience in the training workshops supports learning as it provides real context and a counterpoint to common misconceptions.
- This project has shown that delivering digital health training that focuses on sharing experiences and peer support achieves behaviour change.
- The pilot as delivered has shown more success in enabling changes with how people speak with colleagues compared to changes with how they speak with patients.

Emergency Contact

humetrix

The Humetrix SOS UK app provided carers and patients with an easy way to keep an up-to-date medical record on their smartphone to improve care coordination in transitions of care between GP practices, A&E attendances, and hospital admissions. The user could display health information on their smartphone during any medical encounter or, if they were unable to do so, healthcare professionals and emergency responders could access care information regarding conditions, allergies and medications. It also featured an "SOS Button" to alert emergency contacts with a GPS location in an emergency situation.

The Emergency Contact project was designed to explore how the opportunity to record, control and share healthcare information on their smartphones was received across the population, including individuals with long term conditions, following a public outreach campaign.



Partners

Humetrix, SchARR, Sheffield Teaching Hospitals NHS Foundation Trust, Healthwatch Sheffield.

Key Learning

The project identified the challenges of testing healthcare apps alongside fast-moving upgrades in smartphone functionality, which impacted on overall take-up, and the value of ongoing user feedback.

It was recognised that in order for the 'emergency access to health records' function to make a difference, the service would need to have widespread use for emergency response staff to know to look for the phone and use the app.

Linking the app to the evaluation website, developed and owned by the University of Sheffield evaluation team, was an innovation in evaluation methods showing great promise for future studies.



The importance of team working - promote communication and feedback to guide delivery to ensure the patient is at the heart of what we do.



Emergency Contact

Reduction of urgent care admissions identified as clinical priority

Project Design and Communication Strategy

SOS UK app launched and available for download

App promoted via local networks and communications campaign

Free download phase ends - data collection and evaluation

Share evaluation findings with partners & networks

March 2016

June 2016

December 2016

March 2017

January 2018

June 2018

Predictive Analytics



The Predictive Analytics project sought to explore the ability of machine learning to predict whether a patient would be readmitted within 30 days from the day of discharge from the frailty ward. The objectives for this activity were twofold: to first demonstrate the feasibility of developing an analysis tool that would be competitive with the state of the art based on hospital data alone, and second, to go beyond the state of the art by combining this with an objective assessment of a patient's social/home circumstances, to further improve the accuracy of the prediction.

The social care service in Sheffield, as part of its care package planning process, has a very structured assessment which covers areas such as mobility, social isolation and other aspects of the patient's daily living which, when combined with the specific clinical conditions or interventions, might better help identify those at risk of readmission.

The PPP Test Bed had access to data from January 2008 to September 2017. The project looked at patients with more than 1 admission to the frailty wards in the hospital. This resulted in 5,021 patients with a total of 7,542 hospital admissions, of which 2,823 were readmissions within 30 days of discharge. There were 4.3 million data points associated with these admissions.

Using the machine learning system to analyse the two years' data prior to the event, it was found that if the machine

learning system identified that the patient would be readmitted within 30 days, then the probability that the result was true was over 70%.

This project is ongoing beyond the duration of the PPP Test Bed and for sustainability is now embedded into the machine learning capability of the Trust's Scientific Computing team. Knowledge transfer and sharing of software tools between IBM, one of the innovator partners in the Test Bed, and this team, has led to new capability in predictive analytics for the host Trust, with the opportunity to spread analytics capability across the system.

Partners

IBM Healthcare, Sheffield Teaching Hospitals NHS Foundation Trust, Sheffield City Council.

Predictive Analytics

Early project design phase working with IBM Analytics platform

June 2016

Project design based on frailty unit admission data

January 2017

Analysis of Digital Care Home and Falls Prevention Data

January 2018

Analysis of data collected & recommendations

June 2018

Programme Evaluation

The University of Sheffield School of Health & Related Research (SchARR) were the lead evaluation partners for the programme. Requirements for flexibility and robustness for the real world evaluation of combinatorial healthcare innovation could not be satisfied by the usual academic approaches for research clinical trials. A specific evaluation framework for the Test Bed Programme was created, tested and validated based on four dimensions: **Market, Technology, People and Benefits.**

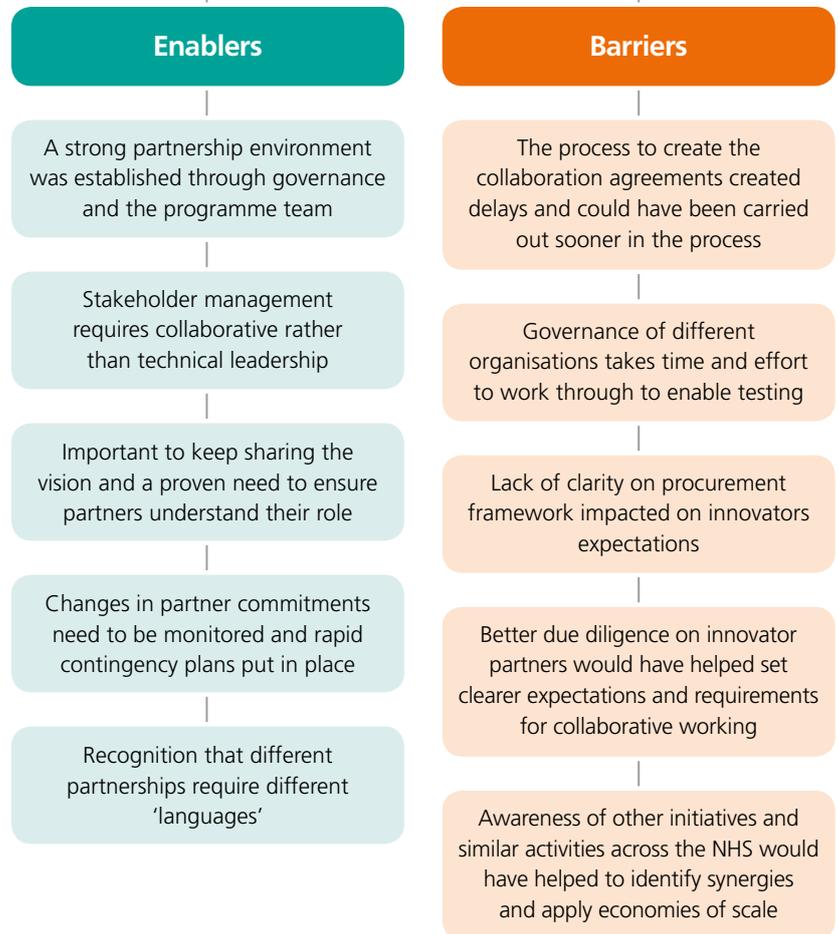
In parallel, the **Perfect Patient Pathway Test Bed Lessons Learned Lifecycle** was developed collaboratively, focusing on particular situations and the root causes, with input collated from many different sources including, but not limited to, the management team, board members, partners, health care professionals, patients, subject matter experts and other key stakeholders.

This Lifecycle supports the development of a culture of continuous improvement by:

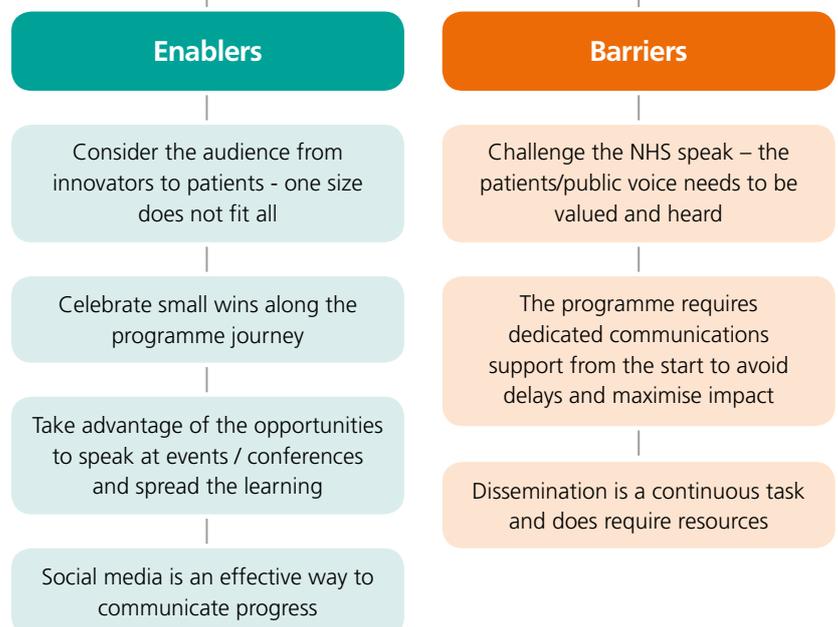
- Encouraging learning from good practice.
- Promoting sharing lessons, both positive actions to sustain and areas for improvement.
- Recognising that identifying and implementing sustainable solutions takes time, resources and opportunity.

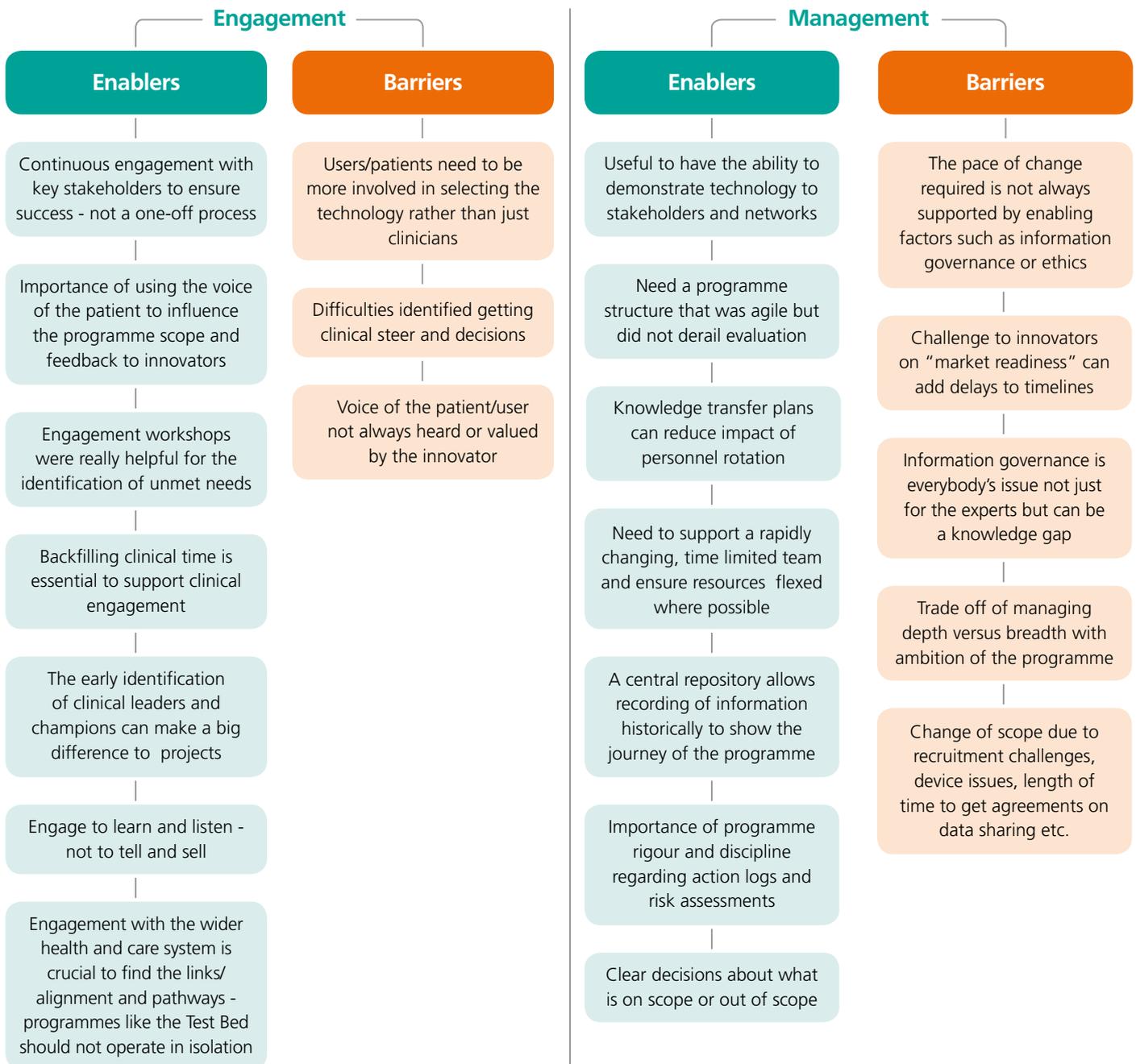


Partnerships



Dissemination





**Start with the people who
will use the service and never
the technology.**



Programme Evaluation

Recruitment

Enablers

Peace of mind is not to be underestimated as a motive for patients getting involved in testing

Spending time face to face in care settings can increase patient recruitment.

Worth of mouth should not be underestimated.

Think about the assets in the voluntary sector to support recruitment.

Understanding the motives for people agreeing to take part in testing

Barriers

Patient recruitment reflects the real world – often patients who might benefit most from support are least engaged or able to use technology

People become used to how they manage their long-term condition in a certain way and this is unlikely to change quickly

People are sceptical of how data might be used by innovators

The length of some evaluation documents (e.g. PROMs) can be off-putting to participants

The number of consents required

Evaluation

Enablers

Co-design the programme and evaluation at the start

Discuss the evaluation process at planning stage to consider critical requirements

Integrate the evaluation team with the management team

Consider 'real world' testing methods, with less academic approach

Keep control over data collection, reducing dependence on innovators and clinical teams

Barriers

Challenge of academic evaluation required versus real time testing and changes required

Different stakeholders have different understanding of the purpose and form of evidence

Difficulties integrating service improvement techniques to testing due to resource pressures

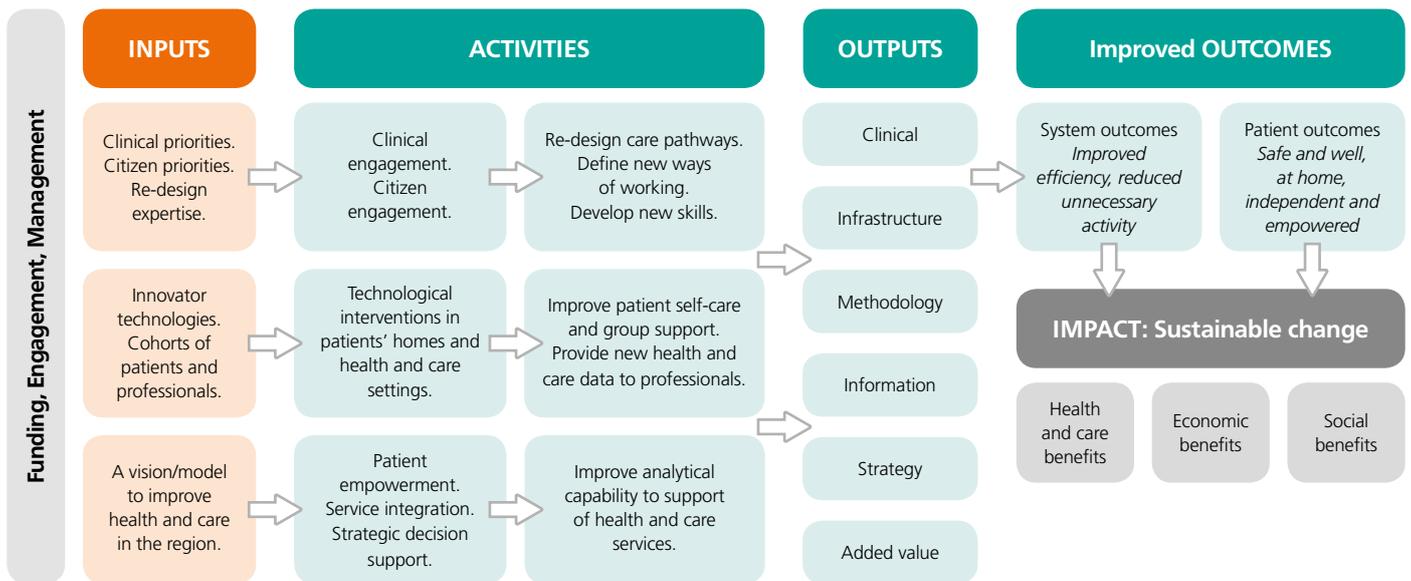
Flexible evaluation methodologies required to adapt approach to real world scenarios



Keep problem solving and tweaking processes. Keep things simple for uses.



Logic Model - Programme Components



Confirmed that you rarely get things right first time and that iteration, feedback and gradual improvement is key!!



Key Learning

- The introduction of technologies and pathway changes in the NHS is part of a non-linear innovation process, that requires capacity and capability to change, adapt and adopt as the learning emerges.
- Real world evaluation of healthcare technologies and redesigned care pathways requires innovative approaches to include all relevant dimensions.
- Meaningful collaborative approach among stakeholders to adopt innovation increases impact, highlights strengths and generates new opportunities.
- Embedding a culture of continuous improvement supports the identification of lessons learned and generates a valuable programme legacy.
- Stakeholders expectations might evolve during programmes and require proper management and realignment.
- Interaction between innovators and patients during evaluations supports the identification of technical improvements and new potential benefits.
- Identification of users and evaluation requirements during planning and implementation design phases minimises risks and difficulties in execution.
- Identification of insights and understanding of motives for patients and public agreeing (or not) to take part in an evaluation are essential as a preliminary analysis of impact and support the estimation of recruitment times and efforts.
- Centralised control over data collection reduces pressure on innovators and clinical teams and facilitates compliance with Information Governance regulation.
- Agreed metrics and indicators for success promotes transparency, improves focus, and increases expectations alignment.
- The Logic Model, Evaluation Framework and Lesson Learned Approach developed in the Sheffield Test Bed Evaluation Framework have been validated and are available for other projects and programmes.
- Technology deployment does not always result in useful feedback to innovators. This provision of feedback for improving and adapting digital technology could be considered a crucial function for NHS infrastructure similar to the PPP Test Bed. The unique combination of organisations and functions integrated into a core team could be a critical condition for this mechanism to operate.

Shared Learning



The Test Bed Celebration Event and Awards in May 2018 was an opportunity to thank all project partners and everybody who had been actively involved in the Programme. The event included a number of awards, nominated and judged by the Test Bed Advisory Group, and special recognition for all the care homes who participated in the Digital Care Home project.



People who use services are very perceptive about what works for them and are a valuable part of making a programme have real impact.



The event was also an opportunity to share and reflect on **key learning** from the Test Bed programme considering the following questions:

“What key learning did you gain from participating in the Perfect Patient Pathway Test Bed?”

- Partners saw significant value and importance in co-production with people / patients and felt that feedback from all user groups is critical in user-centred design.
- There are challenges for patients and healthcare professionals in understanding the benefits of new technologies and developing the confidence in using them but focus on usability can affect the pace at which using digital tools can become routine.
- Testing and evaluating new ways of delivering healthcare using technology is complex and will not always result in wider adoption in the system.
- Collaboration and effective partnership working is essential for progress at pace towards project aims and outcomes.
- The Test Bed provided a great opportunity to act upon real-world testing and feedback in order to develop and improve technology and service design.
- Open communication ensures that all partners felt involved and can stimulate new ideas and opportunities.



Many health professionals don't have the confidence or skills to use digital technology or know where to get support. This hampers patient uptake and therefore limits the potentially beneficial outcomes.





“What advice / feedback would you give to future Test Bed programmes?”

1. Dedicate time and effort to committing to an effective and inclusive engagement strategy with users and stakeholders from day one and throughout the lifetime of the programme.
2. Understand co-production and working in partnership on an equal basis and to help create services that meet the needs of users and increase the chances of getting things right the first time.
3. Develop ownership and shared responsibility for partners in order to move forward as a team towards a shared vision and goals.
4. Be agile and able to adapt to change or unexpected challenges.
5. Establish goals that are realistically achievable and use the Test Bed as a platform for future opportunities.



Engage with the public early on to find out why / why not they would take part in testing.



The importance of team working - promote communication and feedback to guide delivery to ensure the patient is at the heart of what we do.





Sheffield Teaching Hospitals
NHS Foundation Trust



Perfect
Patient
Pathway

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