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Institute for Employment Studies

NHS Innovation Accelerator Evaluation

Final Report

Cox A, Spiegelhalter K, Marangozov R, Institute for Employment Studies

Hanlon J, Hex N, York Health Economics Consortium

Gabbay M, Health Services Research Department, University of Liverpool

YHEC

York Health Economics Consortium

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Institute for Employment Studies
City Gate
185 Dyke Road
Brighton BN3 1TL
UK

Telephone: +44 (0)1273 763400
Email: askies@employment-studies.co.uk
Website: www.employment-studies.co.uk

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Executive Summary

The NHS Innovation Accelerator (NIA) was created to help address the priorities of improving take-up of innovations in the NHS as expressed in the *Five Year Forward View* goals. It is intended to help create conditions and cultural change so that healthcare innovations are adopted faster and more systematically and to deliver practical examples for patient and population benefit. The NIA was created by NHS England together with UCLPartners, Academic Health Science Networks and The Health Foundation to offer a range of customised and dedicated support for 17 Fellows to scale innovations with the goals of improving patient outcomes while maintaining or reducing service costs. The programme support runs over a one year period initially with the opportunity for annual extension via an application process. Fellows received a range of support including:

- quarterly learning events, with specialist expert briefings on topics informed by Fellows' current needs and time to share learning with peers and network
- personal one-to-one support from NIA core team staff at UCLPartners
- a bursary worth £47,000 for the 2015 cohort (which cannot be used for the Fellow's salary costs) funded by The Health Foundation and five Academic Health Science Networks (East Midlands AHSN, Imperial College Health Partners, Innovation Agency, Yorkshire and Humber AHSN and UCLPartners)
- access to mentoring from a range of relevant experts with a broad skills base; pairing with an AHSN, and access to the broader AHSN network
- peer-to-peer support from other Fellows
- SLACK – a collaborative communications tool; a cohort launch event and summit to showcase progress to key stakeholders after one year
- ad hoc learning sessions delivered in response to Fellows' requests.

This evaluation was funded by The Health Foundation and covered the first cohort of the NIA, which was funded by NHS England, the Health Foundation and five Academic Health Science Networks - East Midlands AHSN, Imperial College Health Partners, Innovation Agency (NW Coast AHSN), UCLPartners and Yorkshire and Humber AHSN. The core NIA programme is hosted at UCLPartners.

This final report aims to assess:

1. What the impact of the NIA has been on Fellows, its strengths and areas for development.
2. How far the innovations have scaled, identifying emerging and potential future benefits, including benefits for patient and population health, as well as wider cultural change through the NHS and non-NHS organisations.
3. Factors which influenced current and future innovation uptake and impact operating at the level of individual Fellows, for the NIA as a whole and in organisational settings where the innovation is being adopted.
4. What the current and potential impact of each innovation is in terms of patient/population health benefits, organisational and wider health system costs.

Methods

This report is based on:

- Two rounds of interviews with the 17 Fellows held six months apart, seven staff involved in NIA development and/or delivery, a first wave of interviews with 74 stakeholders and patients, and a second wave of interviews with a further 45 stakeholders and patients, 14 of which were new interviewees for the second wave. The stakeholders include mentors, representatives from AHSNs, and NHS clinicians and managers. All interviews were recorded, with interviewees' permission, and those with NIA Fellows and delivery staff were transcribed in full while detailed notes were made on stakeholder and patients' recordings. Details of stakeholder interviews conducted for each innovation and NIA staff are shown in Appendix Four. The first round interviews with Fellows and NIA development/delivery staff were conducted in August and September 2016 and those with stakeholders and patients were conducted in October and November 2016. The second round interviews were conducted in March and April 2017. The evaluation was overseen throughout by an independent Evaluation Advisory Group.
- Management information from the Fellows' original application forms, application forms to continue on the NIA for a second year, sprint plans and feedback provided after quarterly learning events.
- Data on current and future costs and benefits extracted from templates developed by the research team and completed by Fellows, supplemented by papers and externally commissioned cost-benefit analyses of some of the innovations.

Findings

Chapter Two provides information on the NIA content, delivery, elements most valued by the Fellows and recommendations for future improvements.

NIA content has been extremely well received by the initial cohort of Fellows. Fellows report that participation has brought them considerable personal and professional benefits. Five elements of the NIA made a clear difference to both the Fellows and how they approached innovation scaling: providing access to real world insights; creating and using connections with purchasers and key influencers; building networks and partnerships; personal support to maintain motivation; and help to focus on the patient or user perspective in refining innovations. Contacts gained have stimulated interest and purchasing or adoption of the innovations among targeted users. Crucially Fellows all noted that these were differences that would not have occurred without the NIA. The most valued aspects of the NIA divide into seven main themes: personal support from NIA core staff, especially during the first year of the programme; the bursary to enable networking and innovation development; peer group effects to share practical insights and maintain morale; learning events; endorsement through key NHS staff; mentoring; and AHSN support to access target user groups.

The NIA should retain its unusual dual focus on personal development and innovation scaling as there is evidence that this offers additional benefits, particularly for Fellows with less experience of innovation diffusion. Areas for NIA development included earlier exposure to commercial expertise, eg from serial entrepreneurs for those Fellows with less experience of developing new business models; information on legal implications of different partnership models; input from experts on system level change; and gaining and proving the influence of the NIA through Programme Board relationships with NHS England and the Department of Health for dissolving national level obstacles to innovation diffusion.

Chapter Three outlines the impact of the NIA on innovation scaling, discusses how far impact is attributable to it, the barriers that Fellows have encountered and approaches taken to overcoming difficulties. It then goes on to outline the current and future benefits identified for patients in terms of clinical outcomes, healthcare delivery in the form of cost savings and wider systemic change.

By May 2017, the first cohort of 17 **NIA Fellows had secured additional funding worth £28.4 million** and their innovations were diffused into use across 469 additional NHS providers and purchasers. Fellows secured around 29 new contracts; an extra 45 full-time equivalent jobs were created and 31 research trials were under way; with eight papers already published.

Thirteen Fellows from the first cohort attributed tangible progress in innovation take-up to NIA participation and the NIA produced major benefits for all types of innovations. One Fellow felt that the NIA had been personally helpful but it was still too early to judge its full effects, given the innovation was less mature than others at the start of NIA support. Three Fellows felt that although they had benefited personally from the NIA and found it valuable, they attributed limited or no progress in innovation scaling directly to the NIA.

This was due to challenges among target user communities which were presenting barriers to progress and the focus of innovations on long-term change rather than presenting a quick solution to an immediate problem. Those innovations with evidence of greatest scaling tend to be those with widest uptake at the start of the NIA. More complex types of innovations which require engagement of teams from across different organisations, such as new models of care or pathways, have made slower progress in scaling.

Ongoing barriers to innovation scaling lie in difficulties in navigating commissioning structures; awaiting implementation of the NHS Innovation and Technology Tariff where purchasing of eligible innovations had stalled between its announcement and launch; identifying patients who can benefit and patient engagement; incompatibility of IT systems in different NHS organisations; and skills shortages. Severe time and resource constraints among potential users intensified during the second year of the NIA against a backdrop of a poorer financial climate in NHS organisations. In response Fellows were seeking smaller scale routes to entry and focussing on added value to time-pressed clinicians. Some Fellows working in small firms were relying on other sources of revenue to sustain their businesses.

Current benefits of NIA innovations include: improved clinical outcomes, patient empowerment through access to healthcare information eg on managing long-term conditions, access to new forms of support, diagnosis of rare conditions and early access to drug trials, and reduced costs and improved quality of care through better targeting of resources.

Future potential benefits from NIA innovations will derive from five mechanisms: first an extension of current benefits across a wider UK population as more patients gain access to the innovation; second from long-term benefits of an innovation emerging over time; third from new benefits as a result of an innovation being adapted and extended for further conditions; fourth from demonstrating the potential for innovation in the NHS and opportunities for collaborative working to support it; and fifth from innovations being adopted for the benefit of patients in other countries. The longer-term benefits centre on people being able to function more effectively in their daily lives and participate more fully in society with less or minimal support from external health or social welfare agencies. There are also likely to be wider benefits of reduced health inequalities from improved access to healthcare. Costs and quality of care may benefit from prevention of disease occurring, and prevention of exacerbation of an existing disease or condition which reduces the need to visit a GP or receive hospital treatment.

Current wider system benefits emerged from reducing purchasing barriers through the introduction of the NHS Innovation and Technology Tariff, raising the profile of innovation in the NHS, stimulating wider cultural change through conversations with NHS organisations and bringing groups such as AHSNs together to demonstrate models of collaborative working to diffuse healthcare innovations. Future benefits may include NHS service improvement, illustration of new ways of diffusing innovation in the NHS and improvements to global healthcare, since a number of innovations were scaling or planning to scale into other countries.

Chapter Four provides an economic assessment of the value of the innovations and assesses whether they are cost effective, using a mixture of return on investment, cost consequence and cost utility analysis. The exact scale of benefits will depend on the number of times innovations are used in practice. It was easier to test the potential return on investment for innovations designed to achieve safety and efficiency, as they have clear input costs and comparisons with usual care are possible.

The conservative estimates made suggest that some of the innovations could generate significant savings to the health and social care system. The value of total benefits could be higher, because this calculation does not include benefits that cannot be easily quantified at this stage, or other benefits that have value, both to patients, the health and social care system and to society via increased productivity. Furthermore, there is the potential that benefits across the country are underestimated, as the full extent of scaling is not known. The value of the benefits from these innovations (based on data available and assumptions made) are thought to exceed the costs of the NIA programme in one year.

These results should be interpreted with caution however, due to the quality of the data available and the depth of analysis possible in some cases. Examples of the kinds of limitations in the analyses were as follows:

- uncertainty about innovation input costs;
- assumptions required about the attribution of impacts to the innovation;
- evidence from limited sources;
- requirement to use evidence from overseas; and
- lack of quantifiable outcome data.

Chapter Five outlines the conditions for success identified from the research team's analysis, any commonalities across similar types of innovation and the roles of characteristics related to individual Fellows, the innovations themselves, features of the NIA and wider factors in the healthcare environment.

Successful scaling of innovations was dependent on a constellation of supportive factors acting in combination with each other. Two key factors were common across all innovations: support from the NIA core team (discussed in Chapter Two) and patient involvement. This consisted of patient input to innovation development, user testing and feedback; patient groups which encouraged and attracted people to participate in trials and testing of the innovations; key patient groups mobilising demand and pressure for change among purchasers; and patients promoting innovation benefits and acting as champions to engage other users.

Additional features of the Fellows affecting innovation scaling for one or more types of innovation include a range of personal characteristics. These include: entrepreneurial personality traits and drive; openness to new ideas and ways of working; high levels of intellectual ability and resilience to overcome setbacks; excellent communication skills; tactful persuasion and ability to engage and maintain relationships with stakeholders,

which was developed in some Fellows within the NIA experience. Some Fellows additionally benefited from contextual characteristics such as: using clinical backgrounds to build trust with clinician users; recent experience of working in the NHS and 'inside knowledge' of its structures and processes; and access to wider resources or teams to promote their innovations. Characteristics of innovations which affected scaling included their maturity on programme entry; level of system disruption and having lower numbers of people needed to support implementation in each setting; and short-term versus long-term orientation in the nature of the problem being tackled.

Features of the NIA which assisted scaling were: gaining a 'quality stamp' of endorsement from the NIA brand; choice and use of mentors to provide advice on technical issues or introductions to potential users; navigating local and national commissioning structures; introductions to help build national partnerships; gaining champions and endorsements from key individual figures; AHSN support; demonstrating alignment with national and local agendas; and customising engagement routes and marketing for different types of potential users and purchasers, such as clinical staff and finance staff.

Chapter Six provides a summary of the report findings, makes recommendations for future changes that would help scale innovations faster, either through the NIA or through wider stakeholder organisations, and outlines some lessons for future research. Strategic Added Value (SAV) in its simplest form can be defined as the catalytic effects of an intervention, particularly in engaging and influencing stakeholders.

The NIA has provided strategic added value (SAV) in a number of ways:

- **Strategic leadership and catalyst** to articulate common development needs, opportunities, and solutions for innovation scaling. This took place through direct support to the Fellows and feeding in learning about optimising use of innovations with central commission and regulatory agencies. Full impact at a systemic national level is yet to be seen and is likely to emerge over the next few years.
- **Strategic influence** which enables partners to commit to common objectives and allocate funds and resources to support innovation scaling is evident through success in gaining financial support for the NIA from all 15 AHSNs. In turn these have brokered cross-service partnerships at regional levels to help scale innovations. The introduction of the NHS Innovation and Technology Tariff as a national level lever should help accelerate innovation adoption.
- **Leverage** from financial and other incentives to mobilise partner and stakeholder resources including equipment, people and funding to support innovation scaling. This is evident in the direct impact of the NIA bursary, contracts won and public and private sector investment partly secured through NIA brand endorsement. The NHS ITT has shaped incentives for prospective innovation purchasers.
- **Synergy** from using capacity, knowledge and expertise to improve exchange of information and knowledge transfer and coordination of activities between partners in diffusing innovation. The NIA has provided a unified national voice to articulate

challenges in innovation scaling and is working with national bodies to solve these. It has fostered a co-ordinating role for AHSNs across local healthcare economies.

- **Engagement** via setting up mechanisms and incentives for more effective involvement of stakeholders in the design and delivery of activities to support innovation scaling. This has taken place through the NIA Programme Board and the Evaluation Advisory Group both of which have wide representation from national bodies, AHSNs, individual NHS organisations and patients and public representatives. The NIA has also provided numerous platforms and access to events and conferences for Fellows which have resulted in successful engagement of potential users.

A number of Fellows were seeking to develop a bigger credible evidence base to demonstrate impact on cost, quality and patient care outcomes on a broader scale than existing studies have demonstrated, and to deploy this information effectively with purchasers. On a micro-level the NIA is well-placed to help Fellows undertake this, and the continuing work of several Fellows in conducting evaluations of their innovations should yield results over the next year.

There are a number of further conditions for future success in diffusing innovation. Some barriers encountered by the Fellows that still need to be overcome lie outside the NIA in system-wide change which the NIA can support.

Meeting further conditions for success will depend on exerting influence from the NIA and building on and aligning NIA activity with ongoing work including activities arising from the Accelerated Access Review and work to validate, assess and scale the potential of innovations via NICE, the Department of Health, NHS England and NHS Improvement. The recommendations identified by the research team are:

- **Aligning and exploiting NIA innovations to support key NHS initiatives** by the core NIA team showing how the innovations support key sectoral priorities of NHS Vanguards, NHS Test Beds and Sustainability and Transformation Plans.
- **Assisting in navigating routes in to individual organisations and cross-organisational collaborations,** especially advising SMEs through AHSNs on routes to potential customers.
- **Demonstrating the value of innovations** to individual decision-makers, including short-term benefits, where necessary using AHSNs as a dissemination route.
- **Identifying ways of triggering purchasers to consider innovations** at key points of making purchasing decisions, such as contract renewal or replacement, drawing on behavioural insights principles that people are most likely to make changes at moments of heightened receptiveness.
- **Developing a commissioning culture based on meeting long-term health priorities** by incentivising upfront investment to achieve cost savings in situations of financial challenge and widening the scope of innovations eligible for tariff coverage to support purchase.

- **Tackling perverse commissioning incentives** through shifting funding priorities to long-term population health targets and rewarding prevention rather than treatment, coupled with addressing large vested corporate interests through dialogue with NHS England and the Department for Health.
- **Building an innovation culture** and supporting collaboration across organisations with staff in different roles and disciplines and a commitment to new ways of working among front line healthcare staff by demonstrating 'what's in it for me' through sharing stories of positive change among Fellows and wider networks, including patient groups, AHSNs and professional bodies.
- **Mobilising and activating patients by** starting conversations with broader patient interest groups, especially where no specialist representation exists, to identify innovation scaling gaps; catalysing campaigns for roll out of innovations to improve patient safety which will help to ensure equity of access across all providers; and contributing to building a social movement of patients committed to behaviour change to support self-management of conditions and long-term population health improvement.
- **Supporting development of solutions to challenges arising from information governance** and handling data protection for patients through showcasing how innovations overcome these problems for improved long-term healthcare data management and health research.
- **Helping develop impact assessments suitable for innovative products/services** through using NIA voice to feed into actions being taken forward from the Accelerated Access Review and flagging innovations of future interest for new commissioning routes.
- **Enabling closer collaboration to achieve acceptable standardisation in evaluation** and avoid duplication through liaison between NHS England, NICE and the Department of Health with support from NHS Improvement.
- **Aligning endorsement processes** across central NHS organisations, including NICE, the Department of Health and NHS England, through greater co-ordination to avoid stalling or blockages to innovation scaling.

Evaluating both innovation impact and the contribution of funding programmes to support it is inherently difficult. Lessons for further research in this area include:

- Using a longitudinal study to track the diffusion of innovation over time, recognising that it may take several years for innovations to scale to their maximum extent.
- Developing metrics to assess the impact of innovations which are focussed on prevention of health care hazards whose incidence is not reported and where Randomised Control Trials (RCTs) are inappropriate. This would help build a case for triggering earlier, small scale adoption and avoid the 'catch 22' situation where

potential adopters will not invest until they see large scale evidence of impact in sites exactly similar to their own.

- Undertaking detailed case studies within organisations seeking to adopt innovations focussing on processes, actions and tools required to support innovation scaling from an implementation science perspective.

1 Introduction

1.1 Background, purpose and content of NHS Innovation Accelerator

The NHS faces many pressures including an ageing population, rising incidence of long-term conditions, increased costs and budget limitations identified in the *Five Year Forward View* (NHS England, 2014). Identifying, implementing and scaling the use of cost-effective ways of delivering care are essential to help address some of these challenges and improve the nation's health. More recently, a fundamental reform of models and pathways of care across primary, secondary and community health and care settings is taking place through Sustainability and Transformation Plans. These offer opportunities for radical new approaches to harnessing innovations to deliver more cost effective care at pace and scale.

The NHS Innovation Accelerator (NIA) is intended to help address these priorities by helping to create conditions and cultural change required for innovations to be adopted faster and more systematically through the NHS and delivering practical examples for patient and population benefit. The NHS Innovation Accelerator is distinctive from other forms of innovation support because it is a blend of capability building for individuals, as well as aiming to speed up adoption of innovations which have proven potential for high impact throughout the NHS and wider healthcare economy. The NIA was created to offer a range of customised and dedicated support for at least a 12-month period to help appointed individual Fellows scale innovations, with the goals of improving patient outcomes while maintaining or reducing service costs.

The original idea for the NIA was originated in NHS England. It was developed and co-hosted in its first year by UCLPartners with support from The Health Foundation, in collaboration with Academic Health Science Networks (AHSNs) and NHS England. NHS England initially appointed UCLPartners and The Health Foundation to work together and the NIA was shaped by discussions between all three organisations with input from patient networks, Fellows, AHSNs and other partners around an agreed set of principles. The NIA is based on the aim of offering agile and adaptive support, drawing on what is already known about innovation diffusion from existing national and international infrastructure. Technical support for the co-design of learning content was provided by the Innovation Unit.

A first cohort of 17 Fellows was selected based on their willingness to engage in system-wide learning, sharing appropriate values and personal passion, and suitability of their

innovations for this type of scaling. An open application process using written forms and interviews was used to assess 126 initial applications. The Fellows enrolled on the NIA in July 2015 for an initial period of 12 months. Fellows for all the innovations subsequently applied for a further year of NIA support and gained this in July 2016. One Fellow gained support to take forward another innovation not included within this evaluation and another was replaced by a member of staff in the same organisation representing the same innovation. In 2016, a further cohort of eight Fellows was appointed using a revised selection process, with a focus on innovations that are intended to prevent ill health, intervene early where it occurs and improve management of long-term conditions. These Fellows joined the accelerator activities from November 2016 and this evaluation does not cover them.

The Fellows and their innovations selected to start the inaugural NIA in 2015 are shown in Table 1.1.

Table 1.1: NHS Innovation Accelerator Fellows 2015

Name of Fellow	Type of innovation	Name and description of innovation
Anne Bruinvels	Apps and digital platforms	**OWise**: smartphone app for self-management of breast cancer with data monitoring to share information on symptoms with clinicians.
Ben Underwood		**Brush DJ**: smartphone app to encourage teeth brushing, especially among children.
Peter Hames 2015/ Sophie Bostock 2016		**Sleepio**: digital sleep improvement programme (available via web and mobile) which teaches users cognitive and behavioural techniques by a virtual sleep expert.
Simon Bourne		**myCOPD**: patient self-management system for Chronic Obstructive Pulmonary Disease (COPD) offering clinicians, local healthcare providers and CCGs a dashboard to monitor and manage their patients remotely at an individual and population level, monitor exacerbation burdens in real-time and review potential inequalities in healthcare to plan support services effectively.
Anna Moore	Model of care	**iThrive**: new model of care for child and adolescent mental health to support shared decision-making between clinicians and patients.
Bernadette Porter		**NeuroResponse**: integrated system for patients with neurological conditions including nurse-led telephone triage/advice line, email advice services for GPs wishing to contact a consultant neurologist, and a video clinic linking patients, GPs and specialists.
Neil Guha	Pathway	**Scarred liver diagnostic pathway** to detect significant but asymptomatic chronic liver disease.
Francis White	Devices	**AliveCor Kardia Mobile**: mobile ECG heart monitor that allows individuals to detect, monitor and manage heart arrhythmias with automatic analysis.
Maryanne Mariyaselvam		**Non-injectable arterial connector (NIC)**: prevents accidental drug administration through arterial lines used in theatre and intensive care.
Peter Young		**PneuX:** stops ventilator-associated pneumonia (VAP) through a cuffed ventilation tube and an electronic cuff monitoring and inflating device which prevents leakage of bacteria-laden oral and stomach contents to the lung.
Dharmesh Kapoor		**Episcissors-60:** patented fixed angle scissors that take away human error in estimating episiotomy angles during childbirth.

Name of Fellow	Type of innovation	Name and description of innovation
Lloyd Humphreys	IT platforms	**Patients Know Best**: IT platform which enables patients to hold all their medical information in a single record and interact with any care network of their choice including clinical teams, friends and family.
Andrea Haworth		**Sapientia:** genome analytics software to accelerate diagnosis of inherited diseases.
Matt Jameson Evans		**HealthUnlocked**: peer-to-peer online social support network linking patients, carers and health advocates with professional and accredited organisations to share experiences of health conditions, symptoms, treatments, and health services.
Paul Volkaerts		**Nervecentre Software**: provides a whole hospital platform to improve efficiencies in delivering electronic observations, handover, task management and clinical assessments, governance and escalation management.
Piers Kotting		**Join Dementia Research**: matches volunteers for dementia research to suitable studies. This benefits dementia sufferers and researchers by speeding up evidence-based improvements in prevention, diagnosis and treatment of dementia.
Penny Newman	Workforce	**Health Coaching**: training for clinicians in delivering health coaching to patients to improve outcomes for people with long-term conditions. Enables people to gain the knowledge, skills and confidence to become more active participants in their care, reach self-identified goals and adopt more healthy behaviours covering prevention, decision making, self-management and medication compliance.

The NIA is anticipated to work through a series of inputs and pathways which will lead to positive benefits for Fellows, their innovation, patients, the NHS and wider society. These are illustrated in an overall logic model shown in Figure 1.1 which was developed by the evaluation team. This is intended to be illustrative rather than exhaustive.

Figure 1.1: Logic model for National Innovation Accelerator 2015

Rationale	Inputs	Activities	Outputs	Outcomes
To overcome common barriers to innovation diffusion by helping innovators to navigate NHS commissioning, access funding, and improve system-wide communication about innovation benefits	NIA funding & staff resources Quarterly learning events Peer learning support Bursary of £47k NIA core team support Mentoring AHSN support SLACK Ad hoc learning events Access to dissemination & communication events	New contacts made Endorsement by senior NHS figures Meetings with key purchasers/ purchasers Regulatory approval achieved New resources developed Impact studies started/completed Conference/event publicity Papers published Media citations	Number of new partnerships Number of contracts secured Number of organisations & individuals using innovations Number of app downloads Additional funding secured Number of additional people employed Spin-off/additional products being developed Awards won	Reduced time in hospital and medical emergencies prevented Shorter appointments where are patients better informed & clinical information is available in advance: cost savings and improved capacity Improved treatment and diagnosis Reduction in unnecessary prescriptions Decreased administration costs Better targeted and more timely access to care Reduced need to access healthcare from patient self-management & prevention of ill health Healthcare cost savings from patient self-management Prevention of ill health for NHS and for patients Reduced clinical burnout
				Impacts
				Patient satisfaction with quality of care and outcomes Wider social benefits of increased labour market & civic participation & better long-term health Reduced health inequalities in access to diagnosis & treatment & outcomes Improvements to global health Wider systemic & cultural change in receptiveness & routes for innovation uptake in the NHS

1.1.1 National Innovation Accelerator - learning content and support

The first cohort of Fellows enrolled on the NHS Innovation Accelerator in July 2015. The activities made up bespoke learning containing the following elements:

1. Quarterly learning events with specialist expert briefings on topics informed by Fellows' current needs in the innovation scaling process and protected time to share learning with peers and network, to reflect on progress and plan ahead.
2. Personal one-to-one support from NIA core team staff at UCLPartners, with regular meetings offering critical challenge, encouragement and support for completing 12 week 'sprint' plans of activity between learning events.
3. Bursary worth £47,000 for the 2015 cohort (which cannot be used for the Fellow's salary costs) funded by The Health Foundation and five AHSNs (East Midlands AHSN, Imperial College Health Partners, Innovation Agency, UCLPartners, Yorkshire and Humber AHSN).
4. Access to mentoring from a range of relevant experts with a broad skills base.
5. Pairing with an Academic Health Science Network, and access to the broader AHSN network.
6. Peer-to-peer support from other Fellows.
7. SLACK – collaborative communications tool.
8. Cohort launch event, summit to showcase progress to key stakeholders after one year and other main stage showcasing/networking opportunities.
9. Ad hoc learning sessions delivered in response to need, eg health economics, pitching innovations to purchasers.

Each Fellow is expected to spend two days per week on scaling their innovation throughout their participation in the NIA. This time includes attendance at learning events, with mentors and associated travel and meetings.

1.1.2 NIA governance and NIA evaluation governance

The NIA is managed on a day to day basis by staff at UCLPartners. It is overseen by the Programme Board which meets quarterly and provides direction, scrutiny and support to the NIA. Programme board members are listed in Appendix One.

The Evaluation Steering Group reports to the Programme Board. It is headed by an independent chair and is made up of the individuals listed in Appendix Two. It benefits from diverse representation from staff from The Health Foundation, UCLPartners and NHS England as funders of the NIA in 2015/16, patient representatives, AHSNs, the evaluation contracting team, an NIA mentor, representatives of the NIA Fellows, and an overseas partner with interest in healthcare innovation.

1.2 The NHS Innovation Accelerator evaluation

The Institute for Employment Studies, leading a consortium including the York Health Economics Consortium and the Department of Health Services Research, University of Liverpool, was appointed as the independent external evaluator for the NIA in June 2016. The Health Foundation funded the evaluation.

The three broad objectives to the evaluation were to:

1. Assess impact of the NIA on Fellows.
2. Measure current and future impact of the innovations for patient and population benefit, cost and quality of care.
3. Share system-wide learning about scaling innovation take-up in the NHS and wider healthcare economy.

Within these three broad objectives, the overall evaluation sought to answer the following research questions:

1. What is the impact of the NHS Innovation Accelerator on individual Fellows? What are its strengths and areas for development?
2. How far have the innovations scaled and what is the impact of the NHS Innovation Accelerator on the Fellows' innovations in terms of their development and scaling?
3. What are the critical success factors which explain and have enabled the impacts identified, at individual, innovation, programme and organisational levels?
4. What are the barriers to scaling the innovations and operational impact for the Fellows, for the NIA as a whole and in organisational settings seeking to adopt the innovations? How have these been overcome to date?
5. How can the impact of the innovations be measured appropriately and what is the current and potential impact of each innovation in terms of patient/population health, cultural change and cost through the NHS and non-NHS organisations?

1.2.1 Evaluation design and methods

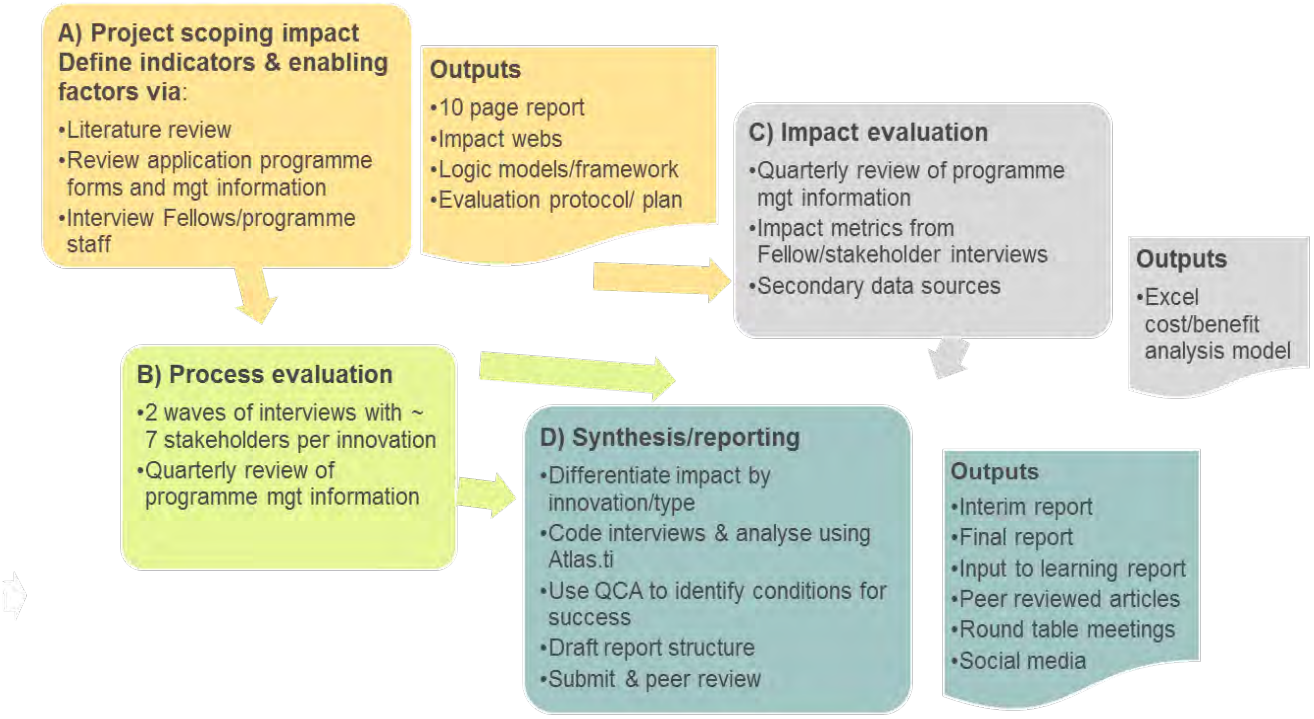
The research design was selected to be in-depth, multi-method and combining qualitative and quantitative sources in a process evaluation and an economic impact assessment. The process evaluation primarily used qualitative information gathered from interviews to understand why the NIA has produced the outcomes identified. The economic impact assessment used data gained from management information, research trials and secondary data to assess the current and future potential impact and benefits of the

innovations on a range of outcomes including clinical outcomes and costs and quality of care[1]. The data collection approach is shown in Figure 1.2.

An example of an impact web is shown in Appendix Five.

[1] These results should be interpreted with caution however, due to the quality of the data available and the depth of analysis possible in some cases. Examples of the kinds of limitations in the analyses were as follows: uncertainty about innovation input costs; assumptions required about the attribution of impacts to the innovation; evidence from limited sources; requirement to use evidence from overseas; lack of quantifiable outcome data.

Figure 1.2: NHS Innovation Accelerator evaluation design



The stakeholders included mentors, representatives from AHSNs, and NHS clinicians and managers. All interviews were recorded, with interviewees' permission, and those with NIA Fellows and delivery staff were transcribed in full while detailed notes were made on stakeholder and patients' recordings. Details of stakeholder interviews conducted for each innovation and NIA staff are shown in Appendix Four. The first round interviews with Fellows and NIA development/delivery staff were conducted in August and September 2016 and those with stakeholders and patients were conducted in October and November 2016. The second round interviews were conducted in March and April 2017.

The findings in this report reflect progress made by the Fellows in innovation scaling from July 2015 to March 2017, after approximately 20 months on the NIA. While the NIA was originally only funded for 12 months, the intention was always to continue to offer some support to appointed Fellows in recognition that innovation scaling across a sector usually takes a number of years and all the innovations had a Fellow appointed to extend support received into a second year.

1.3 Report structure

Chapter Two provides information on the NIA benefits, elements most valued by the Fellows and recommendations for future improvements.

Chapter Three initially outlines the impact of the NIA on innovation scaling, discusses how far impact is attributable to it, the barriers that Fellows have encountered and approaches

taken to overcoming difficulties. It then goes on to outline the current and future benefits identified for patients in terms of clinical outcomes, healthcare delivery in terms of cost savings and wider systemic change.

Chapter Four outlines the conditions for success identified to date, any commonalities across similar types of innovation and the roles of characteristics related to individual Fellows, the innovations themselves, features of the NIA and wider factors in the healthcare environment.

Chapter Five provides findings from the economic assessment on the costs and benefits of each innovation, subject to data availability, and the overall costs and benefits for the NHS, social care and wider society relative to programme costs.

Chapter Six summarises the report findings, considers the strategic added value of the NIA and makes recommendations for future changes that would help scale innovations faster either through the NIA or through wider stakeholder organisations.

2 NIA Impact on Fellows

2.1 Introduction

This chapter explores the personal impact of the NIA on Fellows and how they have approached innovation scaling, outlining the aspects of the NIA they have valued most and how it could be improved. It primarily draws on data from interviews conducted with the Fellows, supplemented by data from interviews with stakeholders and core NIA staff.

2.2 Benefits of the NIA for Fellows and innovations

Six elements of the NIA made a clear difference to both the Fellows and the way they approached innovation scaling: creating and using connections with purchasers and key influencers; building networks and partnerships; personal support to maintain motivation; providing access to real world insights; focussing on the patient or user perspective and enhancing specific knowledge and personal skills. Each of these is discussed in turn below. Crucially, Fellows all noted that these were differences that would not have occurred without the NIA.

Creating and using connections with potential purchasers and key influencers facilitated introductions to people with the power to get innovations taken up, and wider awareness from participation at national events or through meetings with senior influencers. As one Fellow put it, these kinds of relationships were ‘paramount’ as they could block or support complex decisions about innovation adoption. One Fellow talked about the usefulness of having a national platform to raise awareness of an innovation, while another talked about the NIA team being ‘champions’ for the innovation.

> *‘We were able to speak at the NHS Confederation, when we had never been invited to speak there before, and from that presentation half a dozen people approached us.’*
>
> (NIA Fellow interview)

Other Fellows described how access to senior contacts and/or the NIA ‘endorsement’ raised the profile of the innovation, which would not have happened without the NIA. For example, one Fellow described how the profile of NIA participation enabled meetings with two senior civil servants and gained ministerial attention. For others, support at regional levels was significant:

'[name of Fellow] has understood a bit more about how to get things done, and how to unblock blocks. They have linked through with the AHSN's key players who have helped find less resistance to implementation.'

(NIA stakeholder interview)

The NIA also facilitated direct contact with potential customers which would not have otherwise taken place. For example, in several cases, NIA core staff created links between Fellows and NHS organisations to identify how collaborations could offer mutual benefit. The value of initial conversations and opportunities to access senior NHS figures built over time as a number of Fellows emphasised strongly that they were still reaping the benefits in the second interview wave.

Building new networks and partnerships. In addition to specific contacts and opportunities, Fellows and NIA stakeholders reported that the NIA had more generally created new networks, which were helping innovation scaling in a number of ways. One Fellow described these networks as acting as their 'eyes and ears' by helping them to spot opportunities. Others referred to more specific support and guidance to put them in touch with key players in the NHS. For Fellows who saw the large and complex structure of the NHS as a potential barrier to scaling up, the benefits were of raising awareness. One stated: '*This programme has knocked on every door within the NHS structure'.* Stakeholders observed that for some Fellows who could be serial innovators, the networks acquired through the NIA would stand them in good stead for diffusing future innovations.

Personal support to boost and maintain confidence and motivation took the form of greater understanding about the receptiveness of healthcare organisations to innovation that empowered Fellows to move forward and question themselves less. As one Fellow put it: '*Believe in yourself and your product*'. For others, the validation that came from being part of an elite community gave them greater confidence in themselves and their innovation. This made some Fellows more proactive, especially where they had had less experience of pitching or convincing senior stakeholders of the benefits of their innovations:

'Now I have more tools, confidence to go out and ask for things, and tell prospective clients to use us because we're better than others and this is why.'

(NIA Fellow interview)

For Fellows experiencing non-linear progress in innovation scaling, support they received when hitting brick walls or overcoming problems was invaluable to help sustain their commitment:

'The encouragement really helped at times when (the Fellow) admitted they were ready to 'pack it all in'. Some of those personal comments and encouragement were really beneficial, in particular the moral support.'

(NIA stakeholder interview)

Some Fellows talked about developing resilience because of the support received from the NIA. This featured both at a personal level in overcoming rejections received in

attempting to scale up their innovation, but also on a professional level for tackling the '*inertia of change*' as one Fellow described it. Fellows described how this support helped sustain their commitment and develop a '*thicker skin*' so they sustained their determination to progress.

Sharing similar experiences with peers helped sustain motivation and build confidence in some Fellows. They learned that others faced the same problems and this lent a helpful perspective on their own circumstances. One Fellow described this aspect as '*brilliant*' and an '*outstanding part of the programme*' because it enabled him to share his experiences with '*people in the same boat*'. This helped him move forward because he realised, through hearing other's experiences, that the barriers he faced were not unique to him or his innovation.

Providing access to 'real world' insights from access to senior professionals who had succeeded in similar areas enabled Fellows to gain first-hand, practical experience and ideas for overcoming obstacles to implementation. One Fellow described this kind of learning as 'invaluable' in terms of extracting learning from people who had already succeeded and scaled-up innovations in a similar area. In one instance, a Fellow learned to focus efforts on smaller and less high profile potential customers in order to achieve greater scale and diffusion and consequently approached and won business with a different kind of organisation.

> *'[name of expert] chatting about his experience was most useful. He said don't concentrate on the 'big boys' - go for people who would like some help somewhere.'*
>
> (NIA Fellow interview)

Focussing on the patient or end user perspective. At the same time as facilitating networks with key and high-level contacts, the NIA also helped Fellows stay connected to the 'end user' in order to improve and hone their innovation. One Fellow noted that the NIA helped him keep the users in mind and seek feedback from them at every stage to ensure it met user needs as closely as possible. Another Fellow described how much they had learned by interacting with end users and staying close to them throughout the process:

> *'Some of my best learning to date has come by visiting patients at home.'*
>
> (NIA Fellow interview, continuing application form)

Enhancing knowledge and personal skills. Fellows talked about a range of knowledge and personal competences honed through the NIA. For some having a safe space in which to try out new ways of pitching innovations and new presentation skills was valuable, while for others developing a commercial mindset and sales skills, having worked as clinicians, were helpful. For others, learning about how innovations were evaluated and the kind of data that purchasers required was useful.

2.3 Aspects of the NIA most valued

The most valued aspects of the NIA divide into seven main themes: personal support from NIA core staff; bursary; peer group effects; learning events; endorsement; mentoring; and AHSN support, each of which are discussed in turn below. Most of the data is drawn from interviews with Fellows, who each typically named two or three factors which they valued most. This was supplemented by additional information provided by stakeholders familiar with the content of the NIA.

Support from the core NIA team was the most common element, identified by a majority of Fellows, one of whom said '*the programme is a success because of them*'. Tangible forms of support provided by the core team were signposting to key NHS purchasers, users and influencers who were able to make introductions to key advocates, find solutions to obstacles or blockages to innovation diffusion or provide endorsement of the innovations. The Fellows valued the core team's knowledge of the NHS and ability to identify people with the power to influence innovation adoption, dogged persistence in 'leaving no stone unturned' (NIA Fellow) if initial contacts did not generate progress, and access to a wide network of senior healthcare staff. The support was particularly valued by Fellows with less knowledge of and familiarity with NHS systems, organisational structures and roles within them and commissioning processes. As Fellows became more engaged in promoting and scaling their innovations, they became less reliant on and initiated less interaction with the core team, with greater value derived from input received in the first than second year of the NIA.

Bursary support was the second important NIA element, noted by around half the Fellows as extremely helpful. This provided extra resource that Fellows had used in a variety of ways, from funding website construction, building revised technologies, travel to conferences to showcase innovations and learn about evaluation techniques, travel to networking meetings, gaining external commercial support and recruitment of participants to research trials. Those using bursaries for networking and website construction were particularly appreciative. The impact of the one year bursary appeared to grow in the second year of the NIA as Fellows began to reap the benefits of contacts with potential users and purchasers made through events and website traffic.

Peer group value derived from being part of a selected cohort of highly expert, talented and diverse set of innovators. One Fellow pointed to the added value of having a '*collective voice*' so when systemic blockages to innovation diffusion were identified which needed to be addressed, for example in NHS purchasing tariffs, the power of the group made it more *'difficult to ignore us'*. The value of peer support increased during the second year, especially when Fellows encountered persistent obstacles and referred to the community as a 'support group' which was 'cheering along the effort' and helped maintain motivation over a prolonged period.

Learning events were important for Fellows who valued introductions to 'new ways of thinking' and gained access to new knowledge from experts who had shared a similar journey in scaling innovations. The specific inputs which Fellows valued were extremely diverse, reflecting the different starting points and needs of the different types of innovation. Commercial input from entrepreneurs who had successfully marketed healthcare products to the NHS was particularly valued.

Endorsement of the innovations by senior influencers in the NHS provided benefit to several Fellows. This conferred advantages as a 'stamp of approval' or 'badge' (NIA Fellow) in

marketing all types of innovation because the NIA brand had started to build trust and respect. It could help where innovation adoption might threaten income of healthcare providers who therefore needed convincing of wider benefits and Fellows with app-based innovations targeted at open consumer markets also noted specific marketing advantages. This may reflect the benefits of raising the profile of apps with opinion leaders who gain the attention of healthcare professionals, who in turn influence the public in their choices about using healthcare apps. The value of endorsement endured into the second year of the NIA, with Fellows noting that they continued to benefit from being championed by senior NHS figures when marketing their innovations.

Mentoring provided a mixture of benefits ranging from personal development support in communication skills, endorsement from an individual with status and power in the healthcare sector, to technical support on specific issues. The value of mentoring was dependent on a good fit between Fellow and mentor (which is discussed in Section 2.4 below).

Support from AHSNs was valuable for promoting innovations by gaining 'one stop' access to large groups of potential purchasers such as NHS Trusts or CCGs. This proved an efficient way of reaching multiple organisations simultaneously, and was particularly important where Fellows had encountered frustrations in trying to contact individual organisations. The support included practical help such as assistance with dissemination through invitations to speak at events and helping to organise promotional meetings with AHSN contacts.

2.4 How the NIA could be further developed

Based on feedback received from Fellows and stakeholders combined with reflections from core staff, the following eight recommendations for the NIA have been identified in descending order of priority. This order reflects that where information is available, changes recommended may have already been implemented and these are noted.

Type of learning content. Three issues emerged where Fellows reported they would like more input:

- Earlier exposure to commercial expertise, especially from 'serial entrepreneurs' for Fellows working in the NHS who had less experience of developing and implementing viable business models.
- Information on the legal aspects of different partnership models.
- Input from experts in system level change would help advance innovations which required wholesale changes to ways of working.

A further wider issue for the NIA to address is how best Fellows can tackle 'wicked' issues and perverse incentives. This relates to the ongoing challenge of promoting innovation that may improve patient outcomes but reduce income/work for NHS organisations in the short or long-term (see also Section 6.2 Conditions for future success).

Ensuring consistency of support from mentors and AHSNs. Perceptions of the value of external support from mentors and AHSNs varied substantially depending upon quality of match between Fellows and these resources. Fellows noted a number of ways in which more value could be derived from mentoring. This focussed on making sure that mentors had sufficient time to commit to their role, having a sufficient number of mentors to allocate where some Fellows were seeking mentors with similar expertise, getting a good match between the needs of the Fellow and the mentor's expertise, ensuring that the mentors had skills in mentoring and avoiding any competition between mentors' professional activities and the Fellows' innovations. One suggested creating a pool of mentors which Fellows could dip into and this was implemented from December 2016.

There was also some confusion between mentoring, coaching and sponsorship and the support provided by mentors versus the NIA core team, so providing or refreshing guidelines on roles, responsibilities and expectations for both Fellows and mentors would be helpful. Guides on mentoring have now been included within Fellows' induction packs. Some Fellows noted that on reflection they did not use their mentor as much as they could have, reflecting either an imperfect match or uncertainty about the role, so it may be useful to prompt and encourage Fellows to maximise their use of this potential resource.

Levels of support provided by AHSNs to Fellows were similarly variable depending on the priorities of the AHSN and whether these aligned with the Fellow's innovation. NIA staff made efforts to engage AHSNs to bring in a wider pool of support during the inaugural year of the NIA and this increases the likelihood that Fellows in subsequent cohorts will be able to access an AHSN with shared interests. Guidance on roles for the AHSNs were included in Fellows' induction packs for the second cohort. All 15 AHSNs signed up to support the NIA 2017 cohort and the core team co-developed a clear set of AHSN expectations of the NIA, and the NIA's expectations of AHSN support.

Maximising the use of peer learning and reviewing learning formats was recommended by Fellows including:

- More information earlier in the NIA for NHS 'outsiders' about navigating NHS purchasing and commissioning systems, perhaps provided by Fellows who are NHS 'insiders'.
- More adult learning methods rather than direct teaching or delivery of information.
- Earlier group bonding activities to support faster sharing of information.
- More time allocated for peer-to-peer learning.
- More opportunities for small group working, especially in the context of having multiple cohorts of over 20 people at each learning event.
- Offering the opportunity to bring a colleague to attend some elements of learning events, because innovation scaling often relies on a team of people rather than a single individual.

The format of events was revised from January 2016 with more opportunities for facilitated networking, peer learning and small group work using adult learning methods.

Raising the NIA brand profile and influence. Developing ways of promoting the NIA itself may be important for raising the brand's profile. Fellows ideally wanted it to find ways of automatically flagging up innovations that would help improve patient outcomes, cost and quality at the point of purchase to influence purchasers of NHS services, recognising the

diversity of commissioning structures and routes depending on the nature of each innovation. One suggested giving the NIA an online sales/procurement platform illustrating cost savings that would accrue as a result of innovation adoption. Fellows recommended improving the digital presence of the NIA through an enhanced website and in January 2017, the Programme Board approved the re-development of the NIA website[2]. Fellows and stakeholders suggested that in addition to the links to AHSNs, it might be useful to have a network of supportive CCGs attached to the NIA and for the NIA to have direct contact with CCGs. One offered to be a CCG lead point of contact for Fellows to engage with primary care organisations. Another stakeholder noted that more active formal endorsement of the NIA and NIA-supported innovations by senior 'movers and shakers' in a wide range of organisations, including NHS England, would be helpful.

Overall around half of the Fellows felt the NIA had yet to achieve its potential impact at national levels in terms of how the NHS chooses innovations, influencing national agendas and making the impact of innovations visible to senior purchasers. They wanted the NIA to gain greater traction through the work of the Programme Board and sought greater receptiveness from NHS England and the Department of Health to conversations and recommendations from it.

Providing feedback to Fellows on their performance and defining benchmarks for programme level success. Fellows provide substantial amounts of feedback on the NIA content but would like more feedback on their own performance and an indication of 'what good looks like'. At individual level, it may be important to identify appropriate forms of feedback and mechanisms to deliver it to Fellows. There is also an important wider point to consider in respect of what it is reasonable to expect an intervention of this size and scale to deliver in terms of innovation scaling and what benchmarks, if any, are appropriate to use. The NIA Programme Board may wish to consult other organisations active in supporting innovation such as Innovate UK, The Health Foundation and Nesta to help set measurable objectives for future NIA activity.

Targeting NIA innovation selection. Learning events have succeeded in providing 'something for everyone' and a number of Fellows noted the challenge of delivering this for such a diverse group. The tighter focus of selection criteria around three particular healthcare challenges of prevention of ill health, early intervention and long-term condition management for the second cohort may help to address this. Some Fellows felt that there needed to be tighter selection of innovations according to similarity in stages of scaling to enable fruitful learning. A few expressed concern that the NIA may become focussed solely on healthcare technologies and pointed to the value of maintaining support and a balanced focus including non-technology innovations.

Optimising use of communication tools, sprint plans and the application process. More minor points for improvement include use of the communications tool – SLACK, the application process and sprint plans. While there was one example of a Fellow directly exploiting SLACK for their own innovation, this was not widely used due to a mixture of already competing alternatives, and lack of time. One suggestion was to route all internal NIA communications to Fellows from the core team through SLACK to ensure engagement. A communications hub is now being considered as a potential replacement for this system. One Fellow suggested making much more use of virtual meetings and video conferences to enable participation

[2] The www.nhsaccelerator.com site launched in April 2016.

among Fellows with busy diaries. A small number of Fellows felt that the application form was extremely detailed and might deter good candidates from applying for the NIA. Others felt that giving applicants and newly appointed Fellows a realistic preview of challenges they were likely to face in scaling innovation might help set expectations appropriately.

There were mixed views about the value of sprint plans. Fellows who found the content and format did not align with, for example, business plans for their own organisations or that their goals and priorities changed during a sprint period, perhaps to take advantage of an unexpected opportunity, valued sprint plans less than their colleagues. Others wanted a single, clear goal to work towards throughout the duration of the NIA and some admitted these factors affected their willingness to complete the documentation. The NIA has provided some flexibility and guidance on how sprint plans are used which may be helpful to ensure Fellows derive maximum benefit from them.

Maintaining quality of support from NIA core team The quality and level of personal one-to-one support is regarded as a key strength of the NIA. Some Fellows felt that because support in the second year was intentionally focussed on quarterly events with individual support directed at the new cohort of Fellows, they were uncertain about whether they could ask for the same level of support as in the first year, and believed extra resources were required. The Programme Board may wish to consider team resourcing for the third cohort, given that participation for Fellows can now last for up to two years rather than one.

3 NIA Impact on Innovation Scaling and Benefits

3.1 Introduction

This chapter reports the impact of the NIA on innovation scaling and describes emerging and future benefits of the innovations.

Scaling innovation in healthcare contexts is a complex and protracted process in contrast with the linear processes of innovation in single organisations as sometimes depicted in research and development literature. The innovation diffusion process across organisational boundaries is inherently non-linear, often requiring multiple pathways to change and changes of tactics. It can produce outcomes through routes which were not those originally intended and require collaboration with numerous partners. This means that judgements about progress must recognise the challenge and ambition set for the NIA. NIA support for each cohort has been extended to two years and Fellows attached to all the innovations successfully applied to participate for a second year. This recognises the timescales required for these kinds of innovation, a number of which are seeking to achieve impact through disruptive effects across organisations and healthcare systems.

The chapter first provides some snapshot data about key outcomes for innovations at the overall level of the NIA over the 20 months from July 2015 to March 2017 and identifies how much progress Fellows attribute to the NIA. It then goes on to identify challenges to innovation scaling and reasons for any changes in approach drawing on information from interviews with Fellows and stakeholders.

Lastly, the chapter provides some important broader context to the initial metrics given on innovation achievements by outlining the emerging and potential future benefits of NIA-supported innovations. These include improved patient experience and outcomes, reduced costs reflecting reduced need to access care or better-targeted care, reduced medical error, benefits to quality of care and the NIA's impact on wider cultural change through the NHS and non-NHS organisations.

3.2 Scaling indicators for NIA innovations and attribution of progress to the NIA

Table 3.1 provides summary data illustrating some key outcome measures at a collective level across all the NIA innovations. It illustrates the range and scale of achievements that

innovations have had while being supported by the NIA. This information is drawn from the Fellows' original application forms, continuing application forms and interviews with Fellows. It is important to note that as of March 2017, the first cohort of 17 NIA Fellows had secured additional funding worth £28.4 million and their innovations have diffused into use by 469 additional NHS providers and purchasers. The information below is based on data gathered up to March 2017.

It is important to note that these kinds of metrics cannot capture the impact of some very important aspects of the aims and objectives of the NIA. These include its impact on wider systemic, process and cultural change, including key outcomes such as endorsement of innovation by senior influencers, the creation of the NHS Innovation and Technology Tariff and changes to how innovations are diffused in the NHS. This is because such outcomes are not easily amenable to numerical measurement. These types of change are a major outcome of the NIA and are discussed in more detail in Section 3.4.1 and 3.4.2. The figures below exclude outcomes which Fellows did not attribute to the NIA (see discussion below).

Table 3.1: Summary of NIA innovation outcome measures from July 2015 to May 2017

Type of outcome measure	Total
Number of new collaborations/partnerships	>114
Amount of new funding secured	£28,474,800
Number of new contracts secured	~29
Number of new organisations using NIA innovations in UK, including pilots	~469
Number of app downloads	34,566
Number of potential contracts under discussion/negotiation	319
Number of additional people employed (full-time equivalent)	45
Additional regulatory approval secured	2
Number of contacts/meetings with key purchasers	>290
Number of conference/events spoken at	>32
Number of awards won/high product ratings	14
Number of papers/books published (media citations and other forms of publicity are not included as data is not complete)	8
Research studies being developed or in process	31
Number of new spin-off products developed or being developed	11
Product refinement undertaken	10
Number of innovations being sold to countries outside the UK	10

An important question to consider is how far the outcomes achieved are attributable to the NIA. There is no perfect control group of comparable innovations to help address the question of what would have happened in the absence of the NIA. The research tackled this question by inviting Fellows to consider what progress they would have been able to make if they had not participated.

Responses divide into four groups but there is no particular variation in type of innovation across these groups.

- Thirteen Fellows directly attributed substantial progress in scaling their innovations to the NIA. These Fellows included several whose interventions had experienced extensive scaling and some who had benefited from more moderate progress. This suggests that participation in the NIA is able to produce major benefits across a range of different types of innovation. Typical comments from Fellows in this group described the NIA as *'transformational'* saying:

  'I couldn't have done any of this without it.'

  'It's the best thing I've done in the last 20 years in relation to innovation.'

  (NIA Fellows).

- One Fellow felt that the NIA had been personally helpful but it was still too early to judge its full effects, given that the innovation was less mature than others at the start of NIA support.

- Three Fellows felt that although they had benefited personally from the NIA and found it valuable, they attributed limited or no progress in innovation scaling directly to the NIA. This was due to particular external circumstances among target user communities which were presenting barriers to progress and the focus of innovations on long-term change rather than presenting a quick solution to an immediate problem.

A further way of considering innovation scaling is to assess the starting point of each innovation and the degree of scaling during the NIA. This is a qualitative assessment undertaken by the research team based on information provided by the Fellows and in discussion with core staff. Scaling is defined as including both *breadth* of increased engagement by new organisations and *depth* of penetration within existing organisational users. It offers an equitable way of assessing progress by showing the initial market position of each innovation based on scaling within their potential target community across the NHS, so the individual journey of each Fellow and their innovation can be seen. It is not intended to encourage comparison between innovations. The scaling position for March 2017 included formal collaboration or co-operative working with UK public sector organisations outside the NHS and expansion into overseas markets.

Figure 3.1 and Figure 3.2 show the relative progress of scaling for each innovation after 20 months' support from the NIA compared to their position at the start.

Figure 3.1: Innovation scaling in the NHS July 2015

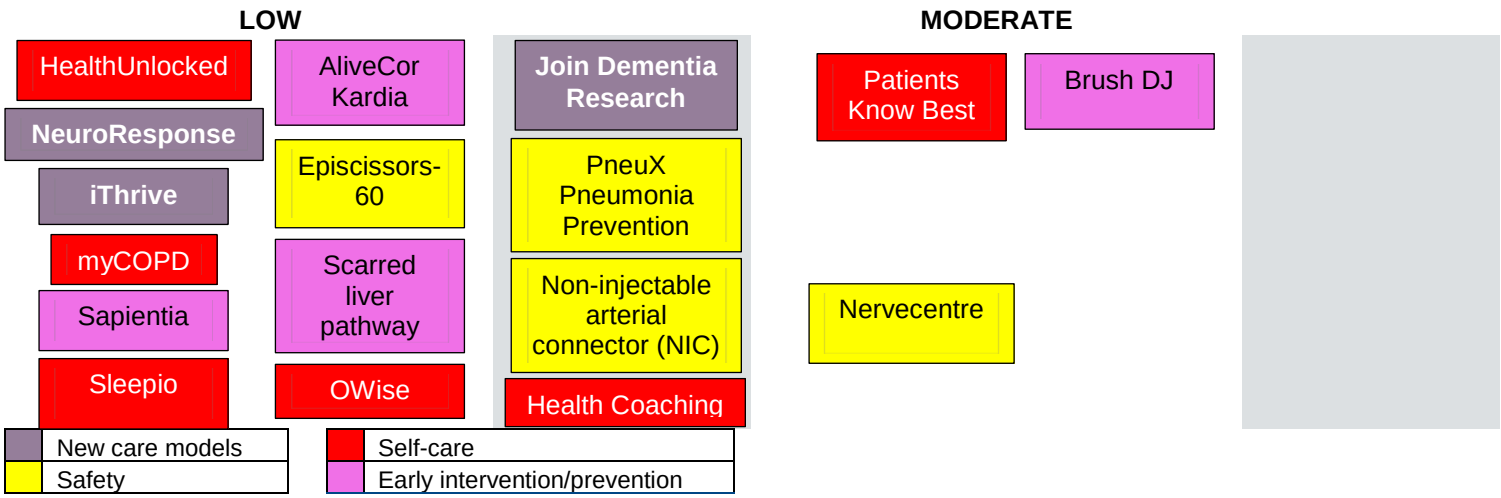
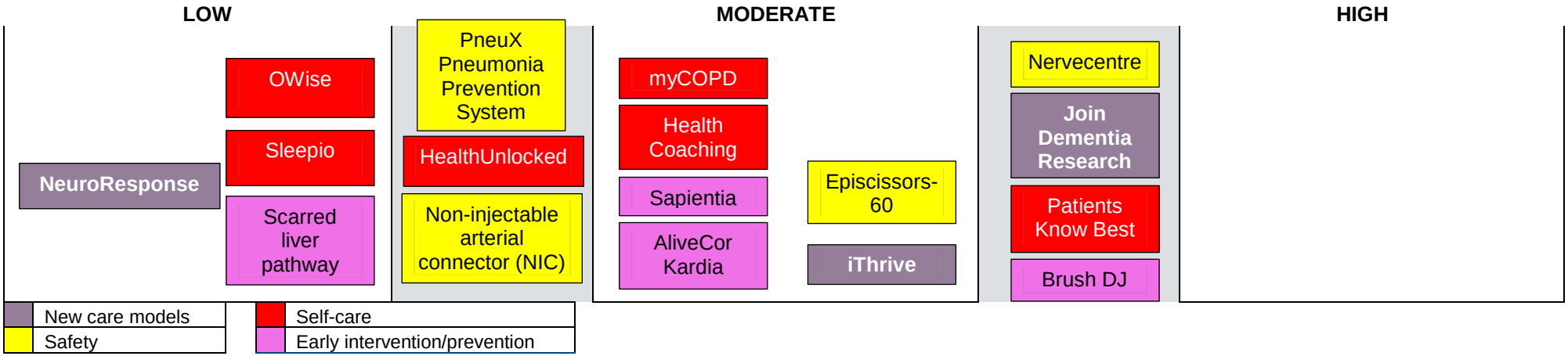


Figure 3.2: Innovation scaling May 2017



3.3 Barriers to progress in innovation scaling

A number of Fellows reflected on their learning about approaches to innovation scaling during the NIA for numerous reasons including tackling obstacles and taking advantage of opportunities. These commonly included system-wide obstacles for diffusion being tackled by the NIA and more information on how these challenges are being overcome is given in Chapter 5.2. Wider challenges identified included **developing a commissioning culture based on meeting long-term health priorities** and recommendations for future action to tackle these are given in Chapter 6.2.

Commissioning structures and processes: For a number of Fellows, delays in scaling due to difficulties in navigating commissioning structures had hampered them, especially where they were working independently or in SMEs, and did not have the resources to compete with major corporations. This prompted some to narrow the focus of their activities and to be selective in prioritising those which were most likely to gain traction.

Some purchasers had imposed requirements for additional trial findings or evidence which was customised to individual settings. For some Fellows this had prompted either greater inclination to explore overseas markets, often where there were greater signals of interest, or intensified focus on routes to market within the UK. As a result Fellows devoted additional attention to modelling benefits using metrics of most interest to staff, even if these were less directly linked to outcomes. Some Fellows were also building data capture and analytics on use and impact directly into the operation of their innovations so they could track impact more effectively as they recognised the importance of evaluation findings in persuading potential users of the benefits.

One Fellow's innovation experienced stalling of a major contract in a central commissioning organisation. Their approach shifted to more work on building cultures conducive to innovation adoption before attempting to persuade clinicians to implement their innovation. This shift in approach to 'changing hearts and minds' (NIA Fellow) was part of a broader impact of the NIA in stimulating innovation adoption in NHS organisations.

NHS Innovation and Technology Tariff impact: The development of the NHS Innovation and Technology Tariff (now called the Innovation and Technology Programme) was welcomed by Fellows as an excellent mechanism to avoid the problem of short-term cost constraints preventing investment by healthcare providers in innovations which would save them money in the long-term. For a number of innovations, Fellows were hoping that listing on the Tariff would overcome disincentives for potential purchasers. In three cases, the announcement of the tariff created a temporary delay in scaling. It halted all purchasing of these innovations because NHS organisations decided to wait until the Tariff took effect before making purchasing decisions in order to secure cost savings. In one case, miscommunication about eligibility for the innovation among different kinds of healthcare organisations under the Tariff created considerable confusion among potential purchasers, and this was being resolved through discussions about commissioning at

national levels. For one innovation, waiting for Tariff implementation had an impact on staffing leading to use of temporary rather than permanent contracts.

Identifying appropriate patients and patient engagement: For one innovation, challenges in patient engagement initially delayed scaling. Patients needed to present a particular set of needs and symptoms to benefit from the innovation, be willing to engage with technology and the innovation required possible involvement of wider family. In addition, stakeholders reported that where vulnerable patients had previously been given access to an innovation that they had found beneficial but this was subsequently withdrawn due to cost constraints, they declined to try out further innovations because of risk of emotional disappointment if funding was not sustained.

One innovation relying on patients using mobile or web-based technologies was more challenging for some patient groups, such as those in rural areas lacking reliable broadband or subgroups of elderly patients who found using these technologies difficult. To overcome the problem, the innovation was positioned as one channel within a suite of options for delivering care including face-to-face engagement.

IT compatibility and skills shortages: One Fellow noted incompatibility in IT systems for those innovations that needed to span secondary and primary care settings which was a resource-intensive problem to solve. Additional support was deployed to address the problem through NIA resources enabling access to specialist IT support. Another noted that a lack of IT skills within the NHS could inhibit development of IT-based innovations from inside it. This has the potential consequence of extra development costs for firms and ultimately the NHS in refining innovations which are designed at a distance from end users.

Time and resource constraints: Fellows identified that these had intensified among potential users during the second year of the NIA, due to severe funding pressures in the NHS set against a backdrop of rising patient demand. Severe cost pressures were affecting commissioning, with examples given where future cost savings were not factored into NHS Trusts' financial decisions about purchasing innovations and innovations were evaluated solely on their potential to deliver immediate cost reductions, eg in staffing. Some Fellows had reduced sales prices by up to 80 per cent to win contracts and some of the SMEs were sustaining their businesses through other sources of revenue during a 'drought' in commissioning.

Several examples emerged of pressures in emergency departments and primary care where it was extremely challenging to reach clinical staff and educate them about innovation benefits and then give any training required. Fellows observed that resource constraints also had an adverse impact on appetite for risk-taking, lowering staff inclination to engage with innovation. Examples of ways in which Fellows were tackling these difficulties included using a 'land and expand' approach where they gained the interest of individual clinicians to run a small pilot and build awareness of the benefits, which then sparked appetite for wider scaling within one or more organisations. The scale of change required to implement some innovations prompted Fellows to focus on where

they would add most value, in some cases on proving benefits to clinicians in terms of decreased workload.

Lastly two innovations had reworked communications materials to appeal to wider stakeholders based on feedback about the complexity of language used. They simplified the materials, recognising that those taking decisions about adoption might include non-clinicians who were unfamiliar with health sector terminology.

3.4 Current and future types of innovation and NIA impact

Evidence suggests that the current and future impact of NIA-supported innovations will be wide ranging, from impacts on patients' health and quality of life, to reductions in costs for the NHS and increased quality, access and timeliness of care, and finally wider systemic benefits. The full impact of the innovations will emerge over time. An economic impact assessment of the innovations is given in Chapter Four.

Current and predicted future impact of the innovations is summarised in Tables 3.2 and 3.3 and discussed in the sections below, together with the wider benefits of the NIA at a systemic level. The analysis draws on information gathered from interviews with Fellows, NIA staff, initial and continuing application forms, management information and interviews with patients and stakeholders.

Table 3.2: Summary of current and future innovation impacts

Type of impact (current)	NIC	PneuX	Nerve-centre	Episcissors	myCOPD	Sleepio	Health Coaching	OWise	PKB	Health-Unlocked
Improved clinical outcomes	✓	✓	✓	✓	✓	✓	✓			
Patient empowerment					✓	✓	✓	✓	✓	✓
Access to new forms of support					✓				✓	✓
Reduced need to access healthcare					✓		✓		✓	
Reduced time in hospital and cost of medical error	✓	✓	✓	✓				✓		
Decreased administration costs, better information and more timely access to care			✓		✓				✓	✓
Type of impact (future)										
Extension across wider patient population	✓	✓	✓	✓	✓	✓	✓		✓	✓
Application potential for wider range of conditions for improved diagnosis and treatment			✓		✓			✓		
Reduced health inequalities					✓			✓		
Wider individual and social benefits				✓		✓	✓			✓
Costs and quality of care	✓	✓			✓	✓	✓		✓	

Table 3.3: Summary of current and future innovation impacts

Type of impact (current)	iThrive	NeuroResponse	JDR	Scarred Liver Pathway	AliveCor Kardia Mobile	Sapientia	Brush DJ
Improved clinical outcomes		✓		✓	✓		✓
Patient empowerment			✓		✓		✓
Access to new forms of support		✓	✓				

Type of impact (current)	**iThrive**	**NeuroResponse**	**JDR**	**Scarred Liver Pathway**	**AliveCor Kardia Mobile**	**Sapientia**	**Brush DJ**
Diagnosis and access to drugs			✓			✓	✓
Reduced need to access healthcare		✓		✓	✓		
Reduced time in hospital and cost of medical error							
Decreased administration costs, better information and more timely access to care	✓		✓				
Type of impact (future)							✓
Extension across wider patient population	✓	✓	✓	✓	✓	✓	
Application potential to wider range of conditions		✓	✓		✓	✓	✓
Reduced health inequalities			✓	✓			
Individual and social benefits	✓		✓	✓			✓
Costs and quality of care		✓	✓	✓			

3.4.1 Current types of innovation and NIA impact

Current impacts of NIA innovations were identified for clinical outcomes, patient empowerment, new forms of support and treatments, costs and quality of care.

Patients

The impacts of each innovation on individual patients have been diverse, ranging from life enhancing to potentially lifesaving. Patients interviewed who had benefited from the innovations all reported that their quality of life had improved. Where patient perspectives on safety devices of which they were unaware or unable to compare alternatives (such as the NIC, PneuX, and Episcissors-60), eg due to sedation or use during a medical procedure, benefits to patients identified by other stakeholders are also reported.

Improved clinical outcomes

Immediate positive health impacts were witnessed by individuals involved in clinical trials of PneuX, myCOPD, Episcissors, NIC and Sleepio. For example, one clinician implementing the myCOPD app reported rapid improvements in symptoms among patients using the app after only a short period of time due to better adherence to use of medication and correct administration, and reported a decrease in overall disease burden and anxiety amongst patients. A study evaluating the PneuX in an ICU found that none of the patients involved in the trial developed post-operative pneumonia and there were no upper airway or throat complications. For patients using Sleepio, trials were described by one clinician as very good with recovery from insomnia related to anxiety and depression showing superior recovery rates compared to other available therapies. Use of Episcissors had reduced risk of obstetric injury and use of NIC prevented human error in arterial line drug injection in regional trials.

Patient empowerment and its benefits

Innovations focused on patient self-management or monitoring of their condition(s) led to improved patient empowerment (OWise, AliveCor Kardia Mobile, Patients Know Best, Scarred Liver Pathway, Health Coaching, Sleepio, Brush DJ, NeuroResponse, HealthUnlocked and myCOPD) which enabled patients to feel more in control of their health. This included examples of people with very poor quality of life whose health improved sufficiently for them to resume leisure activities. Patients reported that the innovations had a positive impact on their mental health and feelings of self-worth which was a particular benefit for people with complex, long-term conditions. Those using NeuroResponse reported reduced anxiety and increased confidence to manage their condition. Clinicians for patients using OWise reported that they were more at ease with treatment and some were better informed during consultations from information gained using the app, which led to improved relationships with clinicians. One stakeholder commented:

'… it's excellent for facilitating patient/clinician interaction making it more efficient and less stressful for both parties.'

(Stakeholder, OWise).

Opening up access to new forms of support

Using consumer technologies helped engage patients who might otherwise have shunned healthcare technologies, increasing reach and engagement with healthcare. Market positioning and branding as apps rather than medical technologies attracted patients and stakeholders noted the value of this in reassuring patients that IT innovations were *'not scary'* (Stakeholder).

IT platforms including Patients Know Best, and HealthUnlocked reached a wide number of patients who benefited from better communication between healthcare professionals and fellow patients, faster processes and accurate recordings of data. One stakeholder described the benefits of patient empowerment offered by HealthUnlocked:

'Patients had a constant place where they could go for constructive peer support which was lacking before and it was very supportive. The Facebook page wouldn't/couldn't provide this. It's a patient focussed place predominantly led by patients.'

(NIA stakeholder interview)

Innovations that focused on specific conditions, such as myCOPD for chronic obstructive pulmonary disease (COPD), and NeuroResponse for neurological conditions, were welcomed by patients who felt that other illnesses sometimes received more attention.

Diagnosis and access to drug trials

Immediate benefits to patients from Sapientia were of faster diagnosis, which was especially critical for people experiencing deteriorating health from serious long-term or life-limiting conditions, where they might commonly wait up to five year for diagnosis or, in some cases, not receive one. For patients in these circumstances, simply having a diagnosis could provide a benefit in offering peace of mind. For Sapientia and for JDR, one advantage might lie in gaining access to new treatments via clinical trials either swiftly or at some future point.

As one clinician explained:

'A lady in the North East signed up to JDR, was matched to a trial, and three days later was down in London getting a very exciting experimental drug. That wouldn't have happened if it wasn't for JDR. She lives in a place where there's no trial activity and she'd never been asked about trials before.'

(NIA stakeholder interview)

The following case studies provide some vivid examples of how patients feel they have benefited from innovations[3].

Case study: Scarred Liver Pathway

Three years ago Gemma was given the option of receiving liver tests after meeting with her doctor due to not feeling well and concern over her alcohol intake. She received worrying results, which 'horrified' her to such an extent that she gave up drinking alcohol permanently. She subsequently underwent regular liver tests, and has watched the results improve and is now showing a normal, healthy liver function which she attributes to giving up alcohol and making positive lifestyle changes. She is now trying to quit smoking.

She also decided to volunteer for a charity which supports people with alcohol dependency problems. Gemma has spoken about her experience on a local radio show, to clinicians at a university and at a healthcare conference in order to promote awareness of liver disease. She has now started an NVQ Level 3.

'If I hadn't had that screening, I would have carried on drinking and I think now I would be really poorly. I got it in time — my liver has repaired. It has changed my life.'

Case study: Sleepio

Jim experienced insomnia for 20 years which also had a negative impact on his partner. He heard about Sleepio on a TV documentary, and then used the internet to find more information about it. The strong evidence base behind Sleepio persuaded him to trust the app and give it a chance, after years of unsuccessfully trying other programmes and apps designed to help with sleep problems. He found the app easy to use and provided feedback to improve it.

Jim can now sleep solidly for up to five hours. He feels he can handle the problem much better and knows how to cope with the negative effects of insomnia. He says these improvements are mostly because he used Sleepio.

Case study: myCOPD

Through a patient group for people suffering from COPD, Austin heard about a study trialling myCOPD and signed up to take part. Austin was initially apprehensive, as he felt that COPD had taken over his life entirely, and was sceptical of what the NHS could do

[3] All patient names have been changed to protect identities.

to improve his situation. When first diagnosed with COPD, he was unable to work and felt suicidal.

Austin believes that using the app has had a tremendous impact on his general health, management of his condition and on his mental wellbeing. He attends a formal pulmonary rehabilitation class once a week, and supplements this with fitness sessions twice a week with instruction from myCOPD. He can check medication against NICE guidelines and receive guidance on dosage and the app identified conflicts between medications. These have been adjusted so Austin no longer experiences side effects such as oral inflammation and loss of taste. He has improved how he uses his inhaler and reduced the number of times he has to visit his GP from 20 times per year to six.

'… I've had more information, more reassurance off this app than I've had off anybody in the NHS including two doctors… It's got a technique on it called 'the huff', on how to clear your lungs, that my GP had never heard of… I know I sound evangelical but before we had this app we were in the wilderness, no control.'

Case study: AliveCor Kardia mobile heart monitor

Ayesha has two long-term heart conditions: postural orthostatic tachycardia syndrome (POTS) which causes her to experience an abnormal increase in heart rate after sitting or standing up and may result in dizziness and fainting and supraventricular tachycardia (SVT) which causes an abnormally fast heart rate of up to 250 beats per minute. Because she has POTS, SVT requires assessment and medical attention if it lasts too long. SVT is unpredictable and the episodes are frightening.

Before using the mobile heart monitor, Ayesha had an implanted loop recorder. Unfortunately she had an allergic reaction to the titanium content and had it removed. The mobile heart monitor had the advantage of not requiring invasive surgery from which she already has a scar and offers her access to and control over the recorder outputs.

Ayesha said:

'It's completely revolutionised my life from the fact that I can deal with it and see what's going on myself and basically manage my problem and know when I need medical help. Rather than having to have a paramedic to come along and do an ECG I can do it on my phone in seconds. It's put me back in control of my own healthcare and given me some freedom.'

Costs and quality of care

Reduced costs and improved quality of care derived from reduced need to access healthcare; reduced time in hospital and cost of medical error; decreased administration

costs, improved information quality and more timely access to care. These are illustrated in the following sections.

Reduced need to access healthcare: Innovations that focused on improving communication and processing data to monitor conditions were frequently cited as helping people avoid the need for a face-to-face healthcare and evidenced through interviews with Fellows, clinicians and results of trials cited in application forms. Innovations such as myCOPD, NeuroResponse, OWise and Patients Know Best have enabled patients to transfer information regarding symptoms to their GP or healthcare professionals remotely, leading to an immediate decrease in healthcare usage.

Using the new pathway and scan to detect asymptomatic chronic liver disease delivered multiple benefits described by a clinician as:

> *'You get early identification, the patient gets the care they need at that point and in the long run they can demonstrate that people aren't coming back a dozen times; they come in for their fixed appointment.'*

(Stakeholder interview, Scarred Liver Pathway)

Other innovations have also had a preventive effect, although the incidence and scale is much more difficult to measure for undiagnosed conditions or where human error is avoided. For example, using AliveCor Kardia Mobile can enable early detection of atrial fibrillation which is a leading cause of stroke. The NIC prevents accidental injection of drugs into the arterial line, which is used for monitoring patients in intensive care and operating theatres, and is also cheaper than the alternative product.

Patients receiving Health Coaching from their GP are taught skills to make positive choices to manage their health. One example is of a patient who benefited dramatically from health coaching. The patient was diabetic, overweight and due to have a hip replacement. He had some health coaching with his GP leading to weight loss, so he no longer required surgery and his diabetes went into remission. As the Fellow put it:

> *'It costs £400 to train a GP in health coaching, so the economic benefits are obvious.'*

(NIA Fellow interview)

One innovation has a direct cost saving to some patients, as well as the NHS. Adult users of Brush DJ who pay for their own treatment and prevent cavities effectively will benefit from reduced costs, while savings will accrue to the NHS for treatment avoided for children. Despite being largely preventable, treatment currently costs the NHS £3.4 billion[4] (which excludes private sector costs).**Reduced time in hospital and cost of medical error:** Patient safety devices, including the Episcissors-60, non-injectable connector (NIC) and PneuX, enabled a marked decrease in time spent in hospital by patients recovering

[4] Data sourced from https://www.gov.uk/government/publications/health-matters-child-dental-health/health-matters-child-dental-health

from a procedure, or due to treatment for a medical error shown in evidence from clinical trials. For example, in a critical care unit where the NIC was used for every patient, there were no cases of accidental arterial line drug injections, where staff previously suspected this had occurred.

Decreased administration costs, improved information quality and more timely access to care: Use of IT was speeding up data processing and enabling prioritisation of patients who required face-to-face consultations or allocating them to research trials in a number of the innovations. This was identified through information provided by Fellows, clinicians and Fellows' application forms. Examples included being able to target face-to-face COPD treatment at patients most in need, while others used the myCOPD app remotely, less time being spent on paperwork by administrative staff in hospitals using PKB and HealthUnlocked, and faster recruitment of research participants for JDR.

3.4.2 Future anticipated types of innovation impact

All the innovations are likely to see greater future impact and this section identifies the type of impact anticipated. The benefits divide into several types:

1. An extension of current benefits across a wider UK population as more patients gain access to the innovation.
2. Long-term benefits of an innovation emerging over time.
3. New benefits as a result of an innovation being adapted and extended for further conditions.
4. Wider system benefits in raising the profile of innovation in the NHS, demonstrating opportunities for collaboration and innovation scaling.
5. Benefits to patients abroad when the innovations are adopted in other countries.

Many innovations will see benefits accumulate as they become embedded in the wider healthcare system. The scale of impact in terms of patients benefiting and cost benefits to the healthcare system may vary. Some interventions will have low monetary value impacts per person over a large population while others may offer significant monetary benefits on a smaller scale. This will depend on the severity of the condition or risk of developing a condition, treatment required and number of people affected. A number of trials and evaluations of the innovations have been commissioned using NIA funding and where results are available they have been incorporated into the economic assessments in Chapter Four and the appendices.

Some NIA-supported innovations had already had a substantial impact, reflecting their existing scaling at the start of the NIA. Others were less advanced in scaling at the start and therefore their impact is likely to accumulate relatively faster over time. For innovations such as JDR and Sapientia which aim to exploit the potential of medical research to devise new treatments, the timescales for seeing full impact are likely to be five to 10 years or more.

Patients

All the innovations have the potential to scale out across the same type of patients who are currently benefiting using the existing product or model. In addition interviews with Fellows and stakeholders identified two possible further types of future patient benefit:

- Reduced health inequalities from improved access to healthcare and better treatment of conditions affecting people from lower socio-economic groups.
- Improved diagnosis and treatment of conditions by extending the application of the innovation to other recognised conditions or identifying new ones.

Reduced health inequalities

Stakeholders for three of the innovations: the Scarred Liver Pathway, Brush DJ and myCOPD, pointed to the specific potential of reducing health inequalities. The Scarred Liver Pathway could be used in community settings to reach medically isolated patients at greater risk of liver disease and to target treatment options within the community. This should contribute to reduction of inequalities in access to diagnosis and treatment across different socio-ethnic groups. Brush DJ has potential to reduce existing oral health gaps for those poorer families who have access to suitable smartphones. COPD disproportionately affects older people in socially deprived areas with particularly debilitating effects on quality of daily life so treating it has potential to reduce health inequalities.

Application potential to wider range of conditions

Data primarily drawn from interviews with Fellows and stakeholders identified potential for several innovations to be applied and extended to enable improved diagnosis and treatments, including development of new drug regimens and new drugs. The Scarred Liver Pathway could be used to detect co-morbid and asymptomatic conditions such as obesity, diabetes and cardiovascular disease, which might stimulate development of new therapies by industrial partners, creating a suitable pool of people for recruitment to clinical trials. Data collected through the OWise app will be valuable for organisations developing healthcare treatments and could be extended initially to other forms of cancer in addition to breast cancer. NeuroResponse could be offered to people with long-term conditions including Parkinson's disease, epilepsy and dementia and the myCOPD platform has been adapted for managing other conditions, including asthma and diabetes.

Two innovations, Sapientia and Join Dementia Research (JDR), were geared towards generating better understanding of serious conditions with high socio-economic burdens for patients, the NHS and wider society. Sapientia may help influence the development of drugs to treat rare genetic conditions, over the next 10 years; and JDR may enable development of treatments for dementia over a similar time period. Data sharing provided via Sapientia should enable differential and personalised treatment for diseases where similar symptoms are caused by different types of gene malfunction. JDR enables more targeted recruitment of participants onto trials and can allocate patients more evenly to

trials, overcoming problems where some trials have insufficient participants while others are oversubscribed.

Future individual and social benefits

A large range of wider social benefits are likely to accrue from the longer-term impact of innovations such as health coaching, iThrive, Episcissors, HealthUnlocked, the Scarred Liver Pathway and Sleepio. These benefits centre on people being able to function more effectively in their daily lives and participate more fully in society with less or minimal support from external health or social welfare agencies. These benefits were primarily identified from interviews with Fellows and their initial application forms. Examples include:

- Improved treatment of mental health conditions for vulnerable young people through iThrive should lead to improved educational attainment, cost reductions to the NHS, the education and criminal justice system, as well as improved life chances for children.
- Long-term benefits from the Scarred Liver Pathway and Episcissors treatment are likely to include increased labour market participation as those with undiagnosed severe liver problems and a number of women affected by poor episiotomies are more likely not to work. This could lead to further benefits of improved financial security for the families concerned; better health and reduced chances of child poverty; and wider economic advantages of increased tax receipts and lower welfare payments. Those affected by serious liver disease are similarly likely to be unemployed and could return to work if motivated to make lifestyle changes when they see poor scan results.
- Using the scarred liver detection scan to help motivate patients to address alcohol misuse could have an impact on reducing crime and domestic violence.
- By tackling insomnia related to anxiety and depression, Sleepio may yield long-term benefits to users including labour market participation and individual productivity.
- Improved mental health for patients benefiting from health coaching and access to social prescribing from HealthUnlocked, could lead to improved decision-making and long-term choices about relationships, labour market participation and health.

Costs and quality of care

Prevention of disease occurring, and prevention of exacerbation of a disease or condition which has already developed are NHS priorities in order to keep patients well and reduce need for them to visit a GP or receive hospital treatment. Numerous stakeholders pointed out the future benefits that may emerge from NIA innovations including:

- Reduced hospital admissions from early treatment of urinary tract infections among people living with multiple sclerosis through NeuroResponse, reduced dental pain presentation to GPs and A&E and reduced costs of treatment among Brush DJ users.

- Several innovations may be able to reduce costs of prescribing. NeuroResponse could help avoid 'just in case' prescription of antibiotics among patients who find accessing a GP difficult. Sleepio should be able to reduce prescriptions for sedative and pain relief drugs and may have applications in palliative care. myCOPD should be able to ensure better value for money from patients trying out different types of inhaler, by directly teaching patients how to use inhalers correctly and training pharmacists to teach patients. PKB patient data sharing should lead to reduced inappropriate prescriptions.
- PneuX could potentially deliver a drop in the costs of acute care, because fewer patients will need prolonged ICU care due to acquiring pneumonia.
- Health coaching should enable people to make better choices about health maintenance and lifestyles which should yield reductions in avoidable admissions to hospital.
- Sleepio could provide cost savings to the NHS by open access and through lower cost care pathways. For example, it can be combined as a part of a package of self-care for people with chronic conditions. It could also be administered through public health interventions, eg through workplaces to help people cope with stress and depression for which they have not yet received clinical intervention.
- The scarred liver scan has potential to be cost saving within local health economies through reducing use of other more expensive tests. One expert described its potential to '*save millions just in one small geographic area if we cut out all of those unnecessary liver function blood tests*' (Stakeholder, Scarred Liver Pathway).

3.4.3 Wider benefits of the NIA

In addition to the impact of individual innovations, Fellows and stakeholders identified a number of ways in which the NIA was bringing about current and future change through wider social impacts and via systemic change within the healthcare system.

Current impacts

New innovation tariff to create purchasing incentives: Despite many of the innovations being able to demonstrate proof of patient benefit, cost saving to the NHS and improvement of quality of care, the NHS procurement and tariff structure remained a barrier to commissioning. This evidence, and the combined voices of the NIA Fellows and advocacy of the core NIA team, informed the development of the NHS Innovation and Technology Tariff. The Tariff enables medical technology devices and apps to be included under NHS national payment rules. Initially myCOPD, NIC, Episcissors and PneuX were among those innovations eligible for the Tariff. In a separate funding stream, CCGs will have access to monies to pay for AliveCor Kardia Mobile. The benefits of the Tariff include avoiding multiple price negotiations in different geographical areas and reimbursing purchasers when the innovations are used, thus providing incentives for uptake. NHS England will also be able bulk buy innovations and negotiate discounts for NHS Trusts, GPs and patients. As one Fellow put it:

'This is probably going to make the biggest difference, and wouldn't have happened without the NIA.'

(NIA Fellow interview)

Making innovation visible in the NHS and healthcare sectors: Stakeholders from AHSNs felt that the 17 fellows 'brought to life' innovation in the health sector, through concrete examples of innovations which were generating impact. One individual felt that the enthusiasm generated by the NIA innovations demonstrated that it was possible for the NHS to '*support and go ahead with innovative things*'. Another felt that by pursuing scaling and implementation of 17 innovations, the NHS was demonstrating a proactive approach. This creates the possibility of inspiring wider system change, the nature and extent of which will be evident over a longer period.

Raising the profile of AHSN activity: Collaboration between AHSNs, NHS England, and the media coverage of the NIA, may have helped to raise the profile of the Academic Health Science Networks. One stakeholder believed that the NIA had brought more continuity between their contacts in government, NHS England and the AHSN. They felt that those contacts were now more 'on the same page', approachable and interested in innovations.

A core staff member believed that the NIA had brought clarity to the role of the AHSN and the kind of support the network was able to offer, and offered a model of project collaboration for the future.

'It's now being used as an example of AHSNs working together effectively because we have all of them that have banded around to support the programme, putting their own money in. It's quite a unique example of the delivery organisation putting money …[in] …, and working together collaboratively to deliver the programme. I don't think there are many national programmes run together by all of the AHSNs.'

(NIA Staff)

By the second year of the NIA a number of AHSNs were taking a leading role in co-ordinating the diffusions of innovations now all 15 AHSNs were involved, bringing diverse organisations and interested stakeholders together to roll out the innovations within particular communities and wider geographical areas.

Introducing new technologies to the NHS: The prominence and endorsement of the NIA innovations using app technology were contributing to a growing acceptance of apps in the healthcare sector. Innovations including OWise, Brush DJ, and myCOPD contended with a negative culture of resistance to new technologies, and widespread misunderstanding of how apps work and their potential impact. Fellows and stakeholders reported that they could see a shift in this culture, as more healthcare professionals became more open to apps:

'(Purchasers and senior NHS staff) are just starting to get their heads around that it's an app and what an app can do for people's health.'

(NIA Fellow interview)

Broader societal benefits: Some innovations are starting to show evidence of broader societal benefits. One element of the iThrive mental health service pathway being trialled in London showed that for children and young people at risk in complex family situations, results included higher rates of re-united families, take-up of family interventions and support with education (Harwin et al, 2014).

Future impacts

NHS service improvement could emerge from the NIA and the prominence of the 17 innovations is beginning the process of bringing innovation in the NHS further into the spotlight. Some stakeholders believe that the NIA will contribute to NHS service improvements by helping to create a more responsive, patient-focused and forward thinking organisation. This is enabled by the national reach of the NIA and diversity of the innovations supported in its first year of operation.

> *'I think it will help to build the profile of innovation in the NHS as something that's must have... Because some of the stories, some of the cash savings and hopefully what is illustrated in the evaluation will help to convince people of the benefits that some of these technologies have.'*

(NIA staff)

New ways of diffusing innovation were taking place through raising the profile of healthcare innovation in the media to help stimulate patient and service demand; while new ways of working between healthcare agencies and organisations could demonstrate opportunities for future scaling. The success of the NIA had demonstrated the potential collaborative power between different parts of the NHS for some stakeholders. Stakeholders reported that this positive collaboration set the tone for how future collaborations might work, and provided valuable lessons for other health organisations to build on. An AHSN representative reported that the NIA had inspired a collaboration with a pharmaceutical company, to assist them in setting up their own innovation accelerator and they hoped to establish further similar partnerships.

> *'In other parts of the system it has been seen to be something from which valuable lessons can be learnt, which can then be used to help support other innovation initiatives coming from industry partners who are keen to work with us because of our experience developing the innovation accelerator.'*

(AHSN representative)

Further gains could come from future collaborative agenda-setting, as one Fellow explained:

> *'I see the NIA as an agent for cultural change… we knew [when] we first started that we were the first troops out of the trenches, we knew it was an exploratory process so I knew it had a value beyond what we have received and it was originally intended as a mutual learning process. We can connect with the NHS and expose*

them to the realities of innovation and… understand their mindset and their priorities and one of the great wins is starting to co-create priorities.'

(NIA Fellow interview).

Global health benefits. These derive from the NIA's potential to accelerate innovation scaling to other countries outside the UK. A number of Fellows were expanding their markets either as a result of UK success or partly in response to difficulties for some Fellows in gaining traction for innovation uptake in the NHS. Episcissors was focussing on diffusion in five countries. Sleepio and PneuX had made progress in the USA while HealthUnlocked and myCOPD were intending to extend projects to the USA, and myCOPD was also working with countries in Asia. Brush DJ was already gaining high ratings from user communities as a health app and had been downloaded in 197 countries with the possibility of a major focus on overseas take up. Sapientia had similarly expanded into a range of countries including the USA and China..

4 Economic Assessment

4.1 Introduction

The aim of the economic impact analysis was to identify the effect on resource use in the NHS and broader public sector, the benefits for patients, and any other economic benefits resulting from the NIA funding and support. Due to the variation between the innovations, different types of economic analysis were considered. Although these different approaches mean that conclusions about the different innovations cannot be directly compared, these nevertheless give an indication of the relative impact of the innovation on cost and benefits. The types of economic analysis were:

- Cost-effectiveness analysis (CEA):
  - compares the relative costs and outcomes (effects) of different courses of action, eg patient outcomes such as reduced infection
  - cost-utility analysis - a form of CEA which uses a single common outcome measure (utility value), usually the Quality Adjusted Life Year (QALY).
- Cost-benefit analysis (CBA):
  - costs and outcomes monetised, eg return on investment (ROI), threshold analysis (the cost above which the innovation ceases to be cost-effective).
- Cost-consequence analysis (CCA):
  - costs and consequences are described and compared
  - consequences can be a range of clinical and other patient measures, eg tooth decay, clinical complications.

The approach used is determined by the information and data available for the analysis. If data are available on the incremental costs and outcomes, it is possible to conduct a cost-effectiveness analysis, comparing the economic value of an intervention with an alternative. Where QALYs are used as the measure of health effect, this allows comparison across disease areas and informs whether the new intervention is an efficient use of healthcare resources, eg Liver Disease Diagnostic Pathway. If costs and benefits can be identified and expressed in monetary terms, it is possible to undertake a cost-benefit analysis and for commissioners to compare the amount of return on a project relative to its cost, eg Episcissors-60, Kardia Mobile. Various outcomes are valued to a

greater or lesser extent by different stakeholders, so even if consequences cannot be monetised they may still have significant 'value'. Hence a cost-consequence analysis can be informative, particularly when taking a wider societal perspective, eg Brush DJ.

Where good quality data are not available, analyses may require assumptions to be made and the results of the analyses should be interpreted with caution.

Examples of the kinds of limitations in these analyses were as follows:

- uncertainty about innovation input costs;
- assumptions required about the attribution of impacts to the innovation;
- evidence from limited sources;
- requirement to use evidence from overseas; and
- lack of quantifiable outcome data.

4.2 Methods

The key tasks for the economic analysis were to identify, measure and value the inputs and outcomes of the interventions. These were analysed to identify the incremental costs and benefits of each innovation and calculate their net benefits. The information from the impact webs and interviews with Fellows was synthesised and supplemented by data and evidence collection using a bespoke analysis template for each innovation. Further interviews with Fellows were undertaken where needed. The information was used to develop a case study for each innovation. Where ROI calculations were possible, a bespoke ROI calculator was built, so that parameters in the analysis could be varied to test the impact of any assumptions made or uncertainty in the data/costs available. The analyses were developed in spring 2017 and are based on the information and evidence available at the time. The limitations of the analysis undertaken are stated within each case study and where assumptions have been required, these are clearly stated.

4.3 Results

The detailed case studies for each innovation are available on the NIA website. ROI calculators have been developed for three of the innovations and these were available to the Fellows. A summary of the resource inputs, outcomes and findings for each innovation, are included in Table 4.1. The conclusions are based on current understanding and information/evidence returned in the analysis templates. Further detail on the assumptions made, sensitivity analysis performed and limitations of the analyses can be found in the case studies.

Table 4.1: Summary of economic impact analysis for NIA innovations

Innovation	Input resources	Outcomes	Key findings
Alive Cor Kardia Mobile ECG	▪ Unit cost of Kardia Mobile ▪ Healthcare appointments for diagnosis (eg GP)	▪ Avoided healthcare appointments & investigations for AF diagnosis ▪ Avoided morbidity / mortality and health/social care costs associated with avoidable stroke ▪ Improved QOL for patients	Type of analysis: return on investment (ROI) Key findings: Kardia Mobile is a cost saving innovation, showing estimated net benefit of £896 per patient investigated and potential ROI from an NHS perspective of 624%. An example of scaled benefits at CCG level (eg 250 patients tested per year), projects savings of £242,000 per year, (approx £1,210,000 over 5 years). Usage data suggests implementation will far exceed 250 patients per year across all CCGs.
Episcissors-60	▪ Unit cost of Episcissors-60	▪ Avoided incidence and cost of obstetric anal sphincter injuries (OASIS) and associated repair and complications ▪ Avoided costs of future caesarean deliveries ▪ Promotion of safety culture ▪ Reduced litigation costs	Type of analysis: ROI Key findings: Episcissors-60 is a cost saving innovation, showing estimated potential ROI from an NHS perspective of 3,056% and a net saving of £28,382 per 1000 births accrued from avoided cases of OASIS, based on the assumptions. If the 50 trusts currently using Episcissors-60 have an average rate of episiotomies (15%) and average births per trust (4,800) this would avoid approximately 4,080 cases of OASIS per year, with a saving of £6,811,682. In this scenario, the development costs of approx. £500k would have been completely recouped in one year.
myCOPD	▪ Cost of access to myCOPD per patient	▪ Improved disease control ▪ Reduced incidence of COPD exacerbations ▪ Avoided hospital admissions ▪ Shorter length of hospital stay ▪ Improved access to pulmonary rehabilitation	Type of analysis: ROI Key findings: myCOPD is found to be cost saving compared with standard care, with a potential ROI of 930% from an NHS perspective. The web-based patient self-management tool offers the potential for improved control of COPD symptoms, and a more cost effective means to provide access to pulmonary rehabilitation. The estimated net benefit from avoided hospital admissions in a CCG with 250,000 patients could be approximately £158,065 per year.

Innovation	Input resources	Outcomes	Key findings
PneuX Pneumonia Prevention System	▪ Unit cost of endotracheal / tracheostomy tube ▪ Loan of seal monitor	▪ Reduced incidence and cost of ventilator associated pneumonia (VAP)	Type of analysis: cost-benefit analysis (CBA) Key findings: the PneuX system is found to be cost saving compared with standard care, with a potential cost-benefit ratio of 668% from an NHS perspective. The estimated net benefit in a hospital with 10 ICU beds is £255,108 per year, with at least three hospitals implementing the PneuX system to date.
Non-injectable arterial connector (NIC)	▪ Unit cost of Non-Injectable Arterial Connector	▪ Reduced time to perform clinical tasks ▪ Reduced cost of consumables ▪ Reduced infection rates ▪ Reduced adverse events (medication errors)	Type of analysis: cost-consequence analysis (CCA) Key findings: the analysis of NIC is currently inconclusive, as the major outcomes of avoided medication errors and infections cannot be measured and valued robustly at present. The estimated net benefit without taking into account avoided medication errors and infections, in a hospital with 16 ICU beds, is £1,376 per year. NIC is fully developed and is in use in approximately 40 trusts, and it has the potential to be cost saving from an NHS perspective.
Brush DJ	▪ App (free to download and use)	▪ Reduced demand on planned and unplanned healthcare ▪ Improved access to dental services ▪ Improved patient outcomes ▪ Avoided loss of productivity	Type of analysis: CCA Key findings: the analysis of Brush DJ is inconclusive at this time as there is no available outcome data. However, Brush DJ has the potential to be cost saving as there are no on-going costs, there is potential for avoidance of healthcare from improved oral health and the theory of change is supported by service user evaluation.
Sleepio	▪ Cost of Sleepio population level programme	▪ Avoided GP appointments ▪ Avoided medication ▪ Avoided psychological therapies ▪ Reduced presenteeism and absenteeism	Type of analysis: CCA Key findings: the analysis of Sleepio is currently inconclusive as information on the current scale of implementation and benefits was not available. However, Sleepio has the potential to be cost saving from an NHS perspective as its total cost is lower than standard care, when implemented at a population level and also the unit cost per patient is cheaper than taking up CBT. There are also potential societal benefits when the potential impacts on productivity are included.

Innovation	Input resources	Outcomes	Key findings
O Wise Breast Cancer	▪ Annual maintenance costs and IT solution	▪ Improved quality of life and reduced anxiety ▪ Increased patient activation ▪ Avoided A&E attendances	Type of analysis: CCA Key findings: The analysis of OWise is currently inconclusive, as it is in the early stages of development and there is not yet any available evidence or data on the impacts. If the proposed outcomes are realised, there is the potential for improvements in patient wellbeing, overall survival and a reduction in healthcare utilisation.
Health unlocked	▪ Set-up and annual licensing fees ▪ Care library fee	▪ Reduced demand on healthcare ▪ Improved patient wellbeing ▪ Increased patient activation	Type of analysis: CCA Key findings: the analysis of Health Unlocked was inconclusive due to a lack of outcome data. There will be social benefits from Health Unlocked if it can be shown to result in improved health behaviours. These may include societal economic benefits from patients with chronic conditions remaining in productive work for longer. There may also be economic benefits to the NHS if patients are making lower use of services such as GP appointments and A&E visits.
Sapientia	▪ Genome testing, data processing and storage ▪ Clinical analysis	▪ Avoided diagnostic tests ▪ Avoided healthcare appointments ▪ Avoided hospital costs ▪ Improved wellbeing of patient and family	Type of analysis: CCA Key findings: as the Sapientia innovation is in the early stages of implementation into clinical practice the analysis is currently inconclusive. However, a sample case study shows that it has promising potential to be cost saving and provide a positive ROI from a healthcare perspective, by considerably shortening a patient's diagnostic journey in some cases.
Patients Know Best	▪ Cloud based server and overheads	▪ Avoided healthcare appointments and associated patient administration ▪ Improved patient activation and health related outcomes ▪ Reduced demand due to improved health outcomes	Type of analysis: CCA Key findings: Patients Know Best has the potential to achieve significant cost savings to the NHS, with a reported ROI of 300% in one case study. Although the exact input costs are not available, a benefits calculator provided by PKB shows that, for a sample NHS trust with a population of 900,000 patients with an average prevalence of long term conditions, the cash releasing savings in year one are approximately £1.9 million, totalling almost £26 million over five years. PKB is being implemented in 30 healthcare organisations in the UK so there is potential for large scale benefit.

Innovation	Input resources	Outcomes	Key findings
NerveCentre			Response not yet received from the Fellow so awaiting analysis.
Join Dementia Research	▪ Service fee for Software as a Service (SaaS)	▪ Economic gains and job creation ▪ Avoided research recruitment fees ▪ Increased commercial research income ▪ Reduced stigma around dementia	Type of analysis: CCA Key findings: the analysis of Join Dementia Research is currently inconclusive due to lack of outcome data. However, there is potential for cost savings to the NHS, with evidence that increased research activity brings benefits to NHS organisations in terms of commercial research income and drug offset value, plus additional intangible savings from benefits to patients by their participation in research.
Liver Disease Diagnostic Pathway	▪ Healthcare appointments in primary and secondary care ▪ Diagnostic tests	▪ Avoided healthcare appointments ▪ Avoided investigations for diagnosis of liver disease ▪ Improved patient outcomes ▪ Avoided treatment for significant liver disease and consequences	Type of analysis: cost-utility analysis Key findings: the Liver Disease Diagnostic Pathway is likely to be cost-effective according to the NHS England willingness-to-pay threshold of £20,000 per QALY. While the intervention costs more than standard of care it generates greater levels of benefit. The scale of benefits is increasing as the pathway is introduced into more CCGs.
i-THRIVE	▪ National programme cost ▪ i-THRIVE Academy ▪ Local OD and system change	▪ Improved access to CAMHS due to improved efficiency eg reduced re-referrals and DNAs ▪ Improved patient experience of services ▪ Increased staff satisfaction	Type of analysis: CCA Key findings: the analysis of i-THRIVE is currently inconclusive due to insufficient outcome data. However, case studies from accelerator sites identify how the THRIVE approach, (supported by the i-THRIVE programme) has achieved better patient outcomes and service efficiencies, enabling improved access to pressured services. These benefits have the potential to be achieved at scale as the programme is now adopted in 72 CCG areas.

Innovation	Input resources	Outcomes	Key findings
Neuro Response	▪ Software and IT ▪ Staffing ▪ Clinical tests ▪ Tele-triage	▪ Avoided A&E attendances ▪ Avoided non-elective admissions (eg for urinary tract infection) ▪ Improved patient health ▪ Reduced carer time	Type of analysis: CCA Key findings: while the analysis of NeuroResponse is inconclusive at this time, due to lack of outcome data, there is scope for it to achieve significant cost savings from an NHS perspective. This is based on the current cost of avoidable infection-related unplanned admissions among the population of people with multiple sclerosis in the UK, which is estimated to be £43m per year.
Health Coaching	▪ Accredited health coaching training for staff ▪ Train the Trainer programme	▪ Improved patient physical and mental health outcomes ▪ Improved self-management skills Avoided demand on unplanned care ▪ Avoided planned healthcare appointments ▪ Avoided demand on social care	Type of analysis: CCA & CBA Key findings: Health coaching is implemented in many settings and while it is not possible to quantify the total benefits from the roll out of the programme, economic evaluations of the model in two settings have found health coaching to be highly cost saving. In a rehabilitation ward setting, indicative savings were approximately £3million per year due to reduced length of stay and reduced need for social care, and when implemented in a community physiotherapy setting, health coaching achieved £12,438 of efficiency savings per full-time physiotherapist.

4.4 Conclusions

The preceding analysis shows that a number of innovations generate cost savings and a positive return on investment at organisational or CCG level (AliveCor Kardia Mobile, PneuX, NIC, Episcissors-60, health coaching, myCOPD). The exact scale of benefits across the country will depend on the number of times these innovations are used in practice. It has been easier to test the potential return on investment for innovations designed to achieve safety and efficiency as they have clear input costs and comparisons with usual care are possible. For Health Coaching, while implementation is widespread and diverse and it is not possible to quantify the total benefits from the roll out of this approach, the evidence indicates that the value of benefits has the potential to far exceed input costs. In the case of the Scarred Liver Pathway, a comprehensive economic analysis has shown this to be cost effective in that it achieves better health outcomes for a slightly higher cost than usual care.

For some innovations there is evidence of potential to generate significant savings but it is not possible to establish the return on investment as the input costs of the innovations are not clear. This is either for reasons of commercial sensitivity, or because the costs have not yet been established (Sapientia, Patients Know Best, NeuroResponse). Conversely, for other innovations input costs are known and the expected benefits have been identified, but the benefits cannot be easily measured (Brush DJ, HealthUnlocked, Join Dementia Research, iThrive, Sleepio, OWise).

Obtaining costs and outcome data presents a significant challenge in establishing innovation cost effectiveness for a number of reasons: costs cannot be identified, evaluations are being conducted but outcome data are not yet available, the implementation environment has high levels of local variation and other related initiatives in place making it difficult to track benefits in a standardised way (eg health coaching) or there is no mechanism for the collection of outcome data, so outcomes can be identified and valued but not measured. For example, it is difficult or impractical to measure app usage reliably for those which aim to reduce demand on healthcare by supporting people to self-manage. However, information available from user feedback and theoretical cost modelling suggests they have great potential to achieve reductions in healthcare demand and costs, while yielding improvements in health and wellbeing.

Development costs for the innovations are mostly not available as they are commercially sensitive or cannot be disaggregated within wider budgets. These were mostly incurred before the Fellow's involvement in the NIA programme and, with the exception of Episcissors-60, are not incorporated in the economic analysis. From an NHS perspective, while the NHS is mostly not responsible for the development costs, it may be contributing indirectly if these have been built into the pricing strategy for the new technology.

Some of the outcomes generated by the innovations are contributing to reduced demand on the health and social care system. These result from increased efficiency, achieving similar outcomes with fewer resources, reducing demand by improving health outcomes or avoiding preventable harm. There are also a number of innovations that bring societal

benefits by contributing to improved productivity or preventing loss of productivity. Other outcomes generated by the innovations are increased patient and staff experience/satisfaction, promotion of safety culture and income from research funding.

The conservative estimates made suggest that some of the innovations could generate significant savings to the health and social care system. These are summarised in Table 4.2. The value of total benefits could be higher, because this calculation does not include benefits that cannot be easily quantified at this stage, or other benefits that have value, both to patients, the health and social care system and to society via increased productivity. Furthermore, there is the potential that benefits across the country are underestimated, as the full extent of scaling is not known. The value of the benefits from these innovations (based on data available and assumptions made) are thought to exceed the costs of the NIA programme in one year.

Table 4.2: Summary of potential annual cost savings from NIA innovations

Innovation	Estimated potential annual savings based on the implementation information available for the analysis
Kardia Mobile ECG	£242,000 per year, if 250 patients per year follow the Kardia pathway rather than the 'typical AF diagnostic pathway'.
PneuX Pneumonia Prevention System	£255,108 per year for a hospital with 10 ICU beds.
Non-injectable arterial connector (NIC)	£1,376 per year, in a hospital with 16 ICU beds.
Episcissors-60	£6,811,682, in 50 trusts with an average rate of episiotomies (15%) and average births per trust (4,800).
myCOPD	£158,065 per year, in a CCG with 250,000 patients.
Patients Know Best	£1.9 million, for an NHS trust with a population of 900,000 patients.
Health Coaching	£3 million per year, if implemented in a 28 bed rehabilitation ward.

As stated earlier, the results should be interpreted with caution, due to the limitations contained within the analyses in some cases.

5 Emerging Conditions for Success

5.1 Introduction

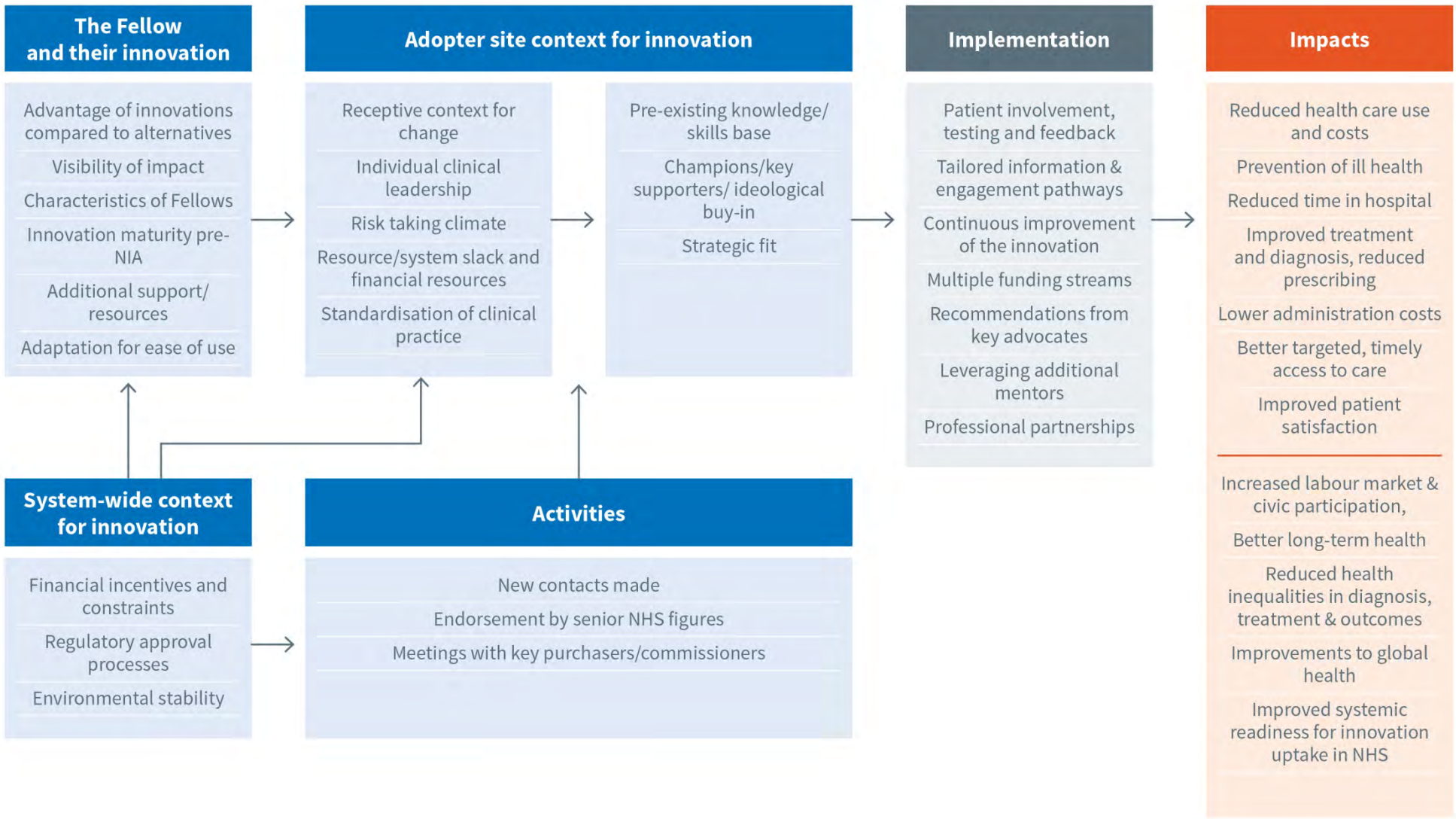
Factors that affect success in innovation scaling have been derived from systematic reviews of factors affecting innovation in healthcare contexts (Greenhalgh et al, 2004 and Dobbins, 2002) supplemented by additional items which emerged from examining the research data gathered for this evaluation.

They may relate to:

1. the personal characteristics of the Fellow, their background, their own organisational context and characteristics of the innovations
2. the NIA content and delivery
3. the features of external contexts covering NHS adopter sites, including their structures and cultures, together with wider features of health care systems.

These factors are illustrated in Figure 5.1 .

Figure 5.1: Conditions for success in innovation and potential impacts



The analysis is based on interview data gathered from Fellows, patients, stakeholders and core staff and on reviewing the initial and continuing applications completed by Fellows as part of the selection process to enrol on the NIA. The data has then been subjected to a process of qualitative comparative analysis, where individual factors and the contribution of each factor in enabling innovations to gain traction and overcoming blockages to scaling, is assessed.

Where the role of the NIA, characteristics of the Fellows and further factors appear to vary by type of innovation, these differences are drawn out.

The key message consistent with the wider literature on innovation diffusion is that **successful scaling of innovations is dependent on a constellation of supportive factors acting in combination with each other**. The precise mixture is specific to each innovation and needs to recognise the particular routes to adoption, characteristics of target user groups and the contexts and constraints in the organisations where the innovations will be used. The analysis suggests that conditions for success are interdependent, that is, several may need to be in place for the innovation to gain traction, and in some cases multiplicative by amplifying each other's effects.

5.2 Common conditions for success in innovation scaling

The two most common factors from across the categories including both NIA factors and further factors identified as important for innovation scaling were the support of the **NIA core team** (already discussed in Chapter 2.2.) and **patient involvement.**

Patient involvement was repeatedly identified as essential to expanding innovation take-up. It played an extremely valuable role in a number of ways.

Innovation development, user testing and feedback was intrinsic to ensuring that innovations that depended heavily on patient choice to use or purchase were user-friendly and offered all the functionality desired by patients, as cited in the case of some of the apps. One IT platform was praised for 'obsessive' attention to user experience through holding feedback events for all patient groups and a highly responsive approach to feedback, eg offering branding opportunities to relevant pages for each patient health charity. For another app, one stakeholder reported that initial navigation issues were solved and new features were added as they '*discovered that what patients want isn't the same as what clinicians think they want or need'*. For some of the care pathways patients were consulted about what was wanted and needed in designing the innovation, which stimulated 'bottom-up' innovation based around patient priorities.

Patient groups were instrumental in helping to **encourage and attract people to participate in trials and testing** in order to develop the evidence base for the benefits of the innovations. Additional benefits were the inspiration that Fellows derived to sustain commitment to scaling their innovations when facing challenges: one described patient reviews of their innovation as '*keeping the passion going… people write honestly so you get great feedback*' (NIA Fellow).

Patients promoting innovation benefits and acting as champions helped spread the word that the innovations were useful, communicated the benefits to encourage other potential users to try them out and this helped to build trust. Patient champions helped break down any suspicion of new technologies (eg Sleepio, myCOPD), especially where patients had suffered long-term conditions and experienced limited benefits from previous treatments. For innovations where changes in patient behaviour were central to their success, patient advocacy was critical because it supported the fundamental principles of the innovation:

> *'Without people who have benefited from health coaching, it would just be a group of professionals telling other people that it works and to do it, which really goes against the whole ethos of Health Coaching. Patients might be less sure about it, whether it will work, whether it's just the latest craze.'*
>
> (Stakeholder, Health Coaching)

The collective power of advocacy through patient representative groups was very helpful in gaining profile for innovations on a wider scale and provided access to user bases for testing and trialling innovations. Building engagement in innovations where research was central depended heavily on them:

> *'I don't think we could have achieved without enough advocates who cross over these organisations and charities… about 20 really powerful advocates.'*
>
> *(*Stakeholder, Scarred Liver Pathway*)*

Patients could also help overcome objections or resistance on the part of healthcare professionals. Putting patients in control in the case of sharing personal data using Patients Know Best helped dispel clinician concern about data protection and removed a key obstacle to diffusion.

Mobilising demand and pressure for change was enormously helpful in persuading purchasers to take notice and act in response to patient needs, particularly in shifting issues up a contested agenda for priority and resources. In the case of the Scarred Liver Pathway, patients acted as the original inspiration for the innovation because they were receiving late diagnoses and wanted to know why. In the second year of the NIA, the Fellow was making a video using patient experiences as part of a case for funding from purchasers believing that patients' voices made it *'harder for them to turn a deaf ear to patients' views and the evidence that backs it up'*.

Once innovations were in the process of scaling, patients exerted influence on funders and potential collaborators to build momentum and support. In some cases this was also helping to create wider conditions for cultural change, eg in debates about information governance, by providing examples of new ways to cope with regulatory requirements in scaling digital health innovations. This illustrates the potential of patient involvement as part of change from a social movement perspective which has already been exploited in NHS contexts (Nesta, 2016). Some innovations, such as health coaching, were explicitly building on social movement principles in stimulating the diffusion of the innovation through training trainers and building on patient-led activation.

5.2.1 Relative importance of different factors based on type of innovation

Mapping the role of different factors in helping Fellows to scale their innovation has revealed the patterns of influence shown in Table 5.1. Factors are listed together with their relative importance for each innovation where signalled strongly by the evidence. For many innovations the process of scaling was non-linear with the same factors being important at a number of different points or indeed throughout the whole process.

Any changes in the level of importance for each factor is noted between the first and second year of the NIA. Overall a majority of Fellows noted their reliance on core programme staff diminished during the second year. For many this reflected an initial phase of identifying what to do, making and appraising plans and experimentation with different approaches followed, for some Fellows, by focussing heavily on delivery.

The overall balance between the influence of NIA factors, Fellows' characteristics and further factors also requires assessment. Where innovations had not made as much progress as Fellows hoped, this was because of particularly tricky external challenges, which the NIA was still supporting the Fellows to solve. Equally, a number of the contextual factors for success were being enhanced and leveraged by support provided through the NIA. Overall, contextual factors and system-wide obstacles were most likely to have delayed innovation scaling, showing the potential role of the NIA to address such barriers on a collective basis. Future conditions for success and the remaining barriers to tackle are discussed in more detail in Section 6.2.

Table 5.1: Conditions for innovation scaling success by type of innovation

IT Platforms	
NIA factors and Fellow characteristics	**Further factors**
(first three factors most important)	*(first three factors most important)*
Access to national platforms for raising awareness of innovation (, all other factors equal)	Patient involvement
Peer to peer learning	Forming (inter)national level partnerships using NIA support
NIA core team support	Gaining individual key champions/supporters leveraging NIA support
Networking opportunities and introductions	
Learning to help navigate NHS structures	Relative maturity of innovations prior to NIA
Leveraging mentors	Navigating commissioning structures leveraging NIA support
Fellows' skills and previous experience	Accessing multiple funding streams enhanced by NIA brand

Devices	
NIA factors and Fellow characteristics	**Further factors**
(first three factors most important)	*(first factor most important)*
Access to national platforms for raising awareness of innovation	Recommendations from key stakeholders/advocates building on NIA support
Networking opportunities and introductions	
NHS Innovation and Technology Tariff*	Navigating commissioning structures leveraging NIA support
NIA core team support	Using professional partnerships
Apps	
NIA factors and Fellow characteristics	**Further factors**
(first two factors most important)	*(first two factors most important)*
Leverage of the NIA brand as stamp of quality	Access to patient feedback enabled via NIA (
Access to national platforms for raising awareness	Gaining individual key champions/supporters leveraging NIA support
NIA core team support	Leveraging (inter)national professional partnerships
NHS Innovation and Technology Tariff*	Readiness of user base
Fellows' skills and experience prior to the NIA	
Models of care/pathways	
NIA factors and Fellow characteristics	**Further factors**
(first two factors most important)	*(all factors equally important)*
Access to national platforms for raising awareness	AHSN support leveraged through the NIA
Leveraging the NIA brand as quality stamp	Access to patient feedback
NIA core team support	Building professional partnerships nationally
Workforce	
NIA factors and Fellow characteristics	**Further factors**
(all factors equally important)	*(all factors equally important)*
NIA core team support	AHSN support leveraged through the NIA
Fellows' skills and experience prior to the NIA	Building professional partnerships nationally
Use of bursary	Access to patient feedback
	Gaining individual champions/supporters leveraging NIA support

Note: *The development of the NHS Innovation and Technology Tariff and role of the NIA in developing it is discussed in Section 3.4.1

There are a number of reasons why different factors accrue different levels of importance for the different types of innovations. These trends are now discussed.

For **IT platforms** a number of Fellows, particularly those from a non-NHS background, pointed to the culture and skills of key staff within the NHS as not heavily orientated towards using and exploiting technology, compared to other sectors. This meant that advocacy and persuasion of the value technology played was a key role in getting clinicians and key influencers to try out and adopt innovations, along with access to national platforms to promote and raise awareness of the technology. Several of the NIA innovations have a large potential market of major NHS organisations which meant that

attracting national profile and credibility was important. Some of these innovations benefited from a base in a relatively large organisation, and were relatively mature in their existing UK user base, sometimes with additional staff to assist diffusion.

For **devices** the role of the NHS Innovation and Technology Tariff has been particularly important in overcoming any perverse cost incentives at the point of purchase. These innovations usually rely heavily on clinical judgement and choice to trigger adoption so the power of personal recommendations and endorsement by key NHS figures was critical for their scaling. In the second year of the NIA, making use of professional networks gained increasing importance because Fellows in this category identified that engaging individual clinicians was important to enable innovation diffusion in primary care settings.

For **apps** there were particular benefits for some innovations from the NIA providing support to refine the innovations and develop new versions. Similar to IT platforms, leveraging the NIA brand and individual recommendations was important to gain attention in a large market for health apps. Patient feedback was particularly important as a form of endorsement because a number of the apps were aimed at users, including the general public, as well as (or instead of) clinicians.

For **models of care** and **care pathways**, diffusion routes and implementation are typically more complicated than some of the tangible innovations. This is because they sometimes demand a complete redesign of ways of working in delivering a service and may also involve implementation across organisational boundaries where staff from different employers need to co-operate. Here AHSN support was helpful in acting as a unifying and catalysing force to leverage influence and use personal connections to persuade different stakeholders of the potential value of new ways of working. Using the NIA brand to convince potential users of these innovations' value gained importance during the second year of the NIA.

For **workforce innovations**[5], AHSNs took a more prominent role to support diffusion in the second year of the NIA, combined with local public sector organisations interested in supporting patient activation and self-management. Word of mouth among professionals within and across organisations was also helpful in promoting spread because of the need to convince clinicians of the value of a changed approach to practice which is central to health coaching.

The analysis also considered whether different conditions for success emerged for innovations with different types of goals. This revealed little differentiation. Small points of variation included:

- **Personal individual recommendation** being particularly important for **hospital safety/quality of care innovations** including Episcissors-60, Nervecentre, PneuX and NIC. This is consistent with the need to build confidence of individual clinicians and

[5] This is based on analysis of one innovation in the category so conclusions may not be generalizable.

win their trust in adopting innovations which are focussed on reduction of harm, especially if they hold personal responsibility for patient safety and its consequences.

- **User readiness** being particularly important **for innovations aiming to improve self-care and patient activation** including Health Coaching, HealthUnlocked, myCOPD, OWise, PKB and Sleepio. This is consistent with the interface for many of these innovations depending heavily on patient trust, skill and engagement in using IT or apps, or willingness to take personal responsibility for health behaviours in the case of Health Coaching.
- **Patient involvement and feedback** being particularly important for **new care models** some of which deal with vulnerable groups and benefited from close collaboration with users in design and development, and adjustment in response to their views.

Role of individual factors

Characteristics of Fellows

The Fellows shared entrepreneurial characteristics of passion about their innovation, challenging the status quo, tenacity, motivation and drive, together with openness to new ideas and the desire and skills to engage with stakeholders and build common coalitions of interest. These characteristics combined with high levels of intellectual ability and resilience to enable them to work at pace and overcome setbacks. These traits were common across all the Fellows and specifically sought by the NIA selection process.

Stakeholders noted that Fellows' engagement skills made a particular difference to how receptive they and others were to adopting or promoting the innovations. These included excellent communication and choice of promotion techniques in a number of the Fellows. Features that stakeholders appreciated were Fellows' clarity in oral communication, openness, honesty and authenticity. In particular, several stakeholders commented favourably on the 'non-sales' approach of several Fellows who simply described their innovation and its features in contrast to the more aggressive sales techniques they encountered elsewhere. In the second year of the NIA, some stakeholders noted the benefits of Fellows' flexibility and agility in responding to opportunities by adapting the ways in which innovations could be used to fit requirements of different settings, or purchaser or patient needs.

A few variations in the characteristics of Fellows and their innovations may have given some of them initial or ongoing advantages in particular contexts. The analysis is not intended to suggest that any Fellows are in any way deficient as all have excellent profiles and track records; they simply indicate that personal attributes or backgrounds sometimes conferred advantages which were not available to all, and Fellows began with different levels of knowledge and skills which were developed over time through the NIA. Fellows without these advantages were still able to make substantial progress in innovation scaling, but in some cases may have faced bigger obstacles and they might have been able to progress even faster if they had shared similar advantages.

- **Having clinical qualifications and bedding in clinicians in product or service development** was helpful for Fellows, especially those with IT platforms or app innovations because stakeholders identified them as capable of building trust effectively relative to other providers.
- Fellows with **substantial recent experience of working in the NHS** had 'inside knowledge' of its structures and processes which those newer to the system had to learn. The NIA helped develop this knowledge in those needing it.
- **Seniority of job role** was sometimes helpful in tackling resistance to change, particularly in contexts where status was helpful in 'getting the ear' of senior staff to learn more about and consider the benefits of the innovation. Resistance of this kind was partly overcome by encouraging senior NHS figures to endorse Fellows' innovations.
- Fellows employed by an organisation with a single focus on the diffusion of the innovation sometimes benefited from **access to a wider team or pool of resources** to promote the innovations when compared, for example, to Fellows operating alone. For Fellows operating alone, NIA activities often sat among a portfolio of diverse roles and responsibilities. Stakeholders noted that personal costs to Fellows acting alone were becoming more acute in the second year of the NIA, in part because their business models for revenue generation to support innovations did not fully cover their own time costs.
- **Maturity and type of innovation,** i.e. how far the innovation had scaled prior to the NIA, whether it was a product being sold or a way of working being cascaded, the route to diffusion and how much collaboration and co-operation was required for implementation. Innovations requiring only a few decision-makers to trigger and accept adoption are potentially easier to implement than those requiring support of many different professional, managerial and clinical groups.
- Fellows with **innovations that solved an immediate recognised clinical problem** or improved treatment of patients with existing conditions for time-pressed clinicians sometimes found it slightly easier to gain traction and attention than those whose innovations were aimed at solving long-term problems.
- Building and maintaining **positive relationships with stakeholders** was invaluable in securing sustained co-operation of busy clinicians and wider interest groups. Stakeholders identified a small number of cases where greater leadership, co-ordination and/or tact was needed from Fellows to engage partners and staff in the interests of maintaining personal reputation and support continued innovation diffusion.

Some stakeholders observed a change in some Fellows who acquired greater confidence, and more developed sales and communication techniques for 'talking up' their innovations. The gains came partly from confidence acquired via the badge of NIA endorsement, partly through the opportunities for pitching innovations gained through the NIA and partly through personal support from core staff or mentors.

Gaining a 'quality stamp' of endorsement from the NIA brand was valuable in three ways:

- Attracting interest and building trust among possible users and purchasers.
- Enabling Fellows to span organisational boundaries while providing reassurance about governance.
- Helping to win further competitive funding and contracts.

Access to key decision-makers was enabled because of the *'badge… which oils the wheels in terms of conversations in the NHS'* (NIA Fellow). The profile and credibility of the NIA was instrumental in persuading healthcare staff to take an interest in the innovations and one stakeholder compared the NIA reputation favourably with other competing kinds of endorsement. It was also important where Fellows were trying to make contacts without warm leads and built confidence among some Fellows when persuading organisations to engage.

Some Fellows felt that a perceived knowledge gap around IT among many NHS staff meant that the benefits of IT applications were not always recognised. One commented that '*the legitimacy that the NIA provided was helpful'* in getting the firm's product taken seriously while some stakeholders commented that the NIA gave a badge of confidence for hospitals who were not sure of whether to invest in a product or services. Another Fellow believed the NIA had *'added significantly to how people see us as a company'* (NIA Fellow). Two Fellows felt that having the NIA badge conferred authority so '*the NIA stamp did help in getting you more recognition… and they started to see it as a serious endeavour*' (NIA Fellow).

For two Fellows seeking to work across organisational boundaries and sometimes being challenged about their authority to do so, the NIA label gave them freedom to manoeuvre and a *'foot in both camps'* to avoid turf warfare and organisational politics about governance responsibilities.

Some Fellows felt that NIA branding had given them an edge when competing for contracts and funding because it demonstrated the credibility of their innovation due to the rigorous selection process and the small number of participants.

Choice and use of mentors was important. Some individuals benefited from a good match identified through the NIA itself with descriptions of mentoring support received as *'phenomenal'*, and others had found additional or substitute mentors. The characteristics of an effective mentor varied depending on each Fellow's priorities. For some, the status, seniority and power of the mentor was instrumental in providing endorsement for the quality and potential benefits of the innovation to get it noticed. For others, mentors introduced the Fellow to other mentors and had an important role in solving technical issues and providing advice on specific challenges. Examples of how mentors enabled success in innovation scaling included:

- Tailored advice on intellectual property issues with NHS providers from a mentor with extensive experience (myCOPD).

- *'Calls every month and I got introduced to other mentors as relevant who could help with preparing pitches and rapid signposting to people who could help.'* (Interviewee, Sleepio)
- *'A mentor… on the practical side… at an experienced IT NHS infrastructure company… we were going through a big tender to deliver a five-year project. He helped us with the tender and we were successful… by far the biggest deal we've ever done*.'(Interviewee, HealthUnlocked)

AHSN support: During the second year of the NIA, three Fellows had intensified their work with AHSNs, via mechanisms such as AHSN-hosted education and training events for clinicians. This offered efficiencies in accessing multiple customers simultaneously and also a degree of endorsement from AHSNs. For two Fellows the role of the AHSN provided a neutral broker with some 'gravitas' that offered clinicians some headspace to reflect on professional practice. The co-ordinating roles of AHSNs in bringing together stakeholders such as primary, secondary, mental health, social care and local authorities played a substantial role in enabling the development of customised applications, especially for community-based innovations.

Characteristics of innovations

Ease of adoption

A critical factor that assisted scaling was how easy and appealing the innovations were to use for staff facing competing time pressures in environments typically experiencing resource shortages. A number of stakeholders noted how easy the innovations were to use for frontline clinicians compared to existing similar products. Enabling factors included portability of scanning for the Scarred Liver Pathway requiring only basic training of nursing staff. Similarly AliveCor Kardia Mobile has fewer parts and is simpler to use than a standard device with 12 leads. This is important for staff with heavy workloads. Similarly, for the NIC, one nurse commented:

> *'Why not introduce something so simple… It didn't make us have to change our practice; we didn't have to rewrite a load of protocols to accommodate it, all we needed to do was add one paragraph to our protocol to say this is now what we do.'*
>
> (NIA stakeholder interview)

Added value to clinicians

Other innovations tackled some of these issues by demonstrating the added value and benefit to the clinician as much as the patient. PKB focussed on selling the benefits of reduced medical time spent gathering patient information and then applied these principles in its engagement strategy by using 'virtual clinics' to help embed the system within the context of busy hospitals. Health coaching was focusing on the possibility of tackling intractable long-term and complex conditions linked to obesity or alcohol consumption which absorb considerable amounts of clinical time to treat.

For more complex innovations which involve more disruptive change, simplicity in enabling collaboration was a key strength, as in the case of JDR and iThrive which built in tools for brokering relationships that were designed to be as easy as possible to use.

Role of further factors

Navigating commissioning structures to identify the people with decision-making rights to implement an innovation and the process by which they would commit was a major blockage encountered by a number of Fellows. Their surprise at the complexity of the system, even among Fellows working in NHS organisations, commonly appeared as a learning point in continuing application forms for the second year of NIA support. A number of Fellows, including those representing Sleepio, the Scarred Liver Pathway, AliveCor Kardia Mobile and HealthUnlocked, illustrated how tackling this issue helped innovation scaling, even when change was required as to choice of initial route to users. The support to do this was provided partly by NIA core staff, partly by networking opportunities afforded by the NIA, partly by mentors and partly by AHSNs. Examples include:

> *'Who do we get involved with? GPs? CCGs? STPs* [Sustainability and Transformation Plans]'*? It's all those people – but who and how you package the service up for is something we're still tackling. The NIA programme gave us access to good sources of information and better commercial opportunity than we otherwise would have… it's acted as a concierge service for making introductions at any level. We're moving away from selling directly to CCGs, and into contracts already provided with CCGs and offering services within services – subcontracting ourselves in.'*
>
> (Interviewee, HealthUnlocked)

> *'Figuring out who the people are who will unlock doors and enable you to actually progress this, has been the biggest challenge. For the CCGs it was almost impenetrable. It felt like "death by sub-committee" – the pathway got taken from committee to committee, then we started again.'*
>
> (Interviewee, Scarred Liver Pathway)

> *'Knowing who to speak to is the first question as you can waste a lot of time in the NHS running around talking to lots of the wrong people. So I tried to use mentors for signposting and their "black books".'*
>
> (Interviewee, Sleepio)

Two stakeholders commented that strategies for targeting individual healthcare consumers were probably inappropriate for two innovations, and Fellows in these cases had both refined their approaches to identify routes to market through greater engagement with clinicians.

Building national partnerships enabled Fellows to develop new products and services, access potential purchasers in new parts of the country and additional resources to support scaling. The NIA supported them to do this by helping them build a network of contacts and potential partners through the personal contacts of NIA staff, mentors, the Fellows themselves, AHSNs and senior NHS staff. Key ingredients of successful

partnerships were having senior staff involvement and sustaining collaboration between organisations using different models, including formal agreements and informal relationships. Some Fellows illustrated astute approaches to partner selection, for example in ensuring that partners were different types of organisation including charities, NHS trusts, universities and AHSNs. This maximised eligibility for different types of funding, as in the case of iThrive.

Gaining key champions and endorsement from single individuals was helpful both through the support of influential figures to raise the profile of innovation and gain attention of purchasers, but also frontline senior clinicians with the power to make decisions about innovation adoption. The individuals could include both senior NHS staff at national level and people within organisations who could leverage support for innovation adoption. Fellows commented that they were able to trace links between their innovations being publicly endorsed by senior NHS staff in speeches at national events and purchasers swiftly expressing interest and contacting them for more information about their innovations as in the case of the NIC and myCOPD. They similarly gave examples of time-pressed potential users showing limited interest but becoming more receptive when the names of senior NHS staff were mentioned as having endorsed their innovations (eg NIC). Centralised commissioning within healthcare organisations has removed much discretion for individual clinicians but in some specialisms powerful consultants adopting innovations has helped diffusion. Through professional networks, they have raised awareness about best practice and where current practice could be improved. This has contributed at all stages of innovation diffusion from supporting research and evidence generation and gaining regulatory approval to offering presentation slots at key conferences and meetings.

Demonstrating alignment with national and local agendas shows that the innovations help clinicians achieve the short-term goals and targets which guide day-to-day service delivery. Fellows noted that tapping into key organisational priorities and finding special interest groups willing to advance the agenda for their innovation was instrumental to building coalitions of interest around innovations, including providing evidence of the impact of innovations on measures of most interest to frontline staff. One Fellow talked about incorporating metrics of most interest into measures of the Scarred Liver Pathway. Another had developed a protocol for the application of an IT system for a medical condition which was a priority for a hospital customer. The intelligence provided through the NIA of shifts and emerging developments in national and local health policy agendas was helping to create a hub for information exchange among innovators.

Customising engagement routes and marketing

Fellows in the second year had shown flexibility in engaging in different routes to market. For some this involved a recognition of the need to engage individual clinicians as opposed to centralised commissioning routes, for others it was a mixture of pursuing *'top down and bottom up'* strategies (NIA Fellow). One Fellow had adopted a strategy of developing a suite of information resources, with targeted information for nurses about training requirements, for CCGs and for finance departments about procurement processes. Overall, a number of Fellows and senior stakeholders observed that it was very difficult to predict in advance which commissioning routes would work because of the diversity and specificity of engagement required for each innovation but the NIA offered the opportunity to build on the experience of successive cohorts.

6 Conclusions and Recommendations

6.1 Introduction

The NIA was introduced to increase the scale and pace of innovation diffusion across the NHS. The scope of innovation types supported by the NIA has been wide and its implicit intention to enable innovations to achieve extensive scaling in 12 months was extremely ambitious. Extending NIA support to two years and concentrating on targeted themes for future cohorts will help optimise outcomes and impact.

NIA content has been extremely well received by the initial cohort of Fellows. Fellows report that participation has brought them considerable personal and professional benefits. These include navigating commissioning structures, gaining endorsement for innovations and access to influential figures at national, regional and local levels in NHS organisations. These contacts have converted senior figures into ambassadors for the innovation who then stimulated interest and purchasing or adoption of the innovations among targeted users. NIA core team support was a particular strength of the first year of the programme and Fellows also valued the bursary, peer learning opportunities and support from a community of innovators to help them maintain resilience when experiencing setbacks. The single benefit not originally foreseen by Fellows from the NIA centred on fostering small number of peer-to-peer collaborations, partnerships and links established between Fellows and across innovations.

Areas for NIA development included earlier exposure to commercial expertise, eg from serial entrepreneurs for those Fellows with less experience of developing new business models; information on legal implications of different partnership models; input from experts on system level change; and gaining and proving the influence of the NIA through Programme Board relationships with NHS England and the Department of Health for dissolving national level obstacles to innovation diffusion.

At a system level, the wider impact of the NIA has been to help tackle financial constraints and structural barriers to innovation diffusion, for example, through influencing development of the NHS Innovation and Technology Tariff. It also stimulated wider cultural change through conversations with NHS organisations and bringing groups such as AHSNs together to demonstrate models of collaborative working to diffuse healthcare innovations.

Thirteen Fellows from the first cohort attributed tangible progress in innovation take-up to NIA participation with one awaiting further evidence of impact. The NIA helped support the first cohort of 17 Fellows up to March 2017 to:

- win at least 29 new contracts for the innovations
- create 45 full-time equivalent jobs
- scale adoption of NIA innovations to at least 469 organisations
- secure over £28.4 million of additional investment
- develop over 114 new partnerships or collaborations with other organisations
- gain speaking opportunities at over 32 national and international events
- undertake 31 new research studies
- win 14 awards/high product ratings
- gain considerable publicity and coverage in national broadcast and print media.

The conservative estimates made suggest that some of the innovations could generate significant savings to the health and social care system. The value of total benefits could be higher, because this calculation does not include benefits that cannot be easily quantified at this stage, or other benefits that have value, both to patients, the health and social care system and to society via increased productivity. Furthermore, there is the potential that benefits across the country are underestimated, as the full extent of scaling is not known. The value of the benefits from these innovations (based on data available and assumptions made) are thought to exceed the costs of the NIA programme in one year.

These results should be interpreted with caution however, due to the quality of the data available and the depth of analysis possible in some cases. Examples of the kinds of limitations in the analyses were as follows:

- uncertainty about innovation input costs;
- assumptions required about the attribution of impacts to the innovation;
- evidence from limited sources;
- requirement to use evidence from overseas; and
- lack of quantifiable outcome data.

6.1.1 Conditions for success

The research identified a number of key factors which played an important role in contributing to innovation scaling. Overall, for each innovation, a **mixture of success conditions was required** which operated in a mutually reinforcing collaboration with a multiplicative effect. This means that the absence of any one of the factors was likely to halt or delay progress in innovation scaling.

The two most important conditions for success applicable to all innovations were **support provided by the core NIA team,** particularly in facilitating introductions to key people and access to national platforms, and **patient involvement**.

Additional features of the Fellows and their backgrounds which affected innovation scaling for one or more types of innovation included a range of personal characteristics. These included:

- entrepreneurial personality traits and drive: openness to new ideas and ways of working, high levels of intellectual ability and resilience to overcome setbacks
- excellent communication skills, tactful persuasion and ability to engage and maintain relationships with stakeholders, which was developed in some Fellows within the NIA experience
- using clinical backgrounds to build rapport with clinicians
- knowledge of the NHS
- access to wider resources or teams to promote their innovations.

Characteristics of innovations which affected scaling included their maturity on programme entry, level of system disruption and having lower numbers of people needed to support implementation in each setting, as well as short-term versus long-term orientation in nature of problem being tackled.

Further factors contributing to success in innovation scaling included:

- gaining a quality stamp from the NIA brand to endorse innovations
- navigating commissioning structures, leveraging mentors, gaining access to key influencers at national, regional and local levels
- ease of innovation adoption
- innovation adding value for clinicians
- building professional partnerships
- demonstrating alignment with local and national agendas
- AHSN support
- customising information and engagement pathways for different kinds of potential users.

6.2 What is the strategic added value of the NIA?

Strategic Added Value (SAV) in its simplest form is the catalytic effects of an intervention, particularly in engaging and influencing stakeholders. Evidence of SAV is qualitative in nature and is often used as a complement to quantitative evidence of the changes

occurring resulting from an intervention. The concept of Strategic Added Value (SAV) comes from regional development policy where the former Regional Development Agencies (RDAs) used a framework of reporting to government. This framework consisted of leading qualitative indicators (as outlined below) to show how the RDAs leveraged funding and influenced wider decisions, particularly relating to behaviours and outcomes among stakeholders that might not have otherwise occurred without RDA funding (PA and SQW 2006). A range of economic data was used by the RDAs to demonstrate SAV and has also been used to understand the contribution of the NIA. SAV also has application for understanding the impact of the NHS Innovation Accelerator because the programme seeks to bring about change by working with and through other organisations.

SAV in the NIA context has five components:

- **strategic leadership and catalyst** to articulate common development needs, opportunities and solutions for innovation scaling;
- **strategic influence** which enables partners to commit to common objectives and allocate funds and resources to support innovation scaling;
- **leverage** from financial and other incentives to mobilise partner and stakeholder resources, including equipment, people and funding to support innovation scaling;
- **synergy** from using capacity, knowledge and expertise to improve exchange of information and knowledge transfer and coordination of activities between partners in diffusing innovation; and
- **engagement** via setting up mechanisms and incentives for more effective involvement of stakeholders in the design and delivery of activities to support innovation scaling.

Strategic leadership and catalyst is evident in the core activities of the NIA in delivering support directly to the Fellows. Their feedback on the impact of the NIA, the role of peer support and mutual learning combined with the progress made in scaling the innovations illustrates this. At a national level, the NIA is feeding in learning about needs and opportunities to optimise use of innovations with central commissioning and regulatory agencies. Fellows and stakeholders felt that full impact at a systemic level was yet to be seen. It is likely to emerge in the next two years as further influence of the NIA develops at national level.

Strategic influence is evident in the success of gaining in kind and financial support for the NIA from all 15 AHSNs. At a regional level, some AHSNs generated cross-service partnerships from primary, secondary, mental health, social care and local authorities to promote innovations, particularly those focussed on new models of care or where delivery points for innovations are in community settings. At national level, NIA influence is most clearly seen in the introduction of the Innovation and Technology Tariff which has tackled a key barrier to purchasing innovations among NHS providers.

Leverage is evident in the direct impact of the NIA bursary and the diverse ways in which Fellows used this to engage a wide range of partners, potential clients and innovation users. It is also seen in contracts won and additional sources of public and private sector

investment which Fellows attributed partly to the impact of the NIA brand endorsement. Additional funds and grants have also been accessed through AHSNs as a result of the NIA. The Innovation and Technology Tariff represents a significant national level lever, introduced as a direct result of the NIA, which has shaped incentives for prospective purchasers of innovations. Indirect influence of the NIA has also taken place through word-of-mouth which has stimulated engagement with the innovations among potential user communities.

Synergy has been generated through the co-ordinating role of the NIA in providing a unified voice at national levels which identifies common barriers to innovation scaling and seeks to generate cross-fertilisation of ideas for future scaling progress. The NIA secured access to numerous high level platforms to enable Fellows to promote their innovations across groups of stakeholders and facilitate common approaches for adoption and implementation. AHSNs have again also provided a co-ordinating role across local healthcare economies. Full synergy from more effective working between the various national level agencies involved in assessing, scaling and regulating innovations, including NHS England and the Department of Health, has yet to be seen.

Engagement has been generated through the establishment of the NIA Programme Board and the Evaluation Steering Group both of which have wide representation from national bodies, AHSNs, individual NHS organisations and patients and public representatives. AHSNs have taken a lead role in engaging organisations within regional health economies. The NIA has also provided numerous platforms and access to events and conferences for Fellows which have resulted in successful engagement of potential users.

6.3 Conditions for future success in innovation scaling and how the NIA can contribute

The NIA has already supported substantial progress in scaling innovation adoption. This section outlines the potential for creating further conditions for future success in diffusing innovation. It identifies barriers encountered by the Fellows that still need to be overcome and recommendations for how this could be achieved, including system-wide change outside the NIA. There is an important strategic role for the NIA to play in tackling many of these issues by exerting influence through its numerous strong relationships with key NHS organisations and aligning its activities with them. While the NIA is a relatively new initiative, it has already developed a substantial profile and there is potential to leverage this to maximise its impact, for example through the proposed Accelerated Access Partnership.

A number of Fellows were seeking to develop a bigger credible evidence base to demonstrate impact on cost, quality and patient care outcomes on a broader scale than existing studies have demonstrated and to deploy this information effectively with purchasers. On a micro-level the NIA is well-placed to help Fellows undertake this, and the continuing work of several Fellows on conducting evaluations of their innovations should yield results over the next year. More broadly, the analysis concludes that the NIA should retain its unusual dual focus on personal development and innovation scaling as

there is evidence that this offers additional benefits, particularly for Fellows with less experience of innovation diffusion.

In addition, a series of more general conditions for future success emerged from the evaluation and are outlined as key action points below and listed in broad order of priority. These align with the mixture of ‘prod’, ‘proactive support’ and ‘people-focussed’ levers for change outlined in recent research on accelerating change in the NHS (Allcock et al, 2015).They are discussed below and Table 6.1 groups them by action and stakeholder.

Table 6.1: Summary of recommendations for action by stakeholder group

Action	Stakeholders to take forward										
	NIA Programme Board	AHSNs	Fellows	CCGs	Patient groups	Dept of Health	NHS England	NICE	NHS Digital	Public Health England	NHS Improve-ment
Signpost routes to market for innovations	✓	✓									
Demonstrate value of innovations to potential users	✓	✓									✓
Avoid NHS reinventing the wheel through raising awareness of innovations		✓				✓	✓				
Flag innovations for consideration by the Innovation and Technology Programme	✓										
Shift focus of funding from rewarding attainment of short-term goals to long-term goals, e population health to avoid perverse commissioning incentive effects	✓					✓	✓			✓	
Identify staff benefits in adopting innovations to support creation of innovation culture		✓	✓		✓						
Mobilise patient demand for innovations	✓	✓			✓						
Streamline information governance processes and optimise use of patient data for tailoring treatments							✓		✓		

Action	Stakeholders to take forward										
	NIA Programme Board	AHSNs	Fellows	CCGs	Patient groups	Dept of Health	NHS England	NICE	NHS Digital	Public Health England	NHS Improve-ment
Define acceptable common standards in evaluation of innovations						✓	✓	✓			
Align central endorsement processes of innovations						✓	✓	✓			

Aligning and exploiting NIA innovations to support key NHS initiatives. Some Fellows felt that defining the potential of their innovations to help the NHS achieve long-term goals needed more attention and finding the right routes to demonstrate innovation benefits should be an ongoing aim for the NIA. There are four challenges here:

- Using intelligence about direction of policy travel to show how the innovations support key sectoral priorities. Some Fellows felt they had 'missed the boat' in contributing to NHS Vanguards, NHS Test Beds and Sustainability and Transformation Plans so there is potential to assess whether closer links can be built and whether early alignment with similar initiatives is possible for any future cohorts. Ongoing reconfiguration of healthcare across primary, secondary and community settings and associated restructuring tariffs may offer opportunities to promote the clinical outcomes and cost savings of applying NIA innovations in these contexts.

- Continuing to assist in navigating routes into individual organisations and cross-organisational collaborations (see discussion of navigating commissioning structures in Section 4.2.1). For example, a number of Fellows identified that finding routes into CCGs and identifying appropriate individuals to contact was extremely challenging. Some AHSNs have been active in facilitating this for individual Fellows (see discussion of support from AHSNs in Section 2.3) and the network may be able to take an even stronger role here, as recommended in the *Accelerated Access Review* (AAR). This has also recommended development of guidelines on routes to market, particularly targeted at SMEs, and findings from the experience of NIA Fellows could contribute to defining and shaping these.

- Demonstrating the value of innovations to individual decision-makers on their terms and helping them to see the wider portfolio of benefits. Some Fellows identified that short-term organisational priorities were major influences on commissioning decisions and that proving benefits of innovations had to focus strongly on measures of local delivery, even if these measures were less relevant to the long-term impact and benefits of the innovation (see discussion on demonstrating alignment with national and local agendas in Section 5.2.1). Work done through the NIA to illustrate, for example, how CCGs respond to innovation could be extended and shared widely through AHSNs, NHS Improvement and other mechanisms.

- Avoiding the NHS re-inventing the wheel by devising or patenting its own innovations when suitable solutions may already exist through drawing attention to available innovations, using all suitable forms of engagement ranging from public events and conferences to conversations with key influencers. Identifying ways of triggering purchasers to consider innovations when they have to renew or replace current contracts may be helpful, drawing on behavioural insights principles that people are most likely to make changes at moments of heightened receptiveness.

Developing a commissioning culture based on meeting long-term health priorities. A number of Fellows illustrated the challenges of trying to implement innovations where cost savings do not fall at the immediate point of purchase and recommended this as an

area for the NIA to address (see Section 2.4 on type of learning content). Due to financial constraints in the NHS, provider organisations are often unwilling to purchase innovations if the initial cost outlay exceeds their current spend, even if long-term cost savings arising from adopting an innovation would be greater. The NHS Innovation and Technology Tariff will contribute to overcoming this challenge and innovations currently outside the initial listings should be considered for inclusion.

Tackling perverse commissioning incentives. An associated commissioning challenge is the role of perverse incentives created by payment by results systems where healthcare providers are rewarded for treatment rather than prevention of ill health and maintenance of good health. Fellows noted this as an area for the NIA to address through raising awareness of this issue with central NHS bodies (see Section 2.4 on type of learning content).These are already well documented in the literature on diffusion of medical technology (eg Llewellyn et al, 2014) and wider public sector commissioning arrangements (Harwich et al, 2017). As one Fellow put it:

> *'If I came up with a pill for 10p that cured cancer, [hospitals] would make a business case and argue that it would destroy their oncology clinics and there's no way it can work.'*
>
> (NIA Fellow interview)

Rethinking the role of incentives and managing a transition from funding based on meeting short-term goals to achieving long-term improved population health is challenging because of local and national power bases at stake, and the presence of powerful interests from major corporations in securing existing income sources. This is combined with tackling the consequences such as reducing or redirecting health sector employment if population health were to improve.

The NIA cannot by itself solve these kinds of systemic challenges, but it can provide a catalyst for unlocking opportunities to make best use of innovation potential through continuing dialogue at a strategic level with NHS England and the Department for Health. Fellows also pointed out the potential role for Public Health England and the NIA could explore opportunities for exerting influence through this route.

Building an innovation culture. Many of the levers for change identified above rely on top-down development of processes and incentives to prompt the adoption of healthcare innovations. Yet the research findings demonstrate that many innovations, especially those involving care pathways rather than tangible equipment, are likely to demand working collaboratively across different job roles and organisations. They will not necessarily come about solely through incentive-based rationales for change. Instead this requires overcoming resistance to change and building a commitment to new ways of working among front line healthcare staff (see discussion in Section 3.3 on commissioning structures and processes within challenges to innovation scaling). The NIA working through its Fellows and wider networks, including patient groups, AHSNs and professional bodies, has the potential to inspire through stories of change that demonstrate 'what's in it for me' to speed diffusion of innovations.

Patient mobilisation and activation. Patient involvement is identified as one of the major conditions for success in scaling NIA innovations to date in Section 5.2, typically operating in tandem with clinical voice and demand. There is further potential to optimise patient contributions in three ways:

- Harness and mobilise patient demand for some innovations. In some cases there are no patient groups with a particular remit for advocacy in relation to the problem an innovation is trying to solve and the NIA can help start conversations with broader patient interest groups.
- Mobilise patient interests to campaign for roll out of innovations to improve patient safety, which will help to ensure equity of access across all providers. This requires further work to open up conversations about admission of human error in clinical settings, assess the incidence of adverse incidents/patient outcomes caused by safety issues, find appropriate measures and create a culture of measurement and improvement. Signposting the problems that NIA innovations are trying to solve and the benefits of innovations to patients may help to galvanise campaigns at local levels.
- A number of NIA-supported innovations rely on patient activation and self-care to exploit the potential of healthcare technologies to sustain good health and manage long-term conditions more easily and with better outcomes. NIA Fellows stressed that behaviour change among patients was a crucial ingredient in tackling and preventing long-term conditions so optimising the impact of the emerging stream of technologies to support self-management could bring enormous benefits and efficiencies. The NIA has the potential to help catalyse conversations about behavioural change and help shape a social movement with the goal of improving long-term population health.

Current approaches to **information governance** and data protection can give rise to problems that a number of Fellows encountered which delayed progress in innovation scaling while individual solutions were found. The NIA is helping to catalyse further work on this to help identify solutions that will assist diffusion of innovations, not just for NIA Fellows but also support wider innovation in healthcare data management. It should continue this and feed it into the work of NHS England, NHS Digital and the National Information Board. As national level IT programmes and contracts come to an end, this presents an opportunity for the NIA to showcase new ways of making best use of patient data, both in the short-term for current treatment and for the long-term in assisting health research. In addition, under the STP process, each area has a remit to create shared patient records which will facilitate take-up of innovations using this function.

Devising impact assessments suitable for innovative products/services is important to encourage adoption of types of medical technologies and services. For example, the gold standard for evaluation of new treatments is usually RCTs but these are difficult to apply for apps because of various challenges, including finding comparable treatments, costs, delays to innovations reaching patients and pace of change of technologies. Similarly, some Fellows commented that the focus of NICE had historically been on assessing drugs and devising suitable methods for validating the impact of new techniques such as genetic screening was essential. Ways of validating app based technologies have been proposed in the *Accelerated Access Review* (AAR) (Taylor et al, 2016) and the NIA could provide a route to flagging such

innovations for early consideration. The AAR also contains recommendations for development of NICE appraisal methods to ensure they are fit for purpose for healthcare technologies and diagnostics compared to pharmaceutical treatments. NICE is currently working on a digital assessment process with NHS Digital. Drawing on the insight of NIA Fellows into the challenges and appropriate considerations for these methods through the NIA voice would be useful here.

Achieving acceptable standardisation in evaluation would be helpful to provide some way of kitemarking research trials so their results are credible across different NHS organisations, reducing duplication of trials and reducing barriers to adoption. Fellows gave examples where results of trials conducted in one setting were not accepted by other organisations and where national level NHS organisations would not accept evidence from clinical reviews conducted by another. Fellows identified that closer collaboration between NHS England and the Department for Health in defining acceptable standards of evidence would be helpful, and NHS Improvement may also have a role to play here. The AAR has already recommended that NHS England and NICE work out how to ensure that innovative specialised products and services are only assessed once in the decision-making process about adoption.

Alignment of endorsement processes across central NHS organisations including NICE, the Department of Health and NHS England. Fellows sometimes encountered difficulties where individuals from these organisations expressed interest and support but organisational policy prohibited support or decision-making inertia had stalled action. These organisations may wish to consider whether greater co-ordination is desirable and the NIA may wish to prompt discussions on this.

6.4 Implications for research

Evaluating both innovation impact and the contribution of funding programmes to support it is inherently difficult. The following approaches may assist further research in this area:

- Using a longitudinal study to track the diffusion of innovation over time, recognising that it may take several years for innovations to scale to their maximum extent. The NIA core team could continue to do this through ongoing monitoring of innovation performance.
- Developing metrics to assess the impact of innovations which are focussed on prevention of health care hazards whose incidence is not reported and where RCTs are inappropriate. This would involve considering the risk and opportunity costs of not adopting innovations resulting in adverse events/patient outcomes and subsequent healthcare costs. This would help build a case for triggering earlier, small scale adoption and avoid the ‘catch 22’ situation where potential adopters will not invest until they see large scale evidence of impact in sites exactly similar to their own.
- Undertaking detailed case studies within organisations seeking to adopt innovations focussing on processes, actions and tools required to support innovation scaling from an implementation science perspective.

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